JUNKERS JU 87 “STUKA”
SOLIDWORKS Final Project

NATHAN WILLIAM RALPH
ENGINEERING DESIGN 100 – SECTION 07
The Junkers Ju 87, or more commonly referred to as the Stuka, is a German WWII dive bomber (see Figure 1). Dive bombers were used widely in WWII, especially by the Axis Powers. During WWII, normal bombers were massive, slow planes with crews of nearly a dozen. They flew at very high altitudes and dropped hundreds of bombs. Each individual bomb was very inaccurate, but when dropping so many at once, missing the target was virtually impossible. This was very effective, but these huge bombers wasted a huge amount of bombs. On the other hand, dive bombers carried only a few bombs, but would “dive” down toward their target, getting to a very low altitude, allowing them to be very accurate. No WWII dive bomber is more recognizable than the Stuka.

Since a young age, I have been interested in WWII. In my opinion, WWII had the most fascinating planes. The use of planes in WWII was the most widespread use of aircraft the world had ever seen. However, these planes were still very basic. I had many models of WWII planes as a child, and this is because they were common and simple. As a child who didn’t understand much anything airplane physics or engineering, I found that all of the Luftwaffe planes always stood out to me as being the most unique. The Luftwaffe was Germany’s air force from WWII. All of the American, British, Russian, and Japanese planes had a standard design. Many Luftwaffe planes were unique, but the most unique one of all, and my personal favorite, was the Junkers Ju 87.

I was very hesitant to choose a project of this magnitude, but I am very happy that I took that risk. The Stuka has many awkward design features from its gull wings, to its non-retracting landing gear.
Sadly, most of these features made it much less effective in combat. But for my purposes, these features made it much more of a challenge to create in SolidWorks.

My design process started out with a simple model. Some people created their models by creating each part perfectly and putting them together in the end, but for me this was simply not the case. I began by creating a basic model of each part, assembling them together, and then improving all of the parts over time. As seen in figure 2, each part had only a simple 3d outline when they were first assembled.

![Figure 2- Initial Model of Stuka](image)

This initial model consisted of five parts. The two wheels were the simplest parts to create. They are simply a combination of some extruded bosses and cuts. The wheels are the same part, only inserted twice. This is the only time I used a single part more than once. The left wing and right wing are very similar, but they are mirrored. For simplicity, I made them two different parts. Each wing is a combination of three planes with sketches, and then two lofts between them. I used two separate lofts instead of one because if I would have used one loft, it would have smoothed the wings out. Since the wings have a sharp bend in them, I used two lofts.

The final part on the initial model, as well as the most complicated part overall, was the body. To create the body, I started by drawing out the top and side views on paper. I then sketched the top view in SolidWorks and boss extruded it. I then created a reference plane on the side of this extrude and then sketched the side view. After this, I cut extruded everything out of the original extrude, other than the sketch. This gave the plane a very basic shape, however it had perfect measurements. After
After the initial model was complete, I first added three new parts. The propeller, rear wheel and bomb were all simple parts to create. Like the other simpler parts, they are comprised of boss and cut extrudes. The bomb also contains a revolved base. These parts were simple to create, but made the plane feel more full and complete. I also added many fillets to the existing parts, to make it appear smoother. Figure 3 shows this progress, along with some basic colors I added while working on assembling these new parts together.

At this point, the only changes to the model I made were simple things like adding fillets or moving parts slightly. I did however add one final feature that was not discussed in class. As seen in figure 4, there are four of the Luftwaffe symbol on the plane. Two are on each side of the body, and one is on each wing. These symbols, along with the yellow band on the back of the body, were created with the Split Line feature. This feature takes a sketch, and projects it through a feature, splitting all of the faces it comes in contact with. Using this feature, I drew the Luftwaffe symbols in sketch mode, and
then used Split Line to project them onto the model. Finally, I colored the symbols and the rest of the model.

![Figure 4 - Final un-rendered model](image)

The Stuka is a very unique plane when it comes to design, so this model offered plenty of challenges. The most difficult part of the project was the final step where I applied color to each of the parts and faces. Not only did I color them appropriately, but I experimented with the diffuse, specular, and reflective values. The cockpit is very shiny and reflective, while the body is rough and matte. This experimentation took lots of time and patience, but I believe that it looks much better as a result of this tedious experimentation. The Split Line feature was also a pain to work with, since it was constantly throwing errors at me because of invalid geometry. Despite all of my troubles, the final colors look great.
I am happy that I learned how to use SolidWorks this semester. I am a prospective computer engineering major, and I love programming, so learning how to use a complex computer program like SolidWorks was a lot of fun. SolidWorks also helped me learn Multiview and Isometric drawings. Being able to create 3D models while learning how to make drawings on paper helped me learn both. The drawing feature shown in figure 5, was another crucial element of SolidWorks that helped me learn how to create physical drawings, and more importantly, understand why physical drawings are important.

In the end, I am proud of what I created, and I am glad I attempted something more challenging. It turned out looking fantastic, and I learned so much about 3D models and computer graphics. I have always wanted to learn how to use a 3D modelling program, so I am happy that I was required to learn this for a class.
Works Cited
