Transform your Approach to Product Development with Fusion 360

Ed Eaton
DiMonte Group, Inc.

Learning Objectives

- Understand the transition between SolidWorks and Fusion 360—and how the Fusion 360 Design Team makes that easier.
- Learn how to use 3D scan data in Fusion 360 (bottom line—it rocks!)
- Discover the power of T-Splines, and the intuitive interface for manipulating them implemented by Fusion 360.
- Never forget that you are a designer first, not a CAD jockey—don't let the tools keep you from making the best possible design.
- Collaboration and Fabrication Opportunities

Description

We've owned Fusion 360 software for a year. Projects that come into our company are commercial gigs, so we haven't been able to justify the learning time involved with using software new to us against a real-world design job's timeline. So, we just kept plugging along in SOLIDWORKS software. But it kept nagging at us that maybe Fusion 360 software could do the job better. We don't believe that you can "play" with new software and really evaluate it. You have to actually work with it toward a specific, focused, real-world goal with real-world consequences in order to gauge if it's a fit for your process.
In this presentation, we will discuss how we forced ourselves to jump into the deep end of Fusion 360 software on a project with very real ramifications. We designed a device for a boy with a physical deformity to enable him to get out on the ice and play hockey. This involved dealing with 3D scan data, matching complex surfaces to those scans, and then designing an enabling device that would finally help that boy to skate for the first time in his life. This session features Fusion 360.

About the Speaker

Ed Eaton is a Senior Industrial Designer and Principal of the DiMonte group. Located in Chicago's western suburbs, the DiMonte Group is a product development consultancy with expertise across a wide spectrum of industries and manufacturing processes. A high-level SOLIDWORKS user for over 18 years, Ed has developed an international reputation for sharing his critical and calculated use of the 3D tools employed by the DiMonte Group in the service of their clients.

Introduction

As designers, we have access to really terrific tools. We assembled this arsenal of terrific capabilities to best service our customers.

We recognize that this privileged suite of tools that we have at our fingertips can also be used to help people out that could not realistically afford to hire us.

This is a story about how we used our existing tools, combined with a new tool (Fusion 360), to help design and fabricate an enabling device that would help one kid overcome his disability and play hockey.

In the process, we learned how Fusion 360, from the ground up, understands design, from concept through changes all the way through to fabrication. It was exciting to discover, and I am excited to share that story of discovery with you.

About the DiMonte Group

We are a product development firm located in the suburbs of Chicago.

I'm an Industrial Designer. My profession is probably understood by most of the folks attending this AU conference. But it means nothing to most people. They wonder if I make factories or something.

So, when I get cornered at social events and try to summarize what I do, I just say that "People hire us to invent stuff for them". That simple line says it all.

The image above shows a little taste of the types of things we've designed. If you are curious about our expertise and how we help our clients, go to http://dimontegroup.com/portfolio_consumer.html for additional examples.

We have deep experience working in multiple industries across the full spectrum of manufacturing processes. So when a challenge like the focus of this case study comes up (or any of the jobs we get from our clients) we can quickly zero in on the most appropriate process for the job and start designing for that process.

It's really rewarding to be in the professional business of helping people. It's a great gig, and I treasure that I found it.

Our commitment to helping out the community

Another thing that I treasure about the DiMonte Group is that we have a commitment to help out our community.

We have sponsored/mentored projects with our local High School's Engineering program. We regularly host young people to do job shadowing so they can see if the fields of Engineering or Industrial Design might resonate with them to help guide their choices in selecting colleges and majors. We hold a position on the advisory boards for the Engineering programs of both Northwestern University and Northern Illinois University.

We also have a relationship with USA Disabled Hockey.   What this organization does is amazing!
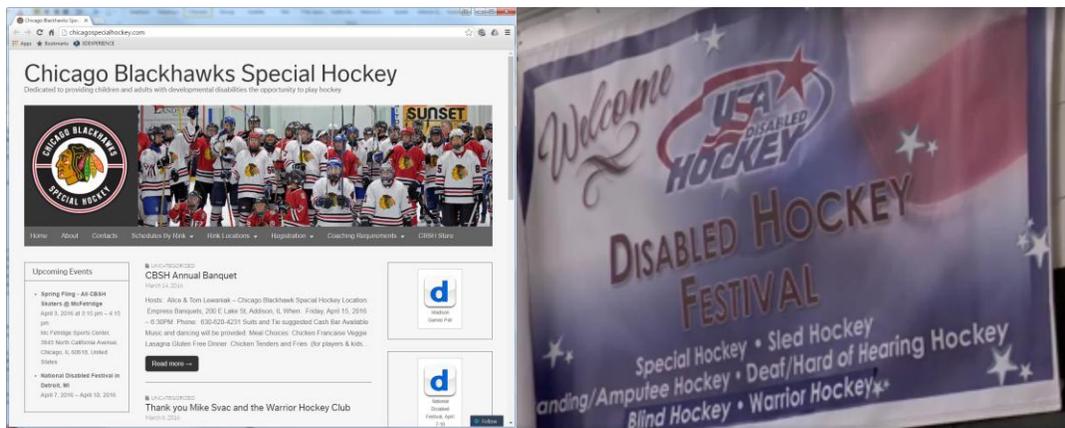
For just one example: Blind Hockey exists. It blows my mind that these people with major-to-total visual impairment go out on the ice to compete, because I can't even skate well. The specialty puck that they use creates sound when it gets hit and as it traverses the ice. The existing pucks are expensive and need to be replaced/retired multiple times during a match due to the damage they take from the hockey sticks. As product designers, we have stepped in to use our skills and our vendor network to improve the puck design and substantially reduce their cost.

We have resources most folks don't have access to

The vast majority of people don't have direct access to the tools we do. We have 3D scanning, 3D printing, full fabrication capabilities, our previously mentioned vendor network, and a staff of talented individuals that can bring just about any idea to reality.


And of course we have high end 3D software.

Expertise in SOLIDWORKS

DiMonte Group was founded with one of the first commercial seats of SOLIDWORKS.
Our President, Gene DiMonte, founded the Chicago SOLIDWORKS user group.
We are known worldwide for our expertise in SOLIDWORKS. We figured stuff out that other people were struggling with, but instead of keeping those discoveries to ourselves, starting in 2002, we've volunteered to give sessions at SOLIDWORKS WORLD to share what we've learned, then posting the presentations and sample files on our website to continue to share that knowledge. I don't need to sell you on this - you can Google my name and SOLIDWORKS to confirm the impact we've had in that community.
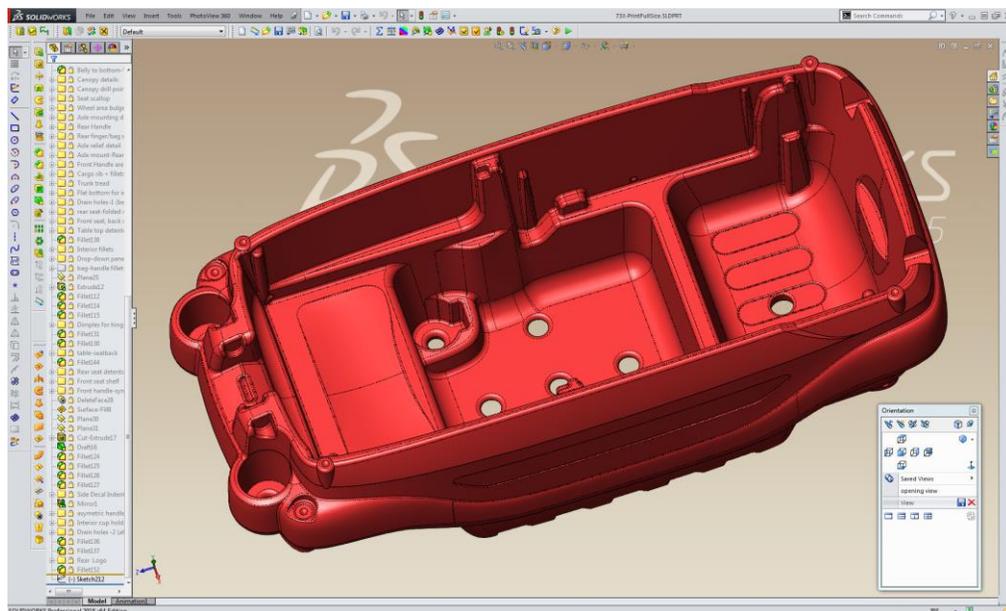
RADIO FLYER WAGON, REVERSE ENGINEERING AN ALIAS FILE, ADDING PRODUCTION DETAIL

