# ***JUST SCRUB IT!***

***New Mexico***
***Super Computing Challenge***

Final Report
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**Team 18**
**CEPi Charter High School**
(Creative Education Preparatory Institute)

**Team Members:**

*Elijah K. Prince*

*Francesca L. Bianchi*

**Teacher:**

**TJ BONZON**

# Executive Summary

The problem we are presenting is an approach to find a better, more efficient & compact design of a $CO_2$ scrubber. The purpose of this is to improve submarine's and coal mines' scrubbers, making the air in the submarines closer to the air on land and the thin air in the mines' breathable. Oxygen has to be replenished as it's consumed, if the percentage of oxygen falls too low; a person will suffocate. If the carbon dioxide rises too high, it becomes toxic. It is critical for us to identify all compounds in air on land, under land and beneath water, to see how they are processed through the other devices. It is also important to find a way to make the device smaller because it will be easier to fix and replace, and free up space in the submarine's and coal mines' for more important equipment.

# ——Report

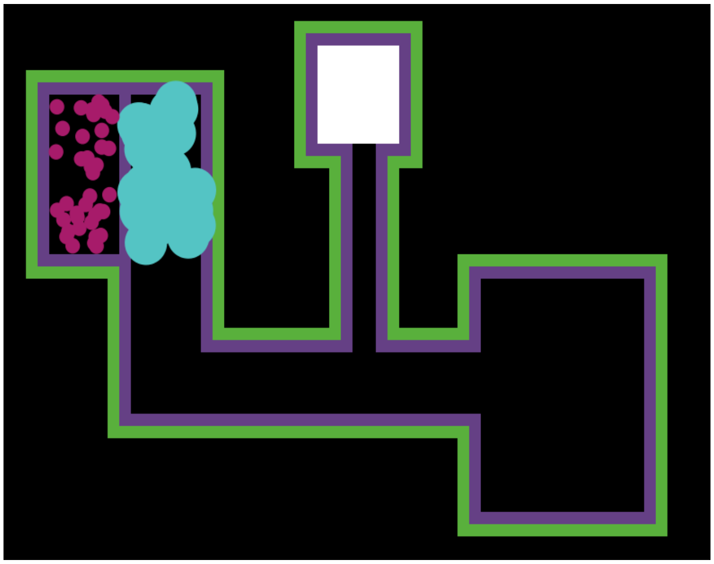
## Introduction

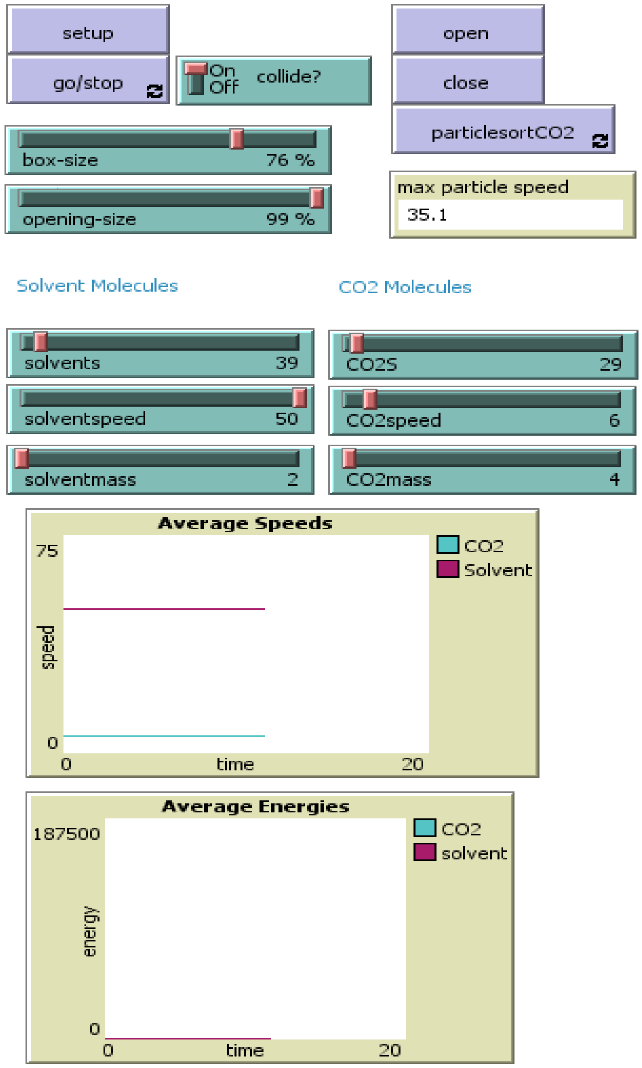
Our hypothesis was that we could find a way to make a $CO_2$ scrubber smaller and more efficient. By doing so we could potentially free up space in coal mines, submarines, and anything that uses the machine. A previous member of our team proposed the idea that we should improve the $CO_2$ and $O_2$ generators in a submarine. After he left the team, we realized that we needed to narrow our idea to something less broad. We went with $CO_2$ scrubbers. We then realized that without our teammate we had no idea what a scrubber does. Once we finished conducting our research, we came to the conclusion that there is a way to create a more efficient system for the $CO_2$ scrubbers.

