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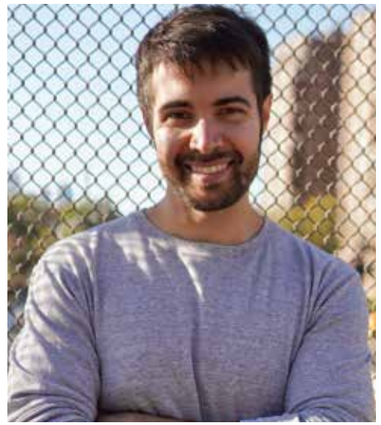
Dr. Stafford Sheehan discusses Air Company's origins, recent projects and future plans in conversation with David Edwards



Staff Sheehan, CTO,
Air Company

David: "The origins of Air Company date back to 2017. How did the company get started?"

Staff: "My co-founder Gregory Constantine and I met that same year at a bar in Israel over whisky. We were both on the Forbes 30 under 30 list and were there at an event hosted by Forbes. He was an executive at Diageo, the largest liquor company in the world, and I was focused on carbon dioxide conversion, trying to find ways to use carbon dioxide conversion technology commercially. We became friends, stayed in touch, and after several months started Concord Spirits, which became Air Company."

David: "Can you describe Air Company's innovative carbon dioxide to ethanol technology?"

Staff: "We capture CO_2 from a variety of sources; in Brooklyn from post-fermentation, in Calgary from the flue gas of an 860 megawatt natural gas fired power plant, and we're developing our own technology to capture it from air as well. We take that captured CO_2 and combine it with hydrogen that's generated in a water electrolyser using renewable electricity. In Brooklyn, we use a mix that's over 90% wind with the remainder being solar. The CO_2 and H_2 are fed into a reactor where they're exposed to catalysts. My Ph.D. was in catalysis, and our catalyst is a proprietary, in-house development that we produce in our laboratory. We end up with a mixture of alcohols in water, methanol, ethanol, n-propanol, that we distill to remove everything but the ethanol. The result is the ultra-high purity ethanol that we use to make Air Vodka."

David: "Commercially, what's your plan for the by-products?"

Staff: "The water we can reuse; it's actually pure enough to drink. The n-propanol is a valuable commodity chemical, but with a high legacy greenhouse gas impact; our n-propanol can make applications like pharmaceuticals greener. As for methanol, we're working on several partnerships, across different industries; industrially, it's one of the most widely used chemical intermediates. Methanol is also a target chemical intermediate for in-situ resource utilization on space stations, and on Mars."

David: "Air Company first approached Zeton in late 2017, and we completed our first project together in 2019. What was it, and how did it come about?"

Staff: "The first project we did together was the pilot plant in Brooklyn, NY, which is a fixed bed flow reactor. The project was partially funded by a grant under the Solutions 2030 Challenge from Ontario Centre of Innovation (OCI). I was initially introduced to Adam Whalley through one of our company's advisors. We had a CSTR in our laboratory, and we needed to scale it up into a flow reactor. We went to many different engineering firms to try to get advice on how to how to do it correctly. Through Adam, I was introduced to Chris Brown. I remember my first call with Chris. I was standing outside of Chelsea Market in New York City. We were reviewing the work that a lot of these engineering companies had done, and Chris knew exactly all the things they were doing right, and what they were doing wrong. He was able to sort out the best way to build this pilot plant, in the most economical way. And then over the course of the next year we designed and built it. It's fully operational in Brooklyn and serves both as a pilot and production plant."

The Brooklyn Pilot Plant

David: "So the scale-specific experience that Chris and Zeton contributed was key to helping this project take the next step and get built?"

Staff: "Yes, it was. Chris' experience was really helpful in keeping us within budget and we couldn't have asked for a better engineer. Even after retiring from Zeton, Chris and I have kept in touch and I really value his advice and mentorship. He got the first bottle of Air Vodka in Canada."

David: "Zeton just delivered a second plant to Air Company, and we've started design work on a third. What do these project entail?"

Staff: "The second plant was developed as a 10x scale up of our Brooklyn pilot plant. It was built with a larger budget, so we could make performance upgrades to several components, for example, temperature control around the reactor. This was a custom-designed solution for our catalyst, and process, and it's made a world of difference. We learned a lot from operating the first plant, and these improvements are included in the 10x scale-up. The third plant will be a continuous distillation system incorporating patent-pending IP for efficiency and impurity removal."

David: "What are the advantages in working with one company to scale your process technology?"

Staff: "One advantage is as you scale, you learn a lot of lessons at each step, and having an engineering partner that knows those lessons, and that they were hard-earned, helps to make sure that the same mistakes aren't made again. If we had a larger team of engineers, internally, then I think it might be different; we'd have more institutional knowledge within Air Company, but we're a 20-person company. So, as a technology developer, we're a small handful of people. Working with one developer - one EPC - ensures that the institutional memory is retained between our organizations as we scale up, which is good."

David: "Are there advantages in working with a company like Zeton that builds what they design, as opposed to working with an engineering company to do the design, and then shopping it around to different fab shops?"

Staff:"Yes, a lot of times we've learned that the as-designed system doesn't always work; what you design on paper doesn't always manifest perfectly in real life. Being able to iterate and modify the design, using the same people that develop the design initially, has been really helpful. So that's a big yes. For small businesses like ours, and at the scale we're operating at, I feel it's a much better decision to use the same firm for design and build. Big companies with their own engineering departments have options using their own internal resources, but for companies like Air Company that don't have a 500-person engineering department, I feel it's much better."

David: "The United States Government has announced ambitious plans to build a clean energy economy. How will Air Company contribute to this effort?"

Staff: "Well, we're already contributing to it. Our goal is to replace consumer products with products that are carbon negative, and higher quality. What we're showing is that you can have a product that is the highest quality, and the greenest, with our vodka, and with our sanitizer. Our vodka has won three gold medals in blind taste tests at the three largest spirits competitions in the world - blind, so they didn't even know it's made from CO_2. That's where we fit into the clean energy future the United States; we're going to make products greener and we're going to make them better."

David: "How would you categorize Air Company? A beverage company? A fine chemicals company?"

Staff: "We're a technology innovator. Eventually, we're going to want to license our technology, because the more people that use it, the more impact it can have toward removing greenhouse gases. But we're always going to have our own brands, which we build as we scale our technology. These brands are going to be made by us so that we can have tight quality control so that customers know they're getting the best product."

David: "One last question. Can you talk a little about your work with NASA?"

Staff: "Definitely. One of our projects, which we codename Air Stellar, relates to applications for CO_2 conversion on space stations in Earth's orbit and on Mars. It's gradually becoming a solid part of our business, especially as the space industry has skyrocketed in the last six months. The big one is Mars; with an atmosphere containing 95% CO_2, if you want to make anything on Mars, you better know how to convert CO_2. And there's water in the form of ice there. You use electrolysis powered by the sun and photovoltaics to make hydrogen and oxygen, and then our technology fits perfectly alongside that. We've done work for NASA's CO_2 conversion challenge, and to date I believe we're the only CO_2 conversion company that's been on the front page of nasa.gov." ■

The 10x Scale Up Pilot Plant