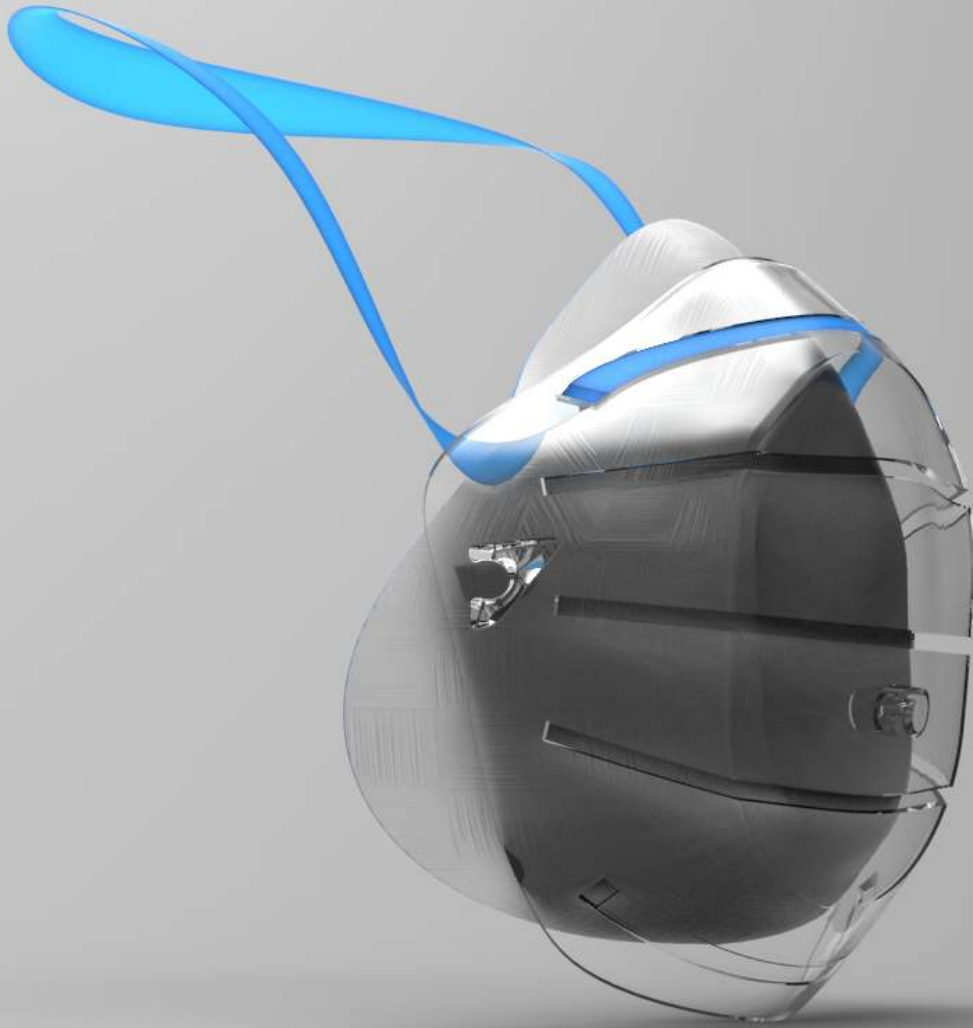


# *Ol' Factory*



**DETAILED PROJECT DESCRIPTION**

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## INTRO

Ol' Factory is a privately-owned cooperative that hopes to solve our world's air pollution problem - both at an individual and systemic level.

For individuals whose lives are affected by air pollution, Ol' Factory will produce Trunk - the first in a line of reusable, pollution-resistant masks designed to maximize the comfort and safety of urban commuters. Trunk achieves this through use of a highly efficient, washable filtering media, and a capacitive sensing system that ensures an airtight seal to a users face. In addition to these safety features, Trunk is thoughtfully designed to be a lifestyle product that allows for user customization and expression.

