Final Project Report
EDSGN 497B
Smith and Wesson .38 Special

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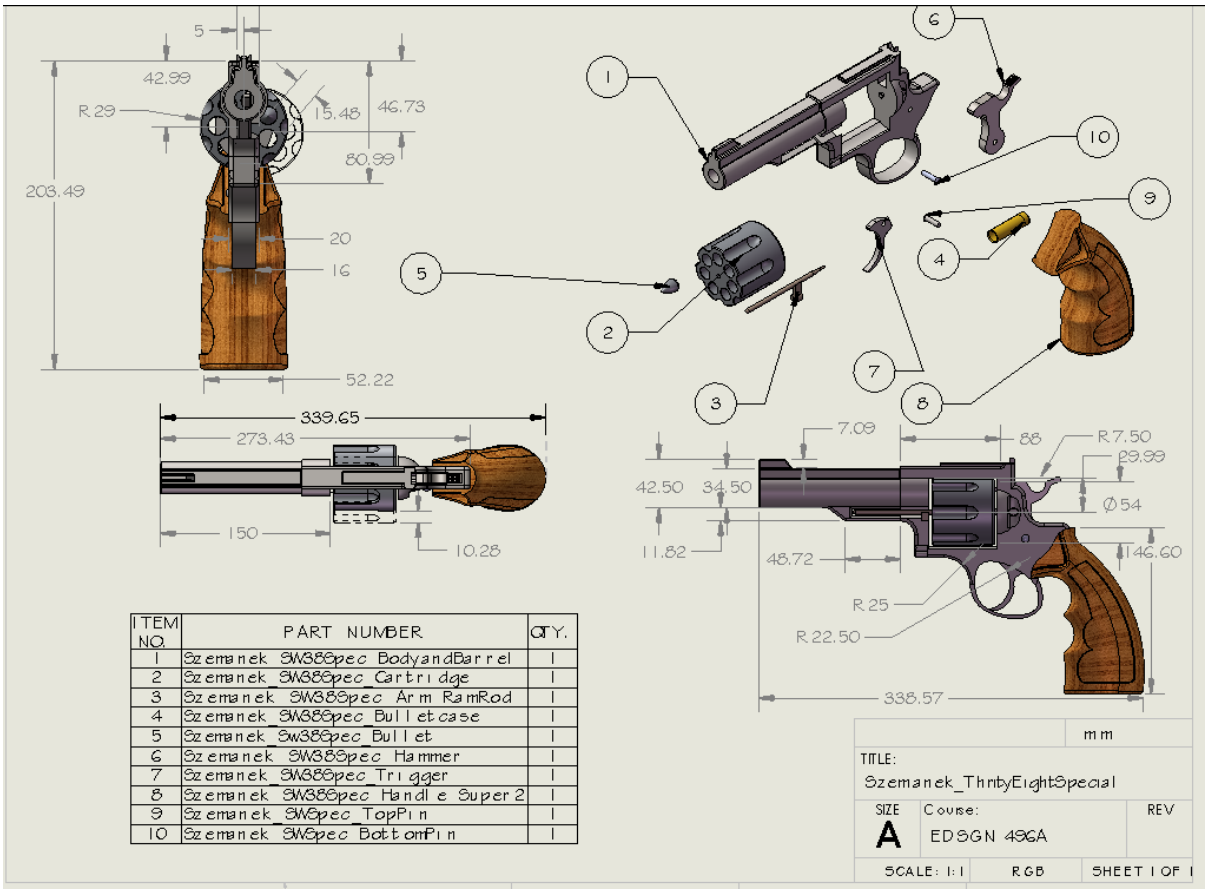


ITEM NO.	PART NUMBER	QTY.
1	Szemanek_SW38Spec_BodyandBarrel	1
2	Szemanek_SW38Spec_Cartridge	1
3	Szemanek_SW38Spec_Arm RamRod	1
4	Szemanek_SW38Spec_Bulletcase	1
5	Szemanek_Sw38Spec_Bullet	1
6	Szemanek_SW38Spec_Hammer	1
7	Szemanek_SW38Spec_Trigger	1
8	Szemanek_SW38Spec_Handle Super2	1
9	Szemanek_SWSpec_TopPin	1
10	Szemanek_SWSpec_BottomPin	1

Introduction:

My EDESGN 497B Final project consisted of the construction and modeling of a Smith and Wesson .38 Special revolver. The gun is made up of ten parts: the handle, the ramrod, the cartridge, the hammer, the trigger, the body, the bullet, the bullet case, and two pins. These 10 parts contain 298 features. The overall mass of the gun is 2729.5 grams, which correlates to 6.02 pounds.