We also have other cool software

We have done jobs in Creo and Inventor in the last year when a client needed the data delivered in those native formats. As mentioned in the introduction, we also picked up a few seats of Autodesk Fusion 360 over a year ago.

Fusion 360 looked like an exciting product. We were eager to give it a try on a job for a customer, but it is the nature of our business that we are at the mercy of what comes in the door. We knew there would be a learning curve and were prepared to eat that cost – if we used Fusion on a gig, we would discount the hours back to what the job would have taken in SOLIDWORKS. I like that we have that flexibility to do that.

Unfortunately, we do not have the ability to add days to a calendar. So even when we got jobs that made Fusion 360 look attractive, the timelines were so tight we'd be doing a disservice to our customers to gamble on it.

Pulling off the band aid

We had Fusion sitting on our computers. Our reseller would ask if we at least played with it?

I do not believe in "playing" with software. I'm a designer. My software is my tool. I need to know that it really works.

Here's an analogy: If I was having a cardiac event, I do not want to hear that the EMT working the defibrillator had "played with it"

I got good at SOLIDWORKS, doing stuff that folks would say couldn't be done in it back in the late 90's, because I committed myself to make things exactly as they needed to be with NO COMPROMISES.

So we needed to "Pull off the band aid" and commit to a real job to see if Fusion 360 had the chops to be a tool we could really use.

As it turns out, the perfect project landed on my lap due to our relationship with USA Disabled Hockey.
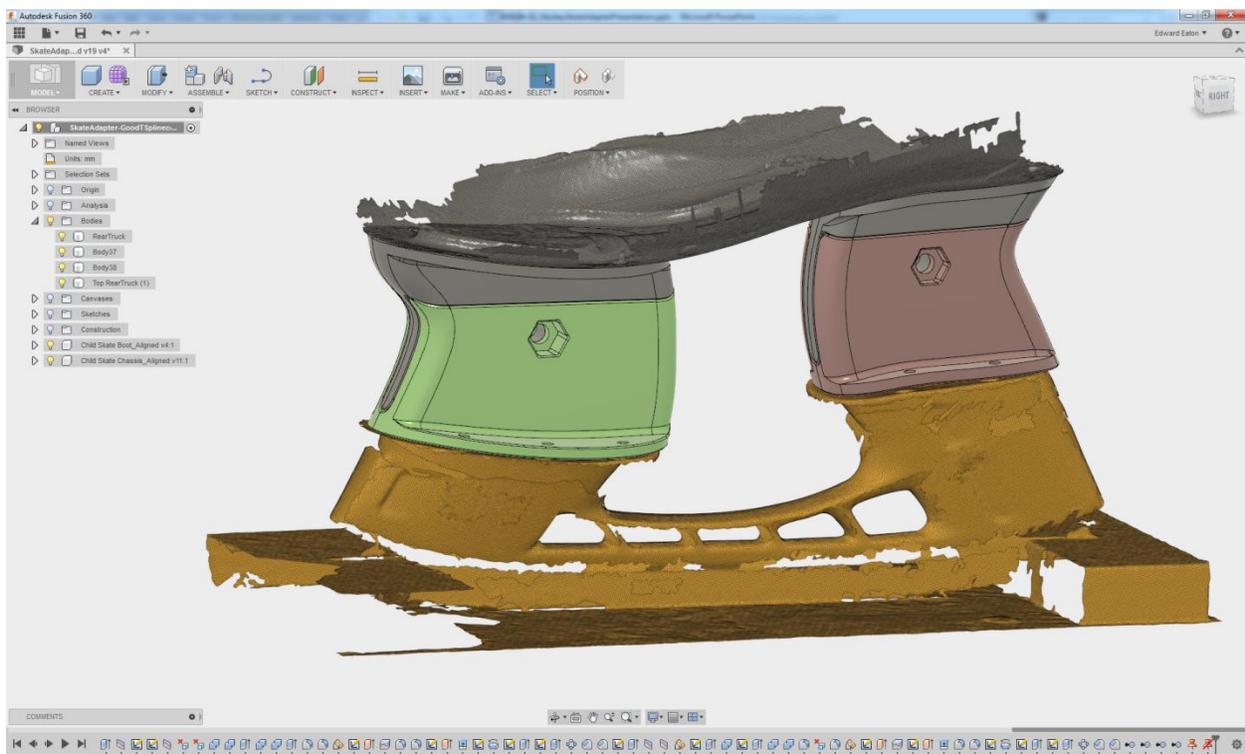
The Project

Gene DiMonte learned about a young adult that has a very specific problem.

One of this kids legs is 2.5" shorter than the other.

There just isn't anything existing out there that would allow him to adapt a pair of skates to his condition so he can get out on the ice. But this kid saw his older brother playing, and really wanted to be able to do the same.

Fortunately, solving problems is what we do. So we volunteered to help out.

And it turned out to be a perfect trial for Fusion 360 because we were going to have to do everything – 3D scans, modeling, problem solving, prototyping, make changes, and then get the final parts fabricated.

The Plan

As with all projects, this started with research. We needed to see the equipment that was used to attach the skate truck to the boot so our adapter would be compatible with that infrastructure.

RIVETING ARBOR AT THE LOCAL SKATE SHOP

From there, we worked through the design using hand sketches to come up with a design that could be machined, worked with the rivet press, and eliminated stress risers.

CONCEPT SKETCHES FOR ADAPTER ASSEMBLY

Understand the transition between SolidWorks and Fusion 360—and how the Fusion 360 Design Team makes that easier.

The first thing that I have to own up to is that I really *hate* learning new software that does the same thing as what I am currently using.

After organic modeling presentations at SOLIDWORKS World, people would always ask me if I had tried Rhino or ALIAS. I said "no". My clients don't have that software, so I don't want to even waste my time. I am focused on getting ALIAS and Rhino results out of SOLIDWORKS.

And I did. And still do.

To be really great at something, you have to focus on that one thing. I have over 30,000 hours of driving SOLIDWORKS. I know how it thinks. When something doesn't work, I can intuit a workaround in minutes.