## Methods and Materials

We chose to test our hypothesis by modeling an example of a $CO_2$ scrubber in Netlogo. We set out to use this programming language because we completed the UNM CS4All course, using Netlogo. Having been fresh out of the class, this was the perfect opportunity to put our understanding of the language to the test. The first step we took in modeling was finding a previous model called, "Gaslab Two Gas." This model was useful because of some of the components it has, including moving particles and a box design. We used parts of the "Gaslab Two Gas" model's components, to model the different gases in a $CO_2$ scrubber. Namely, $CO_2$ and $O_2$ ( $CO_2$ being the larger molecule). Then we modified the design, adding boxes and corridors, so that it was more like that of a $CO_2$ scrubber than a big, yellow box. After we figured out a way to model the scrubber, we could then test our hypothesis.

**Results**






Our model, as seen above, shows four separate boxes. One of which holds the particles before you press the GO button. When another button, ‘OPEN’ is clicked, the separate particles collide and bounce off each other, falling down the corridors and eventually moving completely within the whole boxes- randomly.

There’s a separate button for sorting, when clicked ‘ParticlessortCO2’, the cyan colored particles move up into the top middle box, and the magenta colored particles move down and to the right into the other box.

There are Sliders for the box size, the opening between the boxes, molecules’ mass, their speed, and the number of molecules.

There are two separate plot graphs calculating the average speed and average energy of each of the molecules.

## Discussion

We had a late start in the initial stages of our simulation; we actually started to think about the project in December, and began coding in February. We started late because we took a UNM Computer Science for All Dual Credit class that ran to the end of January. We completed the class, and started the Supercomputing Challenge right after. During the process of coding our program, we ran into numerous errors. Due to our inability to fully troubleshoot our mishaps, we were prompted to email the mentors that heard our evaluation on February 14. We did so, which led to no reply. We waited a couple days before emailing them again, and a couple of them replied. Our team was then referred to other potential mentors who have helped us thus far. Besides the programming setbacks and delays in mentoring, we are exuberant about our overall progress. Going from no model at all to semi-completed model is an extraordinary accomplishment for us.

## Conclusions

At present, without a working model that gives us data outputs, we can only make assumptions on possible outcomes. We currently assume that the variables affect the speed of gas separation, and are dependent on the density and number of the air molecules particles. What we can conclude is that the process of creating a model is more complex than we thought, even working with a completed example model.

## Personal Statement

Getting the model to run the way we intended it to is the greatest accomplishment. There were a couple of smaller tasks that were also exciting. Figuring out how to get the molecules to bounce off of the purple boundary lines was definitely a milestone for us. Overall, we are proud of everything we've accomplished, though our model is not in a working state to give us data outputs. With the amount of time we had to prepare and the different obstacles we had in our path, continuing was difficult.

## Acknowledgments

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