BEAM PROPOGATION THROUGH TURBID AIR AND WATER

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Abstract

We transmitted collimated, Gaussian laser beams through various mediums (low and high turbid water, air) in order to observe the effects on the propagation of light. We took pictures of various beams of light and compared their light intensity using MatLab.

	Distance between source and beam	Diameter of Light Beam (cm)
Through Air	9.525	1.5
Through stagnant water	9.525	0.3
Through 5 volts - turbid water	9.525	0.2
Through 10 volts - turbid water	9.525	0.3

Background

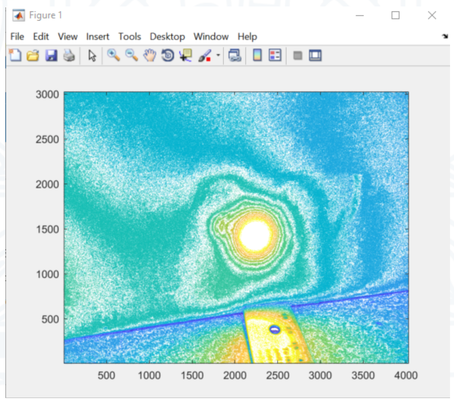
Laser technology is taking on a greater role in the design and construction of tomorrow's Navy. Studying how lasers propagate in various mediums is an important first step towards successfully using them in the future.

As the CNO highlighted in his CS-21R strategy, we must:

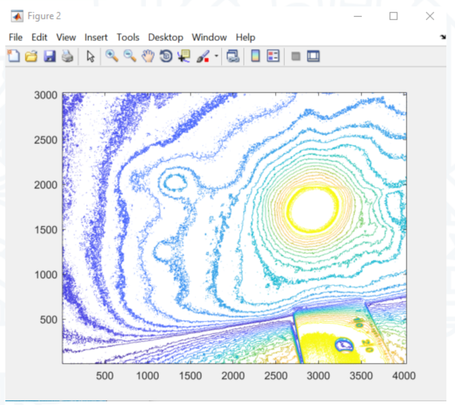
"*Evolve our counter–small boat swarm TTPs to include the use of innovative technologies such as* ***lasers****, advanced guns, and remotely piloted "smart" vehicles to counter this threat.*"

Methods

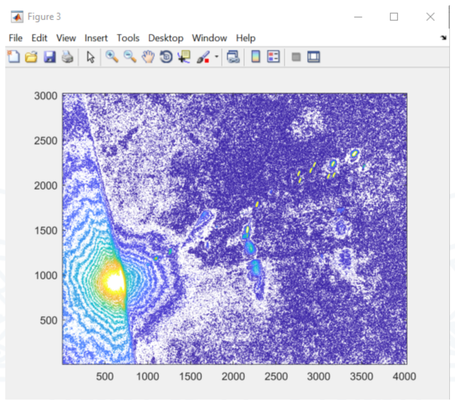
We used a mirror to reflect the light close to its source of origination. We then took a picture of the light from 10 centimeters away at approximately a 20 degree angle. We applied voltage to a 3.763 meter long tank filled with water, and measured the diameter of the light beam in centimeters. We measured the diameter of the light beam in air, in turbid water, and in stagnant water. We used an engineering board as a flat surface for the light to reflect off of.



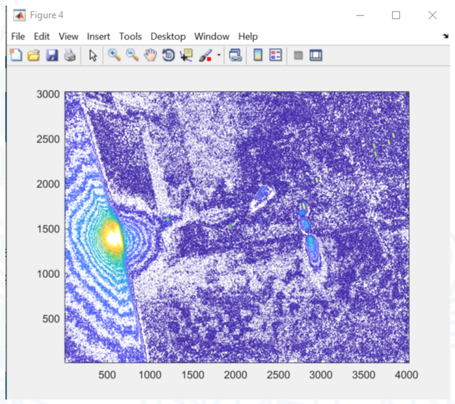
Laser beam through air



Laser beam through stagnant water



Laser beam through water of low turbulence



Laser beam through water of high turbulence

Results

The images show the variation in the transmission of light through air, stagnant water, water with low turbulence (5 V) and high turbulence (10 V). The images demonstrate that water clearly alters the transmission of light. In particular, images 3 and 4 in comparison to image 1 demonstrate that water distorts the light beam. In addition, the light beam is smaller in width.

Conclusion

Our group found that mediums have a profound effect on the propagation of light. In particular, water seems to diminish not only the area of the beam of light, but also the intensity of the light. This is important as it indicates the difficulty of using light as a communication method. Turbulent water greatly affects the transmission of light.

References

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