This Fusion 360 experiment needed to be done because it *doesn't* do the same thing as SOLIDWORKS.

But I still hesitated because I had to learn a new environment, and I knew I would be agonizingly slow at first.

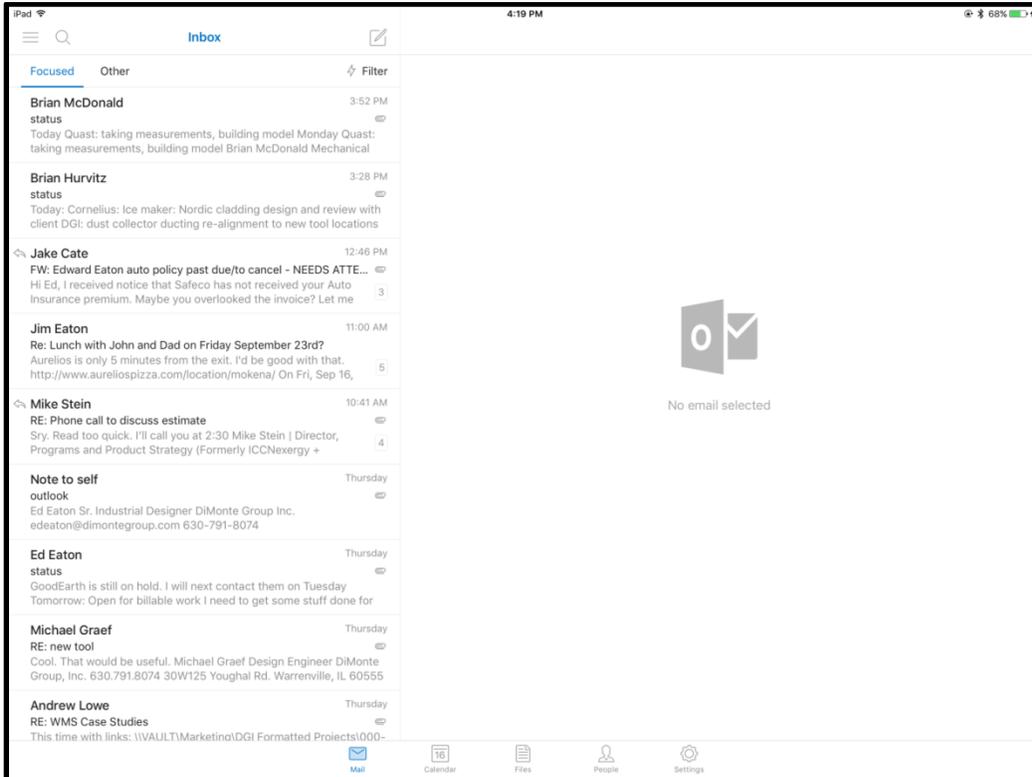Here's an example that I think everyone can understand: Outlook

This is Outlook on a desktop:
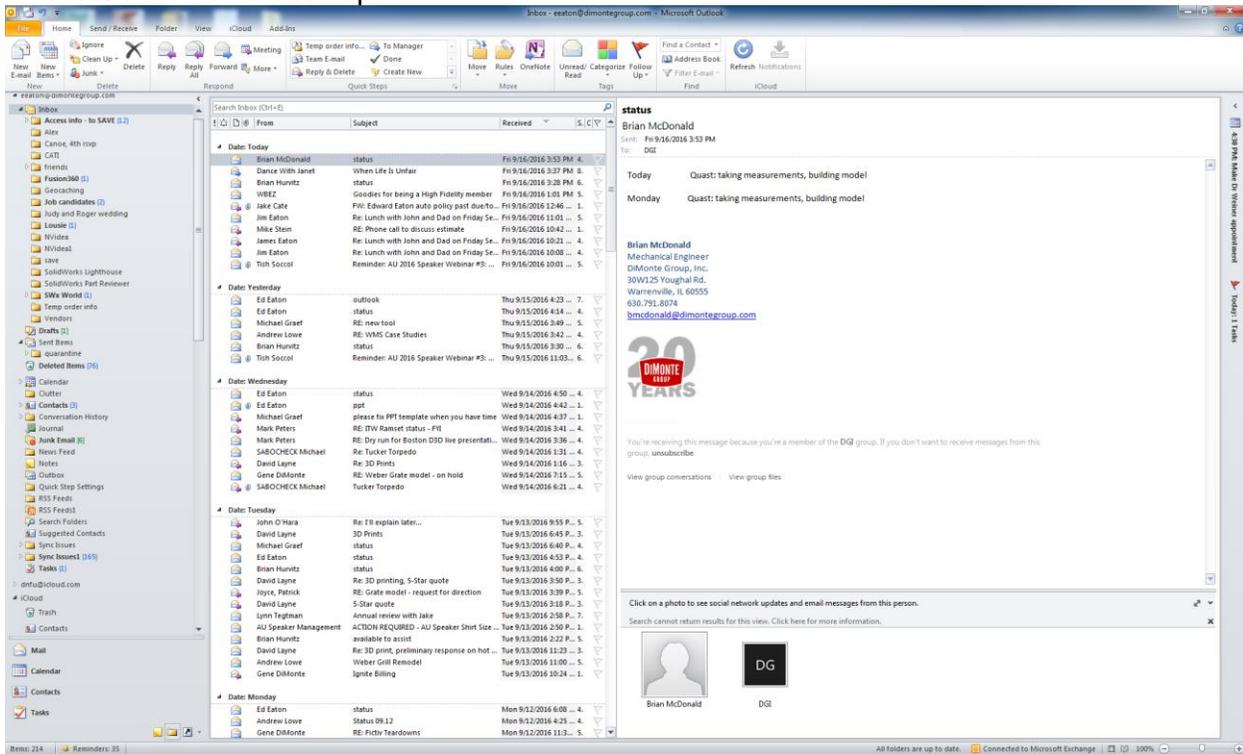
This is Outlook on the web:
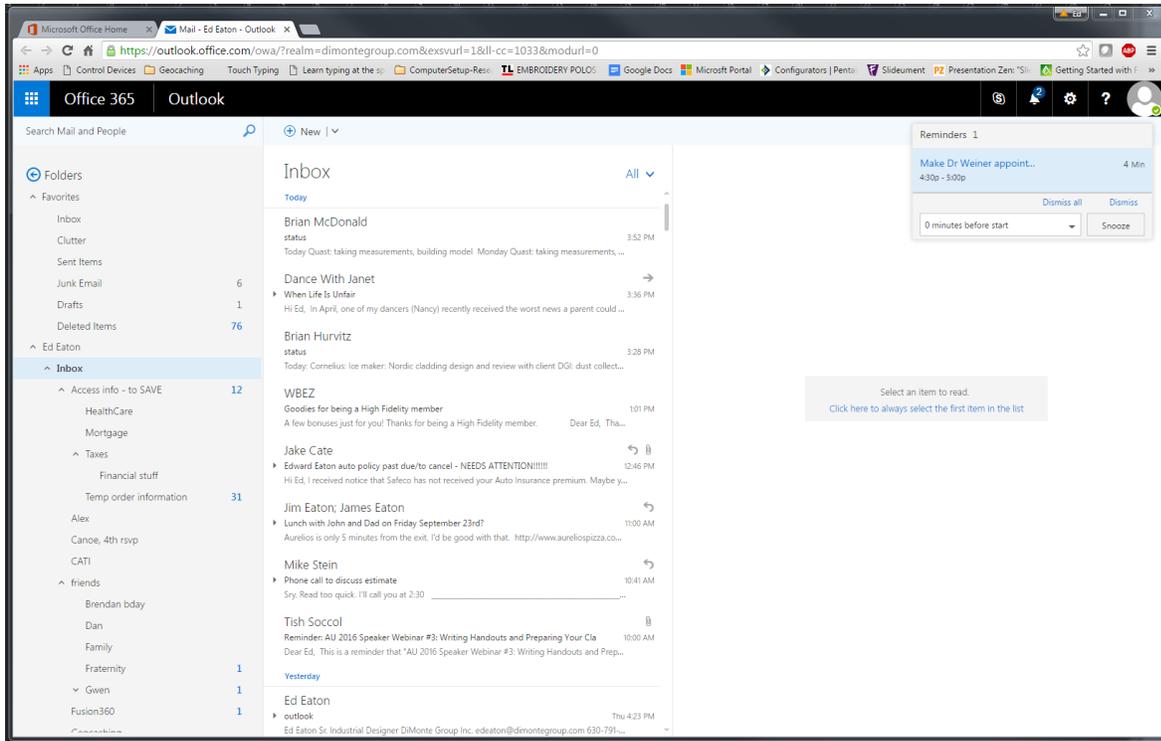

