

Internship at Colpitts Design: Hurry up and Wait

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Abstract

Colpitts Design is a small manufacturing shop in Uxbridge, Ontario. I worked at Colpitts Design for an initial 3 months and then was taken on for the rest of the summer, for a total term of 6 months. My main tasks during my internship included assisting the owner Peter Colpitts in the assembly of TV props, helping machinists with tasks such as setting up injection molding machines, running the machines, and working on the CNC lathe and manual mill.

Acknowledgement

I would like to thank Lynda Litwin of Minden Real Estate at Re/Max. If it wasn't for her curiosity for what I was studying in school I may not have been connected with Peter Colpitts. I would also like to thank Peter Colpitts for investing his time into my internship, taking his time to answer all the questions I had about the processes and reasoning behind our various projects.

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Company information

Colpitts Design Inc. is a small prototyping and manufacturing shop based outside of Toronto in Uxbridge, Ontario. The company specializes in, but is not limited to, injection mold making and molding. Colpitts Design is also well known in the film industry for working on props for films like X-men, Star Trek, and Batman. Consisting of ten employees, Colpitts design is a close-knit group of designers, machinists, and engineers.

Internship responsibilities and roles

From the start of my internship, Peter informed me I would be doing a wide variety of tasks and responsibilities. Firstly, Peter wanted to make sure I could respect his tools and conduct myself properly in the shop. Therefore, he started me with a broom, with the idea that I would prove respect with the broom and move my way up to use more complex equipment. Starting with general shop maintenance such as sweeping the shop floor, taking out the garbage and recycling allowed me to get comfortable in the shop. Regarding salary, Peter believed that I should be compensated for my work and for basic expenses such as gas. He also mentioned that I could earn an increase in pay depending on how I performed and how useful I was to the company, which I did end up getting.

As I became more comfortable with the procedures in the shop, I slowly started working with the machinists, helping by fetching tools, helping “hang” injection molds in their respective machines, cleaning the molds, and trimming parts. Peter always stated that he did not want his shop to be considered a mold shop but the amount of people that come to him makes it hard to say no to extra work.

A significant portion of the work coming through Colpitts Design is contracted work on film props. From movies like X-Men where they manufactured Professor Xavier’s Cerebro helmet and desk, or the badges for the crew of the Star Ship Enterprise on the TV series “Star Trek Discovery”. During my time at Colpitts Design I had the opportunity to work on a few different film props. The first prop I worked on was for the new TV series “Titans”. This prop was a helmet which had LED’s illuminating the characters face and emitting light out of its eyes. This helmet was my first experience assisting with the creation of a film prop, it was an extremely informative experience to see the extensive process that is involved in the creation of a prop. From concept art, designing it to be manufacturable, 3D printing, assembling, painting parts, and finally delivering the final prop to set to see it filmed.

The prop that had the most involved process was for the TV show “Star Trek.” With this project, I had the opportunity to apply many of the skills that I had accumulated throughout my internship experience. This prop incorporated prototyping a rough model, over 100 hours of 3D printing, CNCing, painting, electronics, injection molding, silicone casting, welding, laser cutting, delivering the prop to set and manipulating the prop during filming. Part way through this project, my co-worker who I had been learning from and shadowing was unable to continue working on the project. This allowed me to adopt a more involved role in the project – painting, assembling and working on the set.



Pic left: Working late grinding and painting

Pic below: One of my film set tool kits with all the tools and extra materials I might have needed while working away from the shop.



Being a shop that uses a lot of 3D printing, Peter had implemented a way to reload the proprietary filament cartages for two of his FDM(Fused Deposition Modeling) printers. As one of my tasks during my time at Colpitts Design, I learned how to reload these filament cartridges. I opened the filament cartridge housing and removed any leftover filament. Connecting the filament computer chip to a computer I was able to overwrite what the filament computer chip thought was in the cartridge. I was able to change the type of material, how much material was in the cartridge, and the barcode. All these steps contributed to reprogramming the 3D printer to think it had a new cartridge of filament. After re-writing the chip I put a new spool of filament in the cartridge and closed it back up ready to be printed with again. Small changes like this enabled Peter to cut costs of running the 3D printer maximizing profits.