For our world, Ol' Factory will also develop solutions and drive initiatives that address air pollution at larger scales. These initiatives will involve sustainable development projects as well as research and development of carbon sequestration products. The goal of Ol' Factory is to reduce the levels of carbon dioxide, particulate matter, and other green house gases by 30% in targeted markets by the year 2026.





# THE PROBLEM

A busy street in Hanoi, Vietnam where motorists can be found wearing cloth masks to protect themselves from air pollution

Photo Credit - Nam-Ho Park | CC-ShareAlike | flickr

# THE PROBLEM

## Background

Air pollution is one of the most costly and deadly problems our world is facing in the 21st century. Before exploring the impact these pollutants have, it is important to have a basic understanding of air pollution.

Air pollution describes particulates or other harmful materials that are released into the atmosphere. These pollutants can come from both human and natural activities, examples being the combustion of fossil fuels or a volcanic eruption. Some pollutants stay in the air for hundreds of years, while others like ozone (O<sub>3</sub>) stay aloft for a couple of hours before they undergo chemical reactions.

When it comes to discussing greenhouse gases and the effects of global warming, carbon dioxide (CO<sub>2</sub>) is the most commonly discussed pollutant. However, despite the damage these pollutants are causing on a global scale, other pollutants tend to have more immediate health impacts. For example, particulate matter smaller than 2.5 microns in diameter (PM<sub>2.5</sub>) is particularly dangerous for us to breathe. Upon inhalation, these particulates lodge deep in the lungs and cause a variety of symptoms including aggravated asthma, acute respiratory symptoms, and even death.

## Air Pollution's Deadly Cost

The air we breathe is slowly killing us. For example, research has shown that between 2004 and 2008, the life expectancy of Beijing residents was reduced by a median 15.8 years due to the inhalation of PM<sub>2.5</sub> [1]. However, loss of life is only one of serious prices of airborne pollution.

**\$1.6 TRILLION DOLLARS**

**THE ANNUAL COST OF EUROPE'S AIR POLLUTION, WHICH ACCOUNTS FOR NEARLY 10% OF THEIR ENTIRE GDP**

Air pollution costs European economies nearly \$1.6 trillion USD annually in diseases and early deaths [2]. This amount accounts for nearly 10% of Europe's entire gross domestic product (GDP) [2], or the cost of around 4,570 Boeing 747's. In China, this number is estimated to be \$100 billion USD, around 5.8% of the country's GDP [3].

## Misconceptions and Misinformation

Unfortunately, it has been the tardy response of governments that has resulted in misinformation about air pollution. In Beijing for example, many residents do not wear protective equipment. Of those who do, the majority choose to wear surgical or cloth masks that fit loosely over the mouth and nose. While cheap and disposable, these masks are largely ineffective at filtering PM<sub>2.5</sub>, which pose serious health risks [4]. Despite their inefficacy, hundreds of thousands are sold every day in urban centers around the country [5].





# THE IDEA

Jorge Treviño, an industrial designer  
sketching a design concept for Trunk  
*Photo Credit - Camille Lizama*

## THE IDEA

In short, we are dealing with toxic air that on a global scale is costing us trillions of dollars and steadily killing us. But how do we solve this problem? This is what I started asking myself during a study abroad semester in South East Asia in 2013.

While living in Singapore, I enrolled in an air pollution engineering course. The course taught me the basics of air pollution modeling, the various health impacts of certain pollutants, as well as the principals behind popular sequestration and filtration devices. The class was interesting, but it wasn't until I traveled in Vietnam that the issue struck a chord.

In Hanoi, Vietnam, about 2 in every 5 people wears protective equipment. Unfortunately, almost 100% of these are cloth masks. As a result of the information I was learning in my coursework, I knew that these materials weren't terribly effective at blocking PM2.5. In fact, NIOSH-published results have shown that at best, these masks still allow 25% penetration of airborne particles (in other tests, this penetration value was as high as 90%) [6]. In addition to this discovery, results from the same study showed that poor mask-to-face seal can lower a respirator's efficacy by a median value of 49.5% [8]. Upon discovering this data, I immediately started to ideate on designs for protective equipment concepts.