This is Outlook on a mobile device:

It is the same software, from the same company, on 3 different platforms, with wildly different interfaces.

When switching between these Outlook interfaces, the modality isn't the same.
Email should be the simplest thing in the world. Yet there are different workflows and icons between these three versions of the SAME PROGRAM. Ugh! And as a result I am slow and inefficient in the web and mobile versions, and those experiences even pollute my desktop usage.

SOLIDWORKS compatibility mode

I was pleased to find out that Fusion 360 "gets" this issue, and added an option to match the same Pan, Zoom, and Orbit behavior from SOLIDWORKS to help SOLIDWORKS users out.
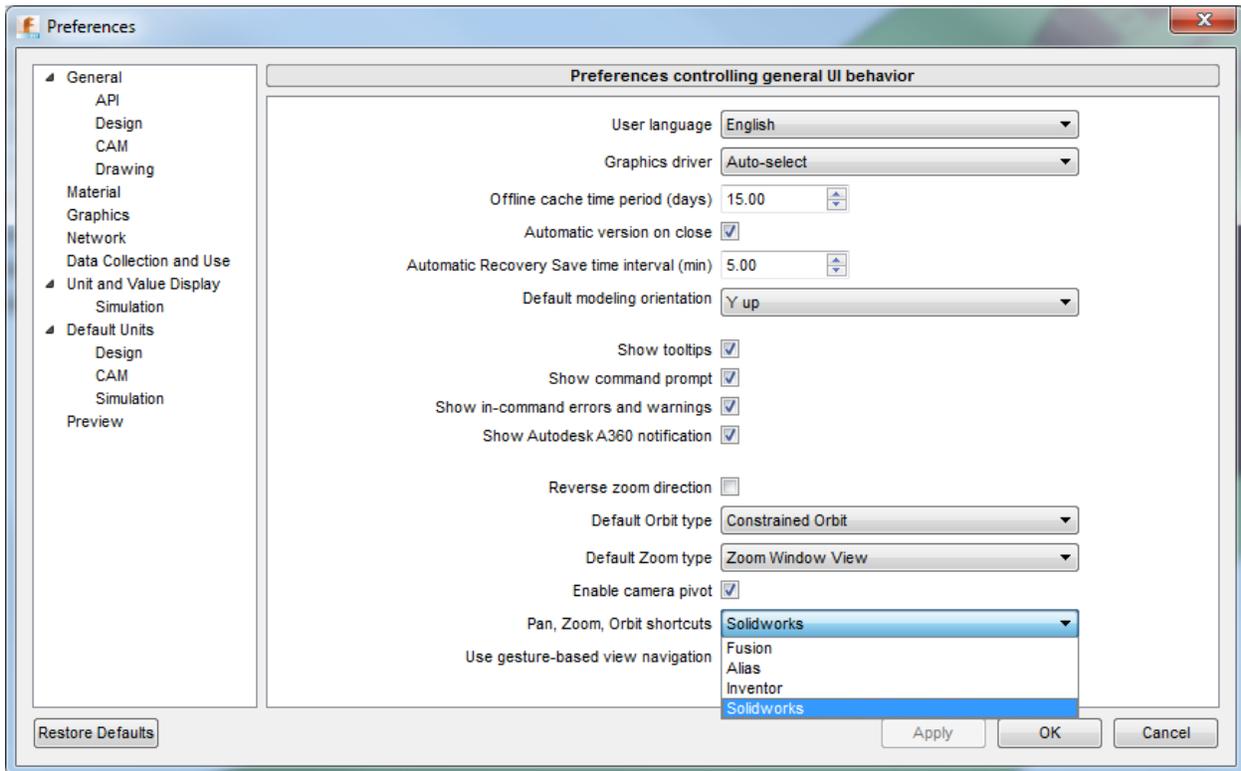
I was a much appreciated treat to not to have to throw out 30,000 hours of muscle memory from my years using SOLIDWORKS.

A lot of the stuff is the same

All the tools a SOLIDWORKS user is used to are there. You just might need to look around a little for them.
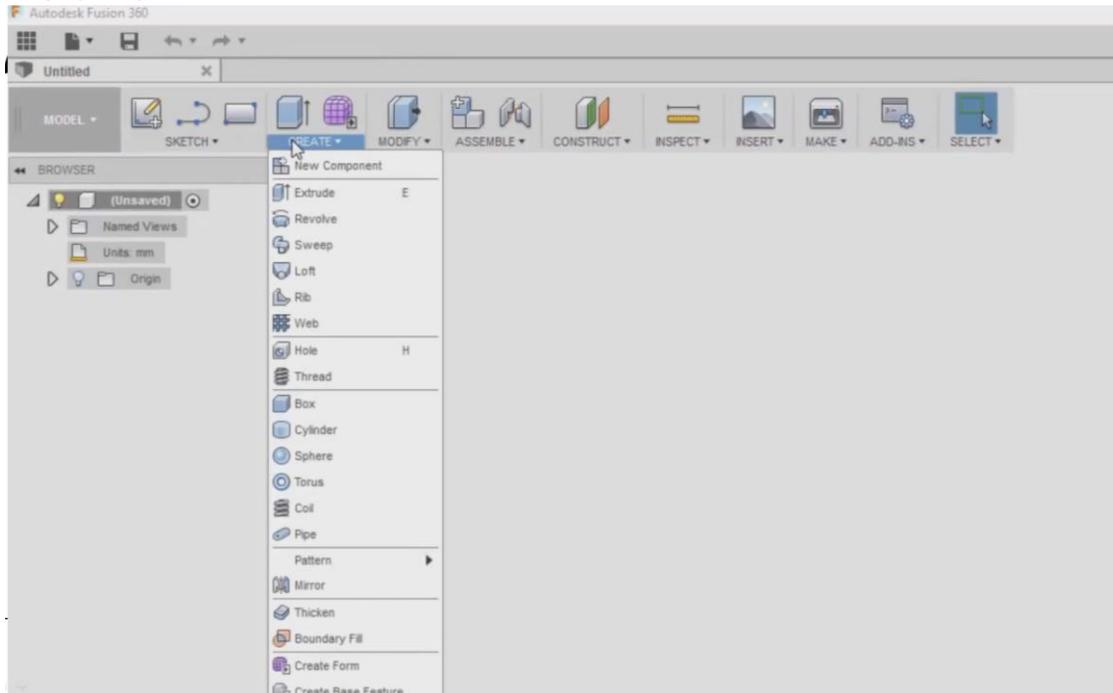
TOOLS AND ICONS