One of the most interesting aspects of the shop was seeing the cumulative process injection molded parts go through. From initial meetings and requirements from customers, Peter designed and manufactured the molds in shop which enabled him to cut down on the time it takes to produce final parts. Using programs like Solidworks(which we learned at Carleton) and Fusion 360(which I now use), Peter designed the molds from physical 3D printed parts or CAD files. Having dedicated machinists in shop, CNCing can happen as soon as the design is done. Using his full shop of CNCs, plunge EDMs, laser welders and manual mills Peter had the ability to create anything. Once a mold is complete I became more involved in working with the injection molding specialist. We would start by prepping the mold with movable cores in some cases, inserting ejector pins, lubricating locator pins and hanging the mold in the machine. Other preparations for the injection process included selecting and drying the right material, mixing colorant or blowing agents and heating up the machine and mold to the correct temperature. I learned that injection molding is a science. There is so much involved in each stage of the injection molding process. For example, selecting for temperature properties you must select the right temperature of the drying chamber, the heater bands or the mold. The immense pressure involved in filling a mold comes down to factors like injection speed, force, distance, holding pressures, cushion. All this information was overwhelming at first, so I kept asking questions about different aspects of the process, learning why certain parts wouldn't turn out well, and what different factors could be adjusted to achieve what we wanted. My tasks in the injection molding process was helping the injection molding specialist with his tasks starting the machine in the morning, cleaning/prepping molds, trimming parts and packaging them for shipment to the customer.

Relationship between education and professional practice

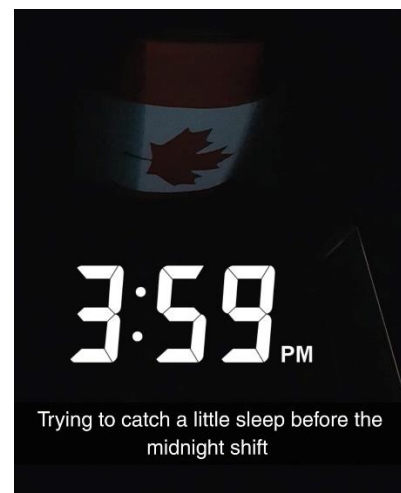
Working in an injection mold shop with both a 60-ton and a 150-ton injection mold machine, there were many molding procedures and techniques to learn. From the initial design of the part, cutting of the mold and the injection of plastic. Colpitts Design is involved with every part of this process, and I had the opportunity to learn from it. Finally, being able to see the processes of injection molding I was able to relate a lot to Mass Production technologies. An interesting stage that I was involved in with the post injection process, was that of a traffic camera mounting system. These components were injected with a glass filled nylon so that it would hold up against the harsh UV rays it would be exposed to outside, and be durable enough to be dropped. The injection process would pack the mold and eject the part into a bin. It was my responsibility to then trim three different parts from the runner, sort them, take one of those parts and put it on a shim so that when the part cooled it would not deform.

Four parts would be put on a shim, then they were hung in a bucket of water to cool. This process was done all day and required constant worker involvement. After making 500 sets, I had to press in threaded inserts into the parts we had on shims. This multi-step process taught me how much can be involved into the post-production of an assembled part. As the injection molding process is not completely automated for all parts, a babysitter/part trimmer must be implemented around the clock. As I got to experience, sometimes the machines run around the clock. In one instance, I had the opportunity to take a midnight shift from 12:00 AM – 6:30 AM. It was my responsibility to trim parts and watch over the machine and ensure that no parts got hung-up on the mold or overfilled the catch bin blocking the sensor that relayed to the machine that a part had been dropped.



Pic left: Trimming parts from the 60-Ton injection molding machine which was running belt clips. This mold had dual brass cores. It didn't need constant attention, so I was able to work on some other things then catch up on trimming.

Pic below: Prepping for the overnight shift it was different as I had to try to fall asleep way before I usually do.



A project I worked on that really tested my knowledge of materials and injection molding was creating silicone molds out of 3D printed parts. A big part of Colpitts design is the manufacturing and design of a device called “AcuShot” a needleless injection system for livestock. Peter designed and manufactured most parts in house. Now working on the second generation of the device I had the opportunity to see how special parts like ball screws were sourced from manufactures. My main job working on the AcuShot device was creating silicone molds of different parts like fluid detector housing, the handle, the battery housings and other small parts. I started off working with a co worker learning from him the different aspects of silicone molding like how to make the mode to produce the best-looking part all the way to curing the finished part. I had to take into consideration different things like how the material would flow from the runner filling the mold and all its cavities preventing air pockets from getting trapped.



Pic left: Platinum Food & Pharmaceutical grade Silicone that was used to make the molds

Pic right: Making the mold for the fluid detector lid.



