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Manufacturing, Technology and Engineering

For the last several years, VC investments have welcomed startups with innovative business models into their portfolios. (Walk, 2016) That is quickly beginning to change, as capital is locking up and investment strategies are returning to VC's original core competency -- innovative technology. (Walk, 2016) This is a natural cycle, but it highlights an important truth; real technology never goes out of style. For example, over the next 50 years, it's hard to imagine any technology that will impact humanity more than artificial intelligence, which is an extremely technical field. (Dadich, 2016) The need to understand and control AI is almost entirely the reason why I'm studying computer science at BYU. With all of this in mind, I believe it's going to be difficult in the coming years and decades to be a real innovator, I mean someone (with his or her team) who makes a significant step-change in technology, without coming from a *deeply* technical background. So, my view of engineering in the global economy is one of complete necessity. Without engineering (and I'm including software engineering in addition to the traditional subcategories of engineering) I think the world's economic growth would be restricted entirely to globalization, and would be devoid of technological progress, an absolute pillar of robust economic mobility. (Thiel, 2014) Pure scientists discover grand theories and lay the foundations for what engineers do, but engineers are the ones who bring concepts to reality.

Interesting and useful technology can only become widely adopted if it's accompanied by an effective business model and persistent team. Manufacturing, an essential component of a business model, is of particular interest to me. I've been very interested in manufacturing since the summertime when I watched the 2016 Tesla shareholders meeting, and Gigafactory unveiling by Elon Musk. Here's a quotation from the meeting where Musk is applying his "physics first principles" thinking style to improving manufacturing, or what he calls "improving the machine that builds the machine." "When you think of a manufacturing facility, for a given size of factory, the output is going to be volume times density times velocity. If you look at our factory and say what is the density of useful to non-useful volume. It's crazy low. It's like 2 or 3 percent if you look volumetrically – not on a footprint basis. Then you look at velocity. What is a reasonable expectation for the exit velocity for the vehicle coming out of the factory? You might think that some of the most advanced car factories in the world are very good at making cars and they are maybe making a car every 25 seconds – that sounds fast, but actually, if you say the length of the car plus some buffer space is approximately 5 meters so it's taking 25 seconds to move 5 meters. That's 0.2 meter per second or not much faster than a tortoise." (Lambert, 2016) Pardon the long quotation, I could read and quote Elon Musk all day, he's a huge inspiration and motivator for me. I love his style of thinking on this, particularly that a factory's output will be "volume times density times velocity." That is a great way to think about enhancing manufacturing operations. Combining this topic with another of the sub prompts, there are several industries I'm very interested in applying these principles in. I know it sounds ambitious, but asteroid mining is a field that is not only technologically

and developmentally important, but extremely lucrative. Asteroids could be used to import massive amounts of precious metals to Earth, such as platinum. Basic laws of economics dictate that a huge increase in supply will naturally drive the price of an item down, in this case breaking down barriers to entry in electronics manufacturing and enabling more invention and innovation because of cheaper parts prices. Clearly, some heavy hardware is necessary to mine asteroids, all of which could be made in factories that are optimized using Musk's first principles approach.

Although spacefaring technology startups are my eventual goal, I recognize I need to start somewhere a little more down to Earth early in my career in order to gain practical experience doing things like raising capital, executing a business model, developing new technology, working with a team in a high pressure environment, etc. I started a business doing 360 video in real estate, and it was a great experience. I learned a few key lessons I'll take with me into my next venture. The most important were probably (1) not to define your market so narrowly that you think you're a special snowflake without any competition, (2) to think real long and hard about who you select as your cofounders, and to set clear expectation in the beginning so there are no surprises later on when things get hard, and (3) being a technical cofounder is immensely better than being a non technical cofounder (I had very little programming experience when I first started my business).

With those lessons learned and lessons I'd like to learn in mind, other fields I'm interested in starting a business in after graduation are AI Cybersecurity and various autonomous car-friendly infrastructure components. Recently, Google researchers reached a milestone when an AI system created an encryption language that was completely alien looking to humans. Another AI couldn't even break it, meaning it would be even harder for humans to do so. That floored me! I'm really interested in protecting what's near and dear to us from nefarious individuals and organizations. Another venture that could be quite impactful and lucrative would be any that aids in the transition to autonomous vehicles via infrastructure improvement. There is much to be done to help teach self-driving vehicles what to do or not do in special scenarios, like for example when there's been an accident and a police member is waving people on. That's not something that is easily discernible to an AI system, so perhaps an app could be made for first responders to signal to all AI-driven vehicles in the area what to do should they encounter the accident.

What would I do with the scholarship money? Pay for tuition and school loans, for one. Putting two people (my wife and I) through school at the same time with neither of us working full time equals debt. We would really like to pay off all our school loans by the end of the year, or at least as much as we can, and this would help immensely with that. Another way this money would be helpful is to expand my wife's photography business, which I help with. We need to upgrade some hardware in order to increase our earning potential, and this money could make that happen too (which also would help with paying off our student debt!) Thank you for your time and consideration, I'm

grateful for the opportunity to apply for this scholarship and hope that my wife and I can make the most happen with this tribute to Chuan Ai Lu Engstrom's memory.

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