The modes are a different thing to get used to

One thing that I stumbled with was not keeping track of what mode I was in
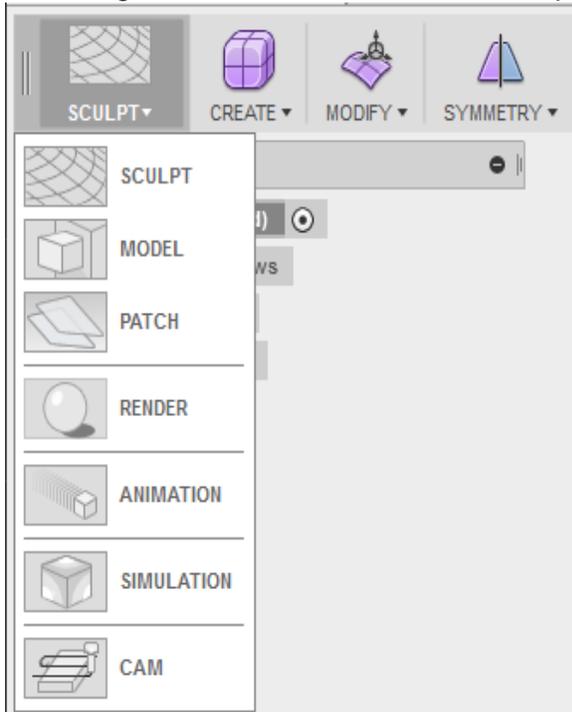
.
There are different modeling environments, each which allows you to only do a subset of things.

Since I did a bit of back and forth between Sculpt and Model modes, I would lose track of what I was locked into and wonder why I couldn't access the tools I was looking for.

It's just something new that I needed to learn to be aware of and get used to.

The training resources are plentiful, and the Fusion 360 team is enthusiastic.

I'd say the biggest surprise (and a welcome one at that) was just how many resources I could find online to help understand Fusion 360. Every time I ran into a snag I could go to Google, describe my problem and get connected to terrific videos. It seems to be in the culture of the company that anytime they get a tech support call or discover a customer issue, they record a video and then share it widely.

Learn how to use 3D scan data in Fusion 360 (bottom line—it rocks!)

No matter the software package, there are important steps that you need to take when you bring in 3D scan data for reverse Engineering. I do have to say that it was a dream in Fusion 360.

1. **Import the data.** Fortunately, this is as simple as opening an STL file. SOLIDWORKS does allow us to bring in an STL file as a "graphics body", and we have developed tricks to make this useful by using extruded surfaces to intersect the "Graphics Body" to create ersatz sections for tracing. Fusion 360 simply works with an imported STL the way it works with any geometry. You can section it, measure it, and even make references to it! *This is cool.*

2. **Check the scale of the imported data and correct it if needed.** THIS IS IMPORTANT. You have to keep in mind that STL data is uniteless. When saving, you need to be sure that you match units with the default units of the importing system. You never know for sure if this happened, so it needs to be a reflex to check before moving on. In this case, the data was exported where each unit was in inches, and then imported as if each unit was millimeters.
    Scaling the body is as simple as going to the scale command and entering a scale factor of 25.4.
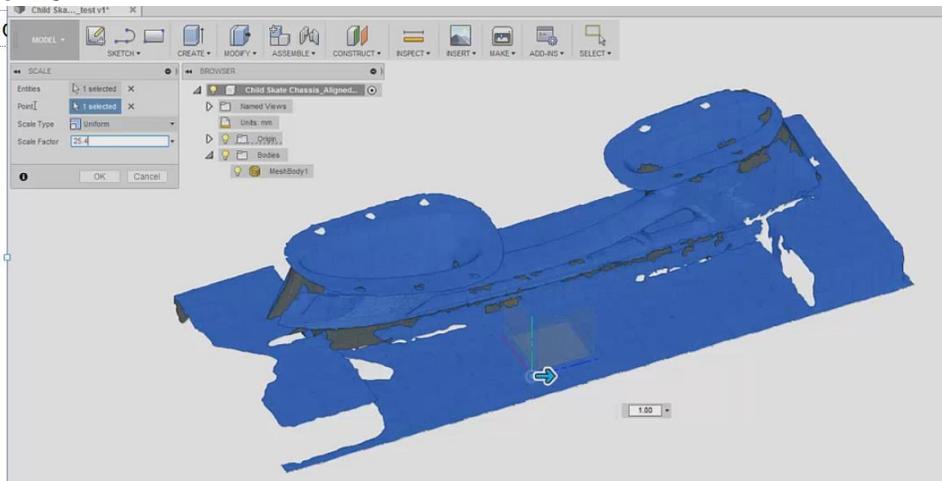

IMPORTED STL IN FUSION 360

3. **Orient to your origin.** The base planes and origin are really useful. You have to move the scan data to take advantage of them.

4. **Enable history!** This is the only area where I hit a bump with using imported 3D scan data. Fusion 360 assumes that if you have imported data, you want to work without feature history, using a direct modeling approach instead. You HAVE to enable history if you want to take advantage of parametric design.

Inspect – Section Analysis

I was very pleased to discover that Fusion 360 allows us to section an STL. The closest we get in SOLIDWORKS is having the ability to section a mesh file, but we have to upgrade to Professional or Premium to do so and enable the Scan to 3D add-in. In Fusion 360, sectioning just works from the get go.
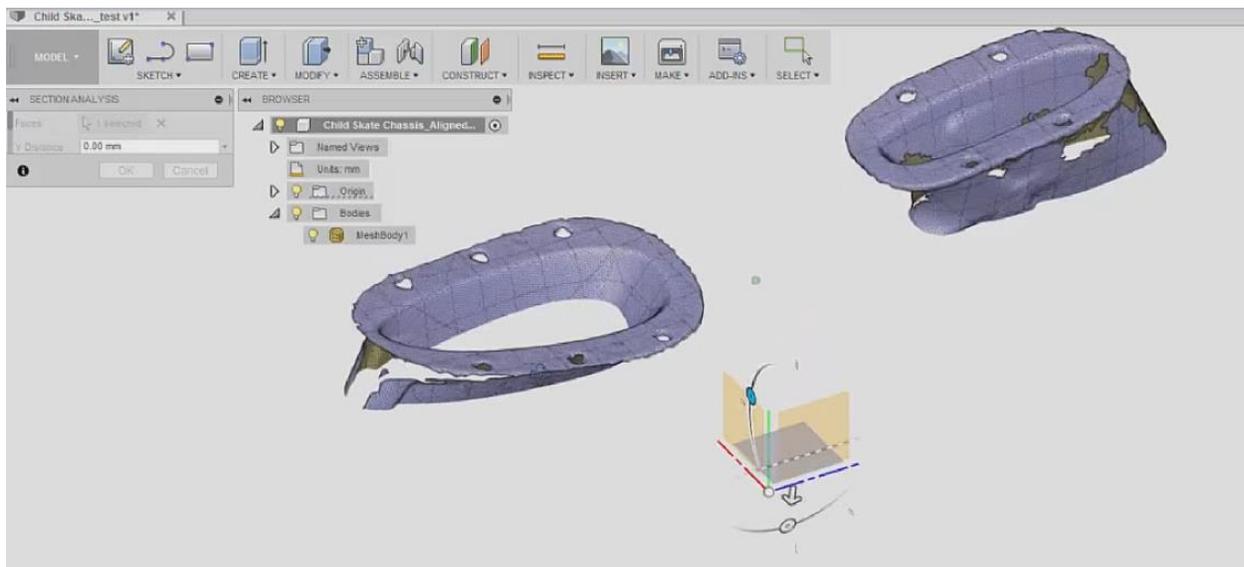
SECTIONED STL