The Trunk mask is the outcome of those brainstorming sessions. It is lightweight, stylish, and provides the protection of a heavier respirator. From a user safety perspective, it was imperative to design a system so that it would ensure a proper mask-to-face seal. However, we didn't want to build a business that benefits off the presence of hazardous air, but works to attack the problem of air pollution at its core.

The Ol' Factory is our proposed business that will address air pollution at both individual and societal scales. In addition to producing Trunk, Ol' Factory will benefit from revenue channels that are rooted in sustainable development initiatives. We will partner with other businesses and local governments to refurbish existing infrastructure. These efforts will result in massive economic savings as well as significant reduction of CO2 emission. To facilitate these partnerships Ol' Factory will pay the upfront costs of these renovations from revenue generated by Trunk sales. Then, our partnering entities will pay annual percentage of the cost savings (around 20%) back to Ol' Factory for the lifetime of that building or structure. In addition to these renovation efforts, we also hope to delve into the research and development of biosequestration systems that actively remove carbon from the atmosphere.

By producing Trunk, our hope is to save millions of years of productive human life. By starting the Ol' Factory, we hope to slow the emission of CO2 to the point where we no longer need to produce Trunk.



# THE PRODUCT

An early product rendering for the Trunk  
pollution-resistant mask

*Photo Credit - Max Bock-Aronson*

## THE PRODUCT

Trunk represents a crossover product that is lightweight and comfortable like a cloth mask, but provides the protection of a respirator. Refer below to the various parts of the Trunk system.



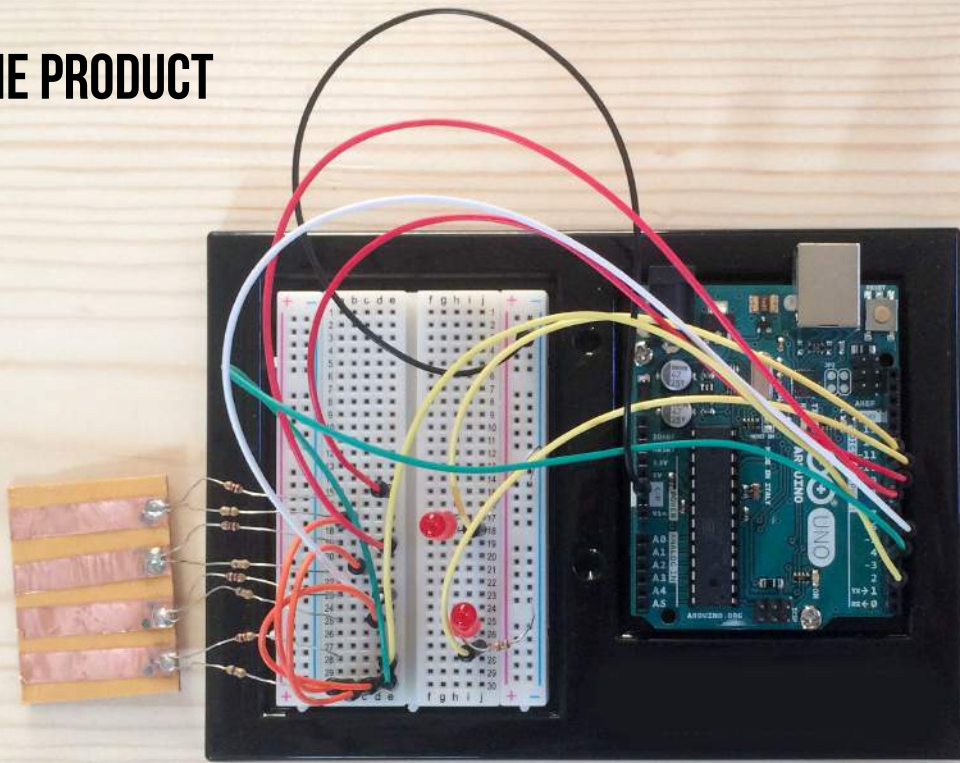
The mask shield is a semi-flexible injection molded component that houses the interchangeable filter media. Its primary function is to provide support and rigidity to the filter media and silicon seal, house the capacitive seal-check sensor, as well provide the head strap a body to which it can apply its securing force. The mask shield features 4 slit features that allow air to pass through the shield as a user breathes. These slits also allow the shield to hinge around a central point, and conform to the contour of a user's face.