The .38 Special is a common caliber used for decades in the military and in law enforcement. Smith and Wesson is the most popular maker the .38 special revolvers, with many different models. This model is the average version which has the medium size barrel length. This gun is for law enforcement and personal protection. The parts involved are intended to be able to simulate a somewhat normal firing action.

The following parts were created for the midterm and remain unchanged in the assembly:

1. One bullet to be replicated in the assembly
2. One bullet case to be replicated in the assembly
3. The hammer
4. The trigger
5. The arbor also known as the ramrod or the cartridge arm that allows it to swing out for reloading.
6. The cartridge which would contain the 7 bullets and their casings

Parts modified since the midterm to allow proper assembly and use of later course lessons:

1. The body of the gun, including the barrel, were modified in the assembly using top down techniques
2. The gun's handle, which was surface modeled
3. The fastening pins (2)

Design Intent:

The internal parts were not created as I do not have a model for them and due to time constraints could not come up with a proper schematic to simulate the legitimate firing process of the .38 Special. Since I am in the engineering design certificate program I will have time to finish this in later semesters. The pins were finally completed and included in the assembly. The parts and assembly are intended to allow for reloading and "firing".

Discussion:

Assembling the 6 unmodified parts from the midterm was relatively simple. They mated together pretty easily and getting the advanced mates such as distance and angle movement relations were not much of a hassle. The body of the gun was used as the base for the assembly. Unfortunately when it came to mating the handle to the body I had a lot of issues. I also thought my original handle design was pretty ugly, so that was redesigned using surface modeling. It is much nicer looking. Unfortunately surfaces and faces do not mate very easily, so I used planes and widths for the majority of the mates between the handle and the surface. But when I had to press fit the handle to the body in the end, and this causes the only interference/collision in the assembly.

The cartridge is assembled with an angle motion mate to allow it to swing from the open to locked position as it would in real life while loading and unloading the gun. Distance mates were used for the bullet, trigger, and hammer. The bullet uses a simple distance mate to allow it to travel from the case through the barrel. If the cartridge is spun while the bullet it outside of the case (which is locked inside the cartridge) the bullet will collide with the barrel. This is allowed because that will never happen in real life and I wanted to simulate all of the moving parts at once.

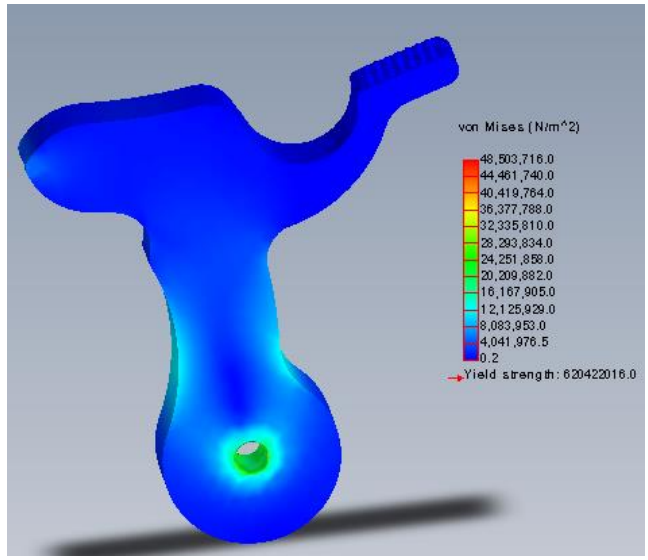
Surface modeling proved to be one of the biggest challenges of the entire project. The loft of the handle took a while to come up with. I decided to use projected curves attached to the guide curve (the circular shape of the handle). This was the only way that I could get it to work, additionally, I had to make two of each of the projected curves to surface the finger rest and palm rest portions of the handle. They would only loft separately, I combined them later on.

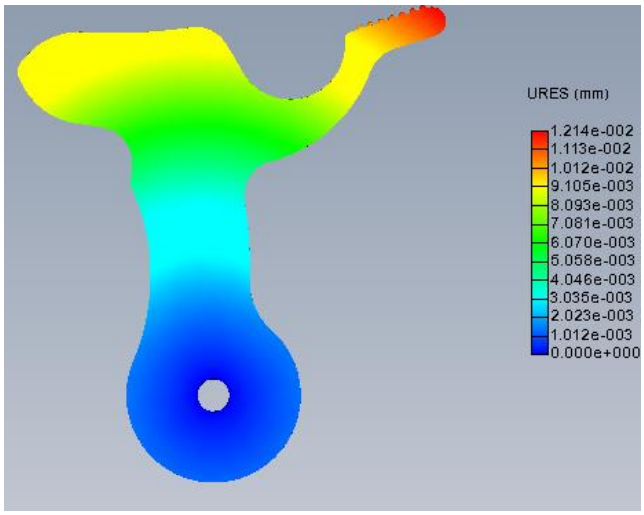
Once the handle was press fit and mated to the body, some portions overlapped and had to be adjusted in the model using top down techniques. I edited the handle and the body of the gun while in the assembly to make the overall appearance of the assembly look neater. The area that was of major concern was the trigger guard. I used in-context references which connected to the external reference of the body and handle (->) so that the part would change in its individual file as well as in the assembly. This also applied to if I moved the handle of the gun, which was a life saver when trying to correctly position it. In using the top down techniques to edit my parts a lot of complex geometry was used including splines, which have under-defined the assembly and the related sketches.