Fitting surfaces to the 3D scan

When working with 3D scan data, it is tempting to use some of the tools that CAD vendors try to provide us to automatically fit new geometry to the scan. In Fusion 360, this is the Pull command: http://www.instructables.com/id/Fusion360-Snapping-a-T-spline-Form-to-3D-Mesh/

I have found it best to resist the temptation. A computer just can't make the right decisions. Note that the 3D scan data that we have is incomplete. There are holes in it. Also note that the 3D scan looks rough. There is a tolerance associated with 3D scanning that makes smooth surfaces end up looking rough/lumpy in the scan data. To get the best results, you need to have a designer at the helm making decisions.

Discover the power of T-Splines and the intuitive interface for manipulating them implemented by Fusion 360.

The most important part of this project was to match our spacer parts to the 3D scans of the boot and truck that we were adapting to.
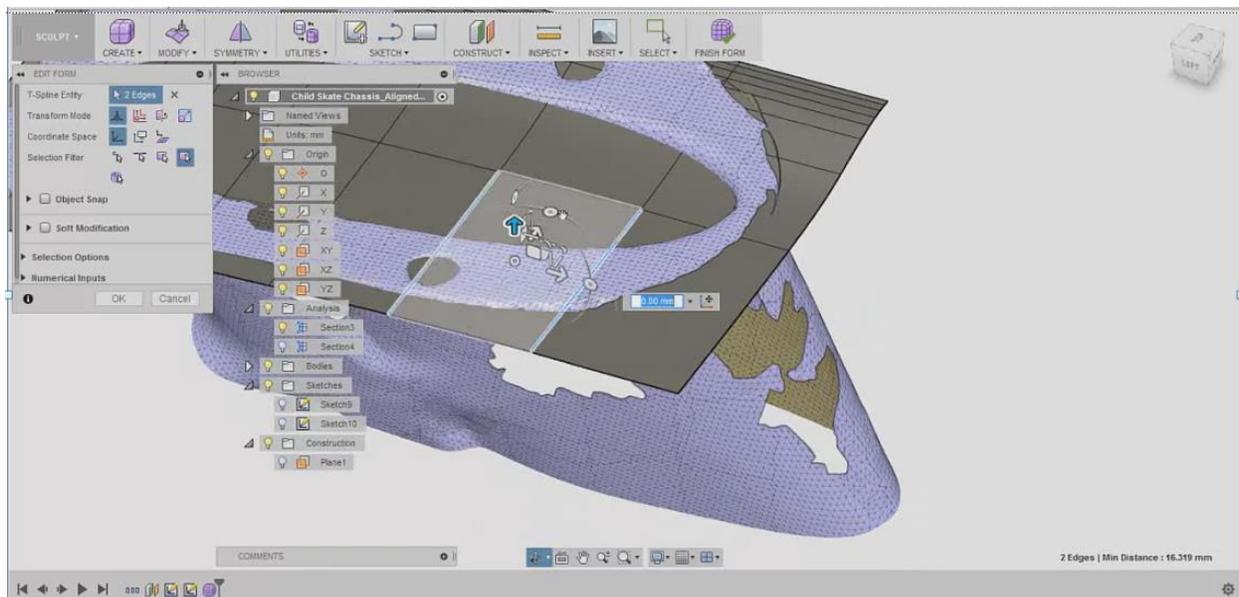
The SOLIDWORKS way

When I do reverse engineering from 3D scan data, I have to extrude planar surfaces to intersect with the graphics body. Then I can trace the intersection.

The top surface of the skate truck is not simple. There is some real subtlety to the surface. In SOLIDWORKS I would have had to create a number of profiles and likely break the surface into multiple patches to isolate shape influence from one region to another. It could take a few hours to match the surface within the tolerance of the 3D scan data.

The Fusion 360 way

I started out with a swept surface that was built from curves that I traced over the sectioned 3D scan. I wanted to start with something that was kind of close.

Then the magic: I went into the sculpt environment, and used the intuitive T-spline manipulator to drag, rotate, and subdivide the single surface until I got an excellent match to the 3D scan.

As a novice, I was able to do in about 20 minutes what would have taken 3-4 hours in SOLIDWORKS to match with the same fidelity to the scan.

Tons of free training materials

The rest of the modeling was pretty straightforward- extruded bosses, cuts, and assembling.

When I had a question about how to do something, the answer I needed was just a Google search away. The Fusion 360 team has exerted a great deal of commitment and effort to posting tons of training material online, and all of it is free.

Verify with prototype

We used our desktop 3D printers to generate the adapters. We brought the adapters to the skate shop, where they were assembled to the boot.

ASSEMBLY AT THE SKATE SHOP

The manager of the shop knows the boy. He couldn't have been more thrilled with the result!

What could have been the most satisfying of his comments was this: That the adapters we had developed fit the boot and truck better than the commercial boots and trucks usually fit!

CLOSE UP OF SEAMLESS FIT

Never forget that you are a designer first, not a CAD jockey—don't let the tools keep you from making the best possible design.

At this point we had a design that worked. It was validated via prototype. The guy at the skate shop was giddy about it. The kid's dad loved it. And I'm sure that "Some sort of solution" was all that the kid was looking for.
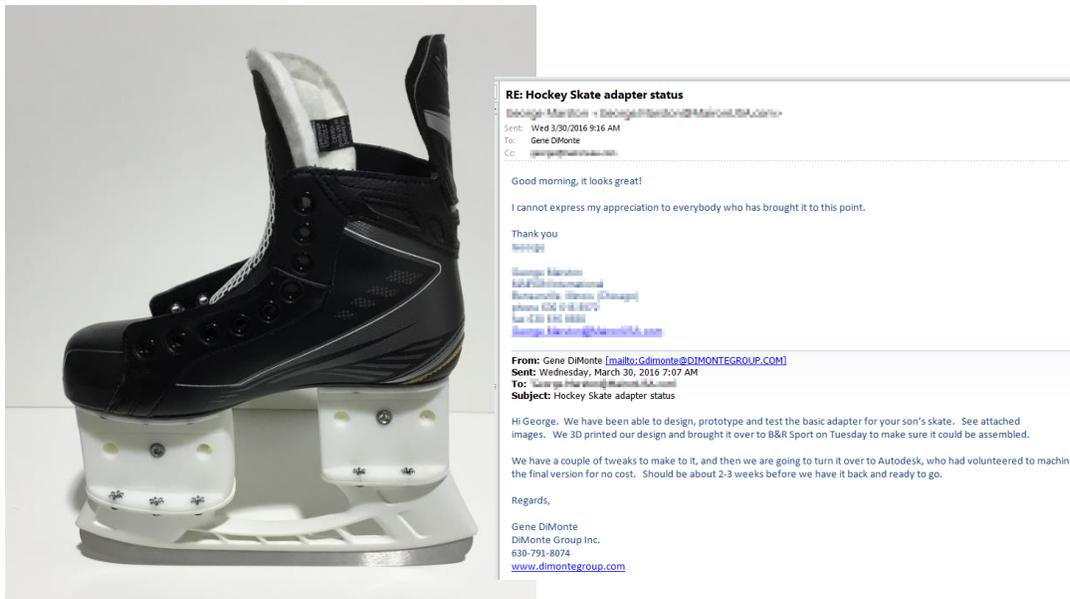
But I *HATED it.*

