Thesis Project Portfolio

Evaluating the Validity of 1D-CARS Using a Single Laser

(Technical Report)

Evaluating Uncertainty and Public Perception of Developments in Climate Change Modeling

(STS Research Paper)

An Undergraduate Thesis

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Bachelor of Science, School of Engineering

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Sociotechnical Synthesis

The technical work and STS research are connected through the desire to better understand our climate system. The technical project focuses on developing a cost-effective method for high resolution spectroscopy in order to better understand combustion, whereas the STS research paper looks at climate science holistically. Understanding combustion and its products represents a small portion of understanding the complex, interconnectedness of the climate. In order to comprehend the entire picture of our earth's climate, it is necessary to better understand all of the factors that alter it. The technical work completed could eventually be used as a tool to analyze combustion and inform large Earth System Models (ESMs) that predict trends in the world's climate.

The technical work focuses on developing a simple 1-dimensional hybrid femtosecond/picosecond coherent anti-Stokes Raman scattering (1D fs/ps CARS) system. These systems are currently used to examine chemical species and temperature in a measurement volume without altering the fluid dynamics or chemistry of the combustion environment. Many CARS systems are point systems, meaning that only one small volume in space can be examined. 1D fs/ps CARS examines many small measurement volumes arranged in a line. The problem with current 1D fs/ps CARS systems is increased cost and complexity compared to point CARS systems. Currently, two lasers are necessary to perform 1D fs/ps CARS. The technical research is focused on developing a comparable 1D CARS system with only one laser, making setups as effective while being cheaper and less complex.

The STS research paper examines the development and current state of climate science, focusing on academic, industrial, and governmental influences. The Sociology of Scientific

Knowledge (SSK) Science Technology and Society (STS) theory is employed to better portray these developments as inherently social. The utility of the science itself is explored in detail, then contrasted with the current opinions of scientists, governments, and the public. Science can never be completely free from social interests; however, the story of climate research reveals just how gravely science can be affected by emotionally charged academics, politicians, and citizens. The paper does not attempt to undermine the truth of climate predictions and models; instead, it addresses the uncertainties inherent in climatology and suggests logical next steps in increasing transparency and furthering developments in the field. Safekeeping the earth, the only one we have, is necessary but confusion and misinformation is dangerous whether used for the right or wrong reasons.

Often times in life, it is too easy to lose perspective. The thousands of scientific developments that shape our understanding of the climate all began in a similar fashion to the diagnostic laser work completed in the technical project. By working on a piece of the climate puzzle, specifically combustion, I was able to better understand how climatology has evolved. In the end, I hope the simplified 1D fs/ps CARS work will lower boundaries of entry to many research labs wanting to do 1D CARS spectroscopy. In turn, this cutting-edge research can feed into our knowledge of the climate and move the science forward.