Logo below: AcuShot a battery operated, handheld mass vaccinator (AcuShot, 2006)

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One of the most meaningful projects I worked on was helping create an assistive device for one of Peter's friends. Peter's friend Ron had recently suffered a stroke and had limited mobility in his right hand, thus making the use of his walker difficult. I assisted Peter in creating a 3D printed handle to be fastened to Ron's walker which would enable him to put his hand onto it and to control the walker with both hands. We did a light analysis of Ron's mobility to assess an improved position for his hand to be more ergonomic. Although the analysis was not very in-depth, we were trying to create an improved handle so that Ron would be able to support himself with his less mobile hand. This project also related to design and the user as we had to consider how Ron would be using his walker ensuring that this device would not interfere with the walker's functions like the brake, and so that he could move the aid to sit on the seat.



An interesting part that was designed and created at the shop was a CatMask. The CatMask is a device a veterinarian uses to put over a cat's face that prevents the cat from biting the vet while the vet works on them. The shop was originally contracted to mold the parts, however the customer had difficulties assembling the masks, so they came back to us to see how and if we would be able to assemble them. After trying a few different application techniques for applying the resin bond to the polycarbonate masks we felt confident we could assemble the parts for the customer. To determine how much to charge the customer a co-worker and I worked as a team assembling 20 masks and timing how long it took us to complete them. As we were timing ourselves it was important that we worked fast while paying attention to the quality of the bonded parts. We had to make sure that we didn't work too fast as we would be assembling 500 CatMasks, therefore we wanted to ensure we could keep up with our timed pace and to account for defective parts. This related to mass production technologies as we were the assembly line wanting to work fast and efficiently we were also the last line before delivery to the customer.

One of my favorite classes at Carleton was Design and Sustainability IDES 3107. It taught me about the designer's role in creating an environmentally and socially responsible product. I am conscious about my personal impact and attempt to make my own practices more sustainable where possible. This class gave me more insight in to how implementing sustainability into designs not only is good for the environment, but it can also end up saving money. From selecting the appropriate material, choosing materials that are responsibly sourced and the transportation of the part. Working at Colpitts Design gave me a first-hand experience into the manufacturing field which I found could very wasteful at times. From the creation of the molds for injection molding there is a lot of waste involved. Particularly in the CNC stage, where due to contamination from coolant or foreign materials, recycling depose will not accept the shavings from machining as scrap. In the injection molding process, during initial molding the first few parts are always considered and treated as waste as the machine is getting adjusted. Throughout the molding process depending on the application of the part, measurements must be taken to ensure that it is within tolerance. If it is off, lots of parts have to be disposed of. All these instances, although seemingly small create waste that builds up over time. In the film industry, I found that there was a lot of wasted time when people would sit around waiting to be called upon. Working on different film sets throughout my internship I experienced first hand how much time was wasted by people standing around waiting. Although it is not creating physical waste, it contributed to the overall cost of the production.

A significant part of professional practice is how you conduct yourself in the workplace. Working on multiple film sets I had to interact with different types of people like security guards, prop masters, actors, and even the directors. It was very important that I conducted myself properly as I was representing Colpitts Design. Peter taught me the basics of film set etiquette such as not taking pictures while on set, keeping out of the way and to "hurry up and wait". This term "hurry up and wait" became very evident in that everyone seemed to be in a rush, but then when it came to completion no one would be ready, and you would find that you had extra time because they are still waiting on other parts or actors to be ready. To illustrate this point, one time when I went to set I was asked to fix a prop that we created for Star Trek that had been damaged. I worked away disassembling and fixing the dents and found out later that they had completed all the shoots for the prop and it was just in case something came up and they had to do a reshoot. After repairing that prop, I sat on set for 6 hours before being called again to work with another prop.

Other relevant information

I grew up helping my dad in his work with construction, therefore I have acquired many useful skills in general contracting including concrete form making, framing, drywalling, painting, roofing and building decks. I feel that this experience has helped me learn about limitations of different materials and how things should be put together. I was able to apply some of these skills when Peter asked me to frame and drywall a section of a room in his shop. Then when professional drywallers cancelled a job at his wife's cottage, Peter asked again if I would work with a co-worker and his brother who works in carpentry. As I had done a few drywalling jobs before I felt confident in taking up the task to drywall the whole cottage. Over the course of a week we installed a total of 140 sheets of drywall. This experience made me realize that I am fortunate to have these skills, and I will be able to apply them in whichever job I end up in or while fixing my own house one day. I feel that my wide variety of experience in general contracting helped me get my internship, through my understanding different aspects of construction and how things are built.

Pic bottom left: Casting silicone prop hand guns for my Peter's hobby in airsoft.