I'm an Industrial Designer. I HATE that enabling devices look like the hacks that they usually are.

Please know that this work was all done on my personal time, after hours.

And I'll level with you – I have to this day never met the kid.

That said… millions of people have used products I've designed, and I have met almost none of them either.

It is in my DNA to always be an advocate for everyone I design for. I always have to do better and make great products or I am not doing my job. Even when I am doing it for free on my time.

So I knew I had to step up and be an advocate for this kid too. And let's face it, this first solution wasn't cool. Imagine being in the therapeutic/differently abled community, surrounded by a world of things that reinforces that you are an afterthought. It is dehumanizing, and it is wrong. It was worth my time to correct that. And If I could pull it off in a day, no one would know or care.

This adapter was never going to look super slick because of the limitations on what we could do safely. But I had to try to make it something the kid could be proud to take out on the ice, that followed the lines of the truck and the boot organically so on a first glance no one would notice that it was anything other than a proper skate.

HAND SKETCH OF WHAT I WANTED IT TO LOOK LIKE

Design Change

Fortunately Fusion 360 is a parametric modeler like SOLIDWORKS. I could roll back in history, and change my base shapes to match the sketch above. I was even able to insert my hand sketch (above) into the modeling environment to use as a guide for my changes via Insert > Background canvas.
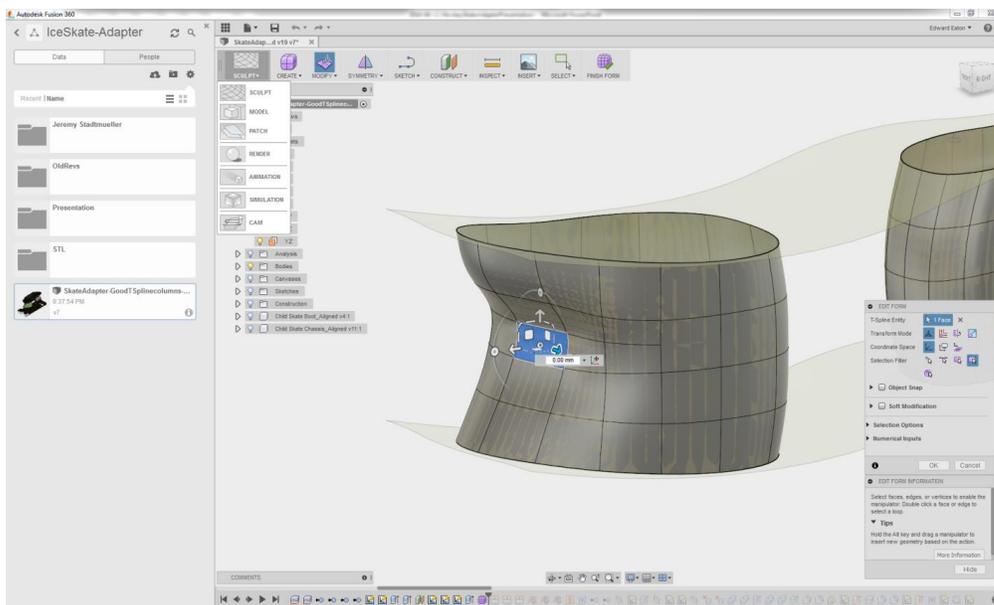
FINAL RESULT

Collaboration and Fabrication Opportunities

Fusion 360 files are stored on the web in projects.