I did not have any references for the internal parts of the firing mechanism. I want the gun to work as an entire mechanical system, and this will be done later on after semester's end. Once these parts are complete I will do a mechanical motion analysis and include animations to properly model the .38 Special.

The majority of the drawing were easy to do. There is a lot of complex geometry in the many of the parts, so fully defining every view was basically impossible. Detail, section, crop, and break views were actually a necessity since there are many small and internal features in parts of the gun. The crop view is used to show the lip on the bullet casing since it is so small. The detail, section, and break views are used for the cartridge since it has small hidden features. This clutters the drawing a bit but it is still very readable. The hardest part of making the drawings was the exploded and layered configuration views since we had to add the configurations ourselves. This took a long time to figure out but I was finally able to illustrate on the assembly drawing how the cartridge and the ram rod swing out to allow for loading.

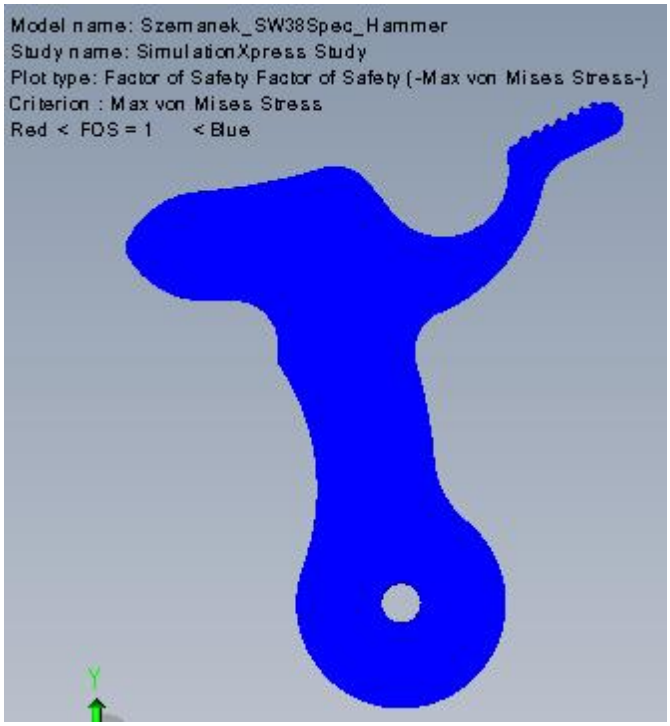
The simulation actually took longer than expected. The complexity of almost every single one of my parts was too great to allow for meshing. I was final able to construct a mesh on the hammer of the .38 special. I simulated the force on the head of the hammer that would be exhibited when striking the bullet case and firing the bullet. The fixture is the pin hole as the bottle of the hammer where is rotates. The first study that was run was a stress analysis on the hammer. The highest von Mises stress that the hammer is exposed to is between 20 and 42 Mpa. The yield strength is approximately 620 MPa.





This results will in very little displacement since the stresses don't come anywhere near the yield strength. A displacement analysis was run and the results are illustrated to the left. As predicted there is minimal displace in the hammer of the .38 Special. The largest displacement is in the thumb rest of the hammer, which is a little surprising, but it is the farthest and most angled portion so it does make sense.

The final study that was conducted was a factor of safety analysis. This further proves that the hammer will not fail. As seen to the right, the hammer is shown in blue throughout its entirety, which means that no portion of the part will fail as its factor of safety is above one.



Conclusions:

I thought the .38 Special was going to be a struggle to work on with some of the more complicated parts and as it turns out I was right. In the long run, I learned a ton about assemblies and surfacing because of it, so I am thankful. I am now a big fan of surfacing regardless of how painstaking it is. I am very much looking forward to continuing this project and SolidWorks education. I fully plan on taking the CATIA course next spring and doing as much as I can with SolidWorks over the summer. After I took my junior design class I knew I wanted to be a design engineer, and this class confirmed it. I can’t get enough and I would love to make a career out of this newfound skill. Thank you.