Pic bottom right: Helped cut and frame for windows and doors on a shipping container for Peters Cottage Bunkie.

Pic right: While hanging sheets of drywall on the ceiling of the cottage I thought of creating platforms boots to reach the ceiling a little better.



The culture of a company can be an important factor in determining if a company is a good fit. During my interview Peter and I talked about our passions and what we did in our spare time. I told him about my passion of jet skiing and he told me about his old jet ski and how there is a group of jet skiers on his lake. The connection of passions outside the work environment brings together more enjoyable work environments where more people have things in common. Peter is also very involved in airsoft which is similar paintball, so the connection of common interests made me very interested in being a part of his work environment.

One of the first things you notice when you walk into Peter's shop is sound of Industrial techno playing. Peter has speakers setup around his shop so that he can listen to the fast-paced music in almost every room. As a fan of electronic music, I was happy to be exposed to a different kind of electronic music and to find a new online radio station "DigitalGunfire.com". The fast-paced music might have been a contributing factor to the elevated mood and motivation when working around the shop. I found that because there was a constant drone of machine noises the industrial techno in the background was a good distraction.

A point Peter made a few times was that he doesn't necessarily know more than other people he has just broken a lot of things. In breaking things, Peter has learned from his mistakes in finding the different limitations of materials, tools and how to build things better. Sometimes the best way to learn is through experiencing a scary event. This relates to lessons we've been taught in school to create many different iterations by creating and failing quickly to promote learning from failures. These failures may seem bad and make you want to quit the project, but it is then when you must continue, learning from mistakes and building from them. One time when I was working with Peter operating the CNC lathe, we created a program to cut a small part but we input the wrong value. Peter left to check on another project and I was left to run the program. The cutting edge got really close to the chuck and I panicked and pressed what I thought was the emergency stop, but it only turned off the power to the motor. Since it was spinning so fast it kept running through the program and cut into the chuck creating a really loud noise and breaking the carbide insert. After the machinists came over and realized what I had done he quickly helped me change the carbide insert. Fortunately, I hadn't broken anything other than the insert and gouged part of the chuck. Peter was more concerned that I hadn't hurt myself and that I had learned a lesson about being more aware.

A major benefit that I realized quickly when I started working at Colpitts Design was how close the shop was to my house. In my previous occupation, I would have to commute over an hour just to get to work then would have to battle in rush hour traffic to get home. But while working at Colpitts Design my commute was only a 20-minute drive to work. This enabled me to get extra sleep, make a better breakfast and added up to less of a total time commitment to work every day.

Before I started working at Colpitts Design I had never thought about working in the film industry. Since then I found a great interest in the wide variety of tasks involved. From set design, prop building, prop acquisition there is a wide variety of projects to be involved in. I was most interested in the bizarre fast paced projects that we would get asked to build. Sometimes having to work with tight deadlines where we would be working overtime to finish different aspects of the parts. This reminded me of projects in school where we would be working up until the last minute. Peter would bring up a quote from Leonardo Da Vinci that “art is never finished, only abandoned.” There can always be further steps taken to achieve something great and improve a project, it simply depends on how much time can be put into completing a project and deciding when is enough.

Pic right: CNC'd AcuShot housing from a block of plastic.



Pic bottom left: Helping Peter assemble weld and paint a prop.

Pic bottom middle: Laser Etched prop bullets for a TV show.

Pic bottom right: Prepping parts to be painted for a Star Trek prop.



Discussion

If you can find a job where you enjoy the task of going to work, your job will turn into a source of enjoyment and you will find yourself less drained at the end of the day. I found that going to work knowing every day will be different working on different things was very fun. Constantly modify and update your portfolio and resume before you forget about all your great accomplishments. Also depending on the type of job applying to modifying your portfolio to similar projects can help. When you show up to work with enthusiasm you are setting yourself up for improved mood and learning. Like starting anything new it may be nerve racking at first, but you will slowly get comfortable. Don't be afraid to ask to many questions.

One of my biggest disappointments that happened mid-way through my internship experience was that my phone died, and I was not able to access any of my pictures that I had taken throughout my internship. I not only lost all my pictures from my internship but also all the photos on my phone for the past 2 years. This was an unfortunate error on my part and made me think about how I should be saving all my documents in multiple places and that I should be backing up things that are important to me.



Pic left: When I went to Pinewood studios in Toronto to deliver and work on a prop for Star Trek.



Pic bottom left: Custom fabricated nuts for University of Ontario Institute of Technology's Electric race car for competing in Formula North.



Pic right: failed part for an AcuShot housing in a silicone mold.

Bibliography

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