The silicon seal cap slips over the mask shield edge and the electronics, and provides the mask's seal edge. This is the ideal material to allow Trunk to conform to a users face. Due to the injection molding process, the material thickness will be uniform, resulting in an sensing surface accurate at distances of .15 mm.

The filter media is comprised of an N95 HEPA filtering medium that fits into an attachment feature on the mask shield. The filter media attaches to the mask shield from the back, and sits in front of a user's airway during use. The filter media will clip in through a simple attachment that will allow for simple insertion and removal. The filter media is designed to shed condensation, allowing users to remain cool while wearing the mask. This aspect of the material also allows the filter media to be used multiple times. Simply wash the filter, and allow to dry before reuse.



## THE PRODUCT



Proof of Principal Capacitive Seal Checker

The capacitive seal checking circuit is Trunk's most essential (and novel) feature. The sensor features four metal contacts that simultaneously need to sense the presence of skin at a distance of 1.5mm (the material thickness of the silicon seal) or less in order to register a value of "protected." There are two pads for each side of the mask, placed symmetrically about the face. When one of the metal pads isn't in contact with skin, the circuit will register a value of "not protected" and a small haptic rocker component will give a subtle buzz to the side of the mask where the seal is broken.

The head strap (which isn't pictured) uses two pieces of high quality woven elastic to provide the clamping force that ensures the mask has a good fit. The shorter length of elastic strap enters ports along the sides of the mask shield, and runs in channels along the top of the outside of the mask. The longer strap runs in a similar channel along the bottom of the mask shield. These two pieces are then woven together at the side of the mask (near high point of a users cheekbone) to ensure an even distribution of clamping force to the mask shield. From this point, the long strap continues behind the users head in order to secure the mask the face.

All in all, Trunk is a relatively simply device. The unique aspect of Trunk is the application of capacitive sensing to ensure that the seal around a silicon seal is well maintained.



# THE VISION

Singapore's "Super Trees" collect rain water and use solar energy to power to the park in which they're installed

*Photo Credit - Pa Van | CC-ShareAlike | flickr*



## THE VISION

Our vision for Ol' Factory goes far beyond Trunk. We have no desire to be a company that only produces a bandaid solution for a problem that impacts the lives of over a billion people on a daily basis. In fact, it is this reason precisely that we are applying to the Rolex Awards.

