Quantitative Optical Gas Imaging – Remotely Quantifying Hydrocarbon Leaks.

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This project focuses on the use of Long Wave Infrared (LWIR), or thermal, cameras to detect and quantify hydrocarbon gas leaks. David Halnon was brought onto the project May 2019 to assist Jared Richards in all areas of the project, beginning with the development of a method to consistently, predictably, and safely simulate gas leaks using a CONCOA gas pressure regulator controlling releases of a mixture of air and methane. Verifying the accuracy of the regulator was difficult, as the exit velocity of the gas was too low for many anemometers. Eventually we were able to verify the exit velocity when using 100% air mix with a hot wire anemometer, however we decided that it was unsafe to use this with a methane/air mixture.

The next step was to design and build the lab in which methane could safely be released, this involved the construction of a custom fume hood. As it stands today (4 May) the fume hood is complete, however unusable due to the lack of a suitable power outlet in a location the fan can be placed. This was going to be rectified by ICI early this year, but the COVID-19 outbreak caused progress on the project to grind to a halt.

I used the extra time the delays in constructing the lab gave me to familiarize myself with MATLAB’s image processing toolbox and found two types of image analysis to use to analyze the data once collection can begin. The methods I have explored are velocity fields, in which I construct a velocity field where I can measure the difference in velocities of the edges of the plume of gas with the velocity of the center and find the Reynolds number of the flow, which can be used to find a mass flow rate, and block matching, which will predict the motion of individual parts of the plume and highlight the differences between the predicted motion and the actual motion.
This is the state of the project as of right now. Once the stay at home order is lifted and the required outlet is provided, I will be able to start collecting data and I feel that I will be able to finish collection and analysis shortly after that.