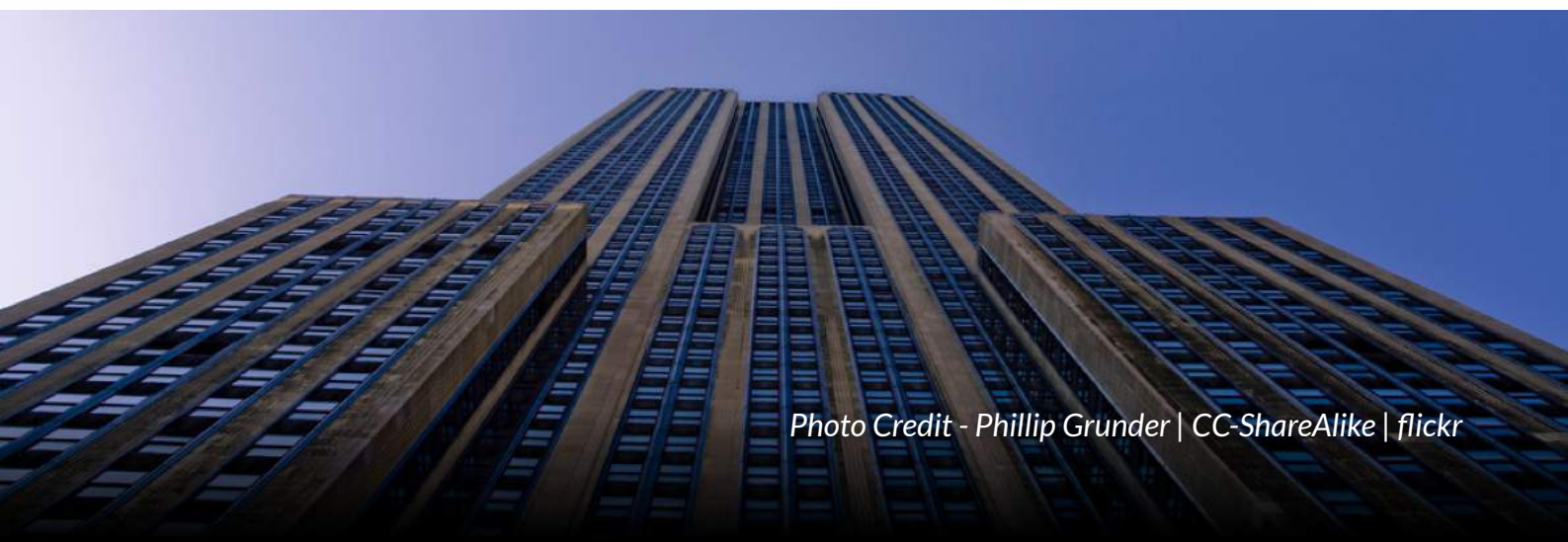
In this section, we will give a general outline for activities we plan to undertake once we have established profitable revenue streams from Trunk and other consumer product sales. As previously mentioned, the goal of Ol' Factory is to reduce the levels of CO<sub>2</sub>, particulate matter, and other green house gases by 30% in targeted markets by the year 2026.

### Renovation Initiatives

Buildings consume about 80% of the energy used by our world's largest cities. For a city like New York, this equates to roughly 5.1 million metric tonnes of CO<sub>2</sub> dumped into the atmosphere annually. Interestingly, around 20% of New York's buildings account for 80% of the energy consumption for all buildings in the city. In theory, by refurbishing only the most energy-sucking buildings, Ol' Factory could reduce the annual CO<sub>2</sub> emissions for large markets by 25.4%.

In 2010, the Empire State Building underwent a sweeping \$13.4 million USD renovation. This renovation included refurbishing all of the building's 6,514 windows by treating them with UV-resistant film and pumping them with argon, installing a state-of-the-art automated electricity system, and installation of better insulation [9].

Using this renovation as a model, Ol' Factory will partner with other businesses and local governments to refurbish existing infrastructure. Similar to the work done on the Empire State Building, this development work will result in massive economic savings, and significant reduction of CO<sub>2</sub> emission. Ol' Factory will forge these partnerships by paying the upfront costs for these renovations. Then, on an annual basis, the partnering entities will pay annual percentage of the cost savings (around 20%) back to Ol' Factory for the lifetime of that building or structure. With this channel, the Ol' Factory recoup its initial investment in 10 - 15 years, our partners will save 30% on their annual energy bills, and together we will reduce carbon emissions by millions of tonnes.





# THE VISION

## R&D for Carbon Sequestration

Carbon sequestration describes a family of devices and processes through which carbon is retained so that it doesn't enter the atmosphere. There are many steps that lay between Ol' Factory and the deployment of 9 figure development projects. Still, like Singapore's SuperTrees, our desire is to partner with communities to do large scale installations that are not only beautiful, but provide energy for the region and take carbon out of the atmosphere.

We want to live in a world that is beautiful for hundreds of years. To make that happen, something needs to change, and we want to be the people who do it. Thank you immensely for your time and consideration in reading this application.

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