When it was time to get the final parts machined, it was as simple as sharing the project by inviting the machinist to it.
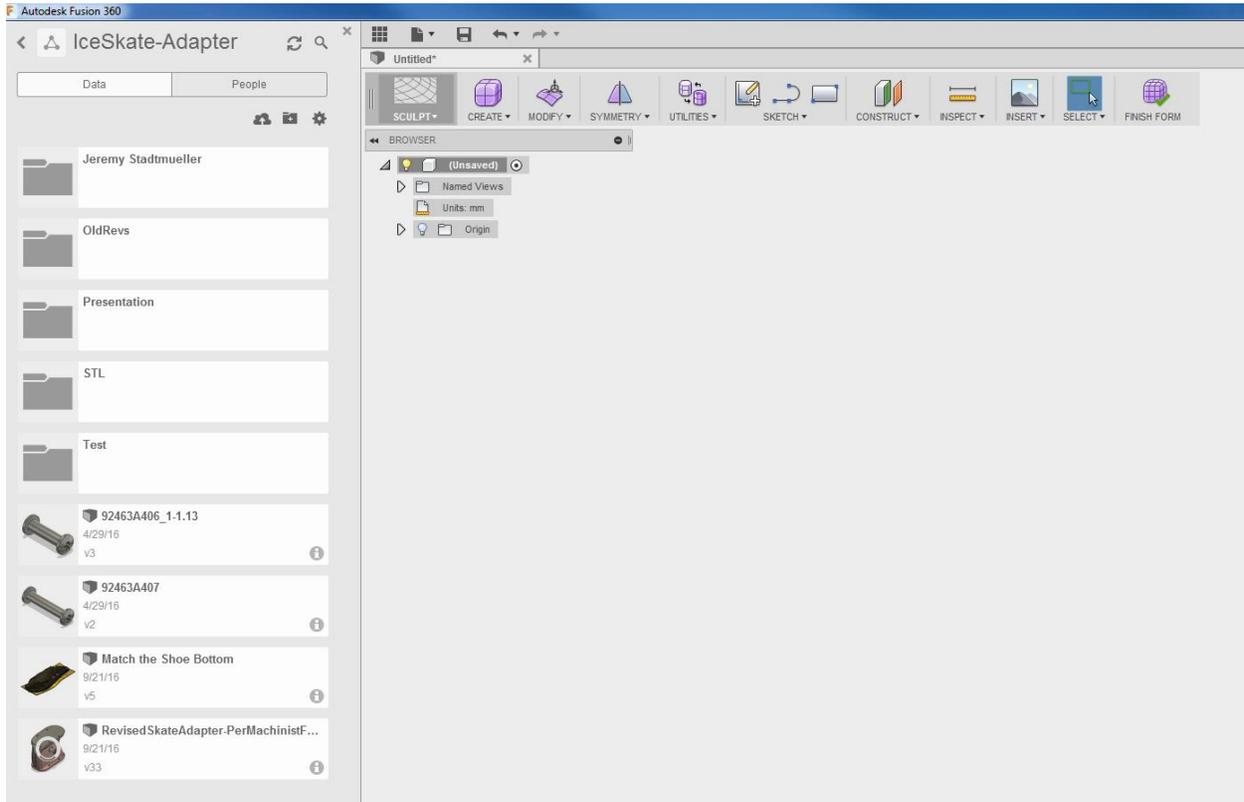
SKATE COMPONENTS AND SUBFOLDERS
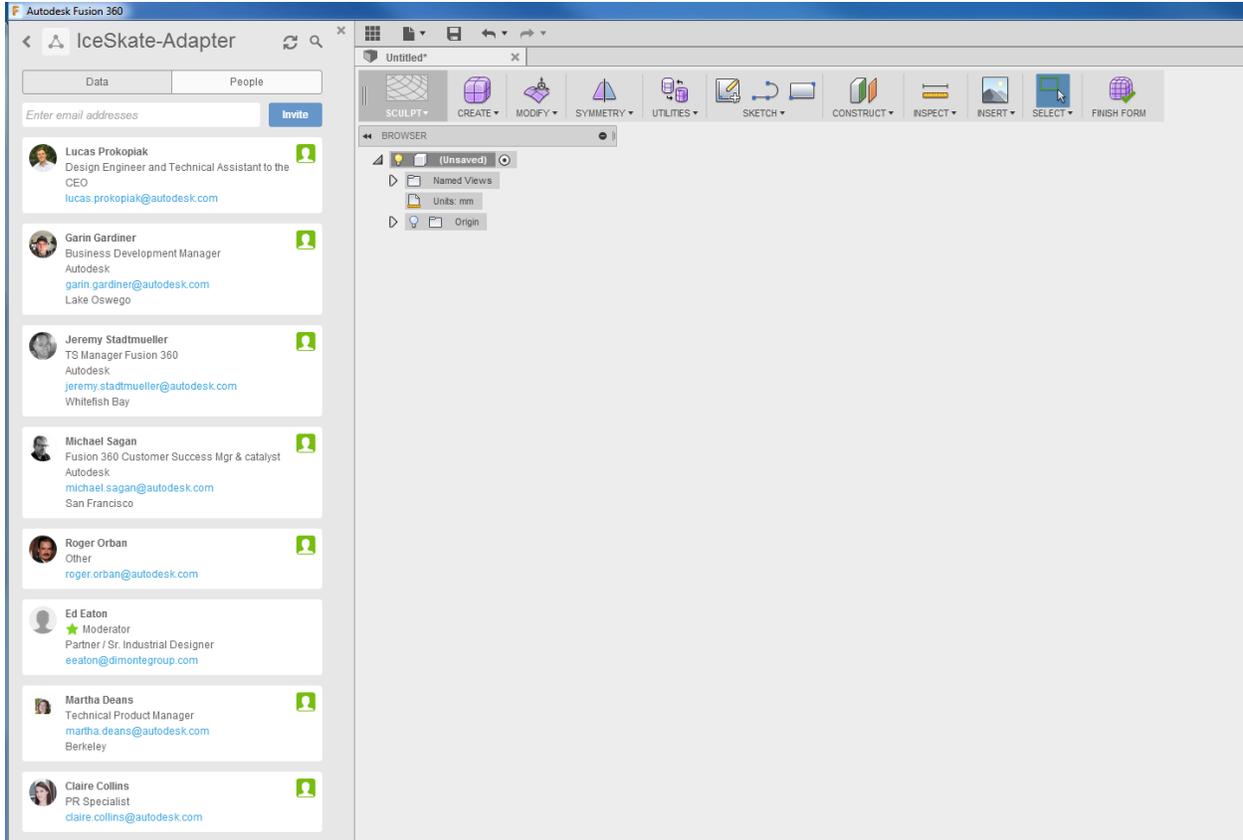
PEOPLE INVITED TO THE PROJECT

Since everyone is accessing the same files, there was no need for revision control. It's handled automatically.
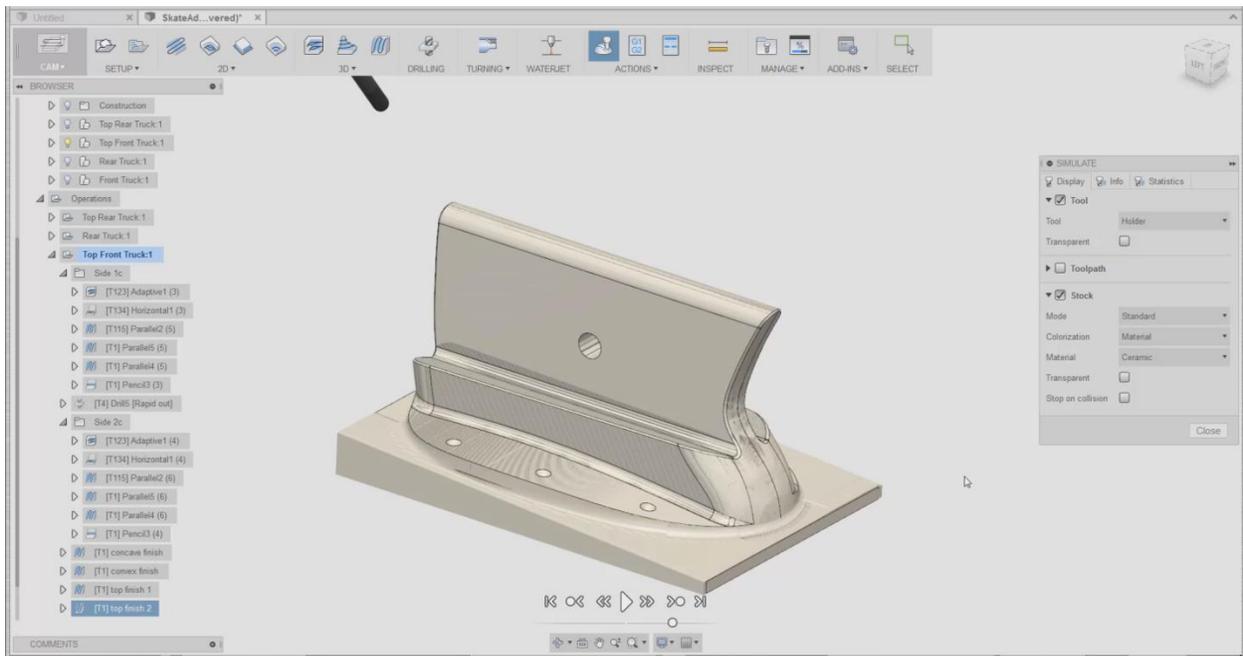
ANIMATED PREVIEW OF TOOL PATHS AND MACHINING OPERATION

As a matter of fact, I snuck in a last-minute change without having to file an Engineering Change report!

A surprise benefit to how Fusion 360 works with the cloud
During the course of this project, my home laptop started to have start problems. In a few days, it flat out died and would not reboot.

THE MOST EXPENSES PRESENTATION ANECDOTE I'VE EVER HAD

If this had been a project in SOLIDWORKS, this equipment failure would have been devastating. If I hadn't recently backed up my files, a ton of work could have been lost. And then there is just the sheer amount of time it takes to Install SOLIDWORKS.

Since this was Fusion 360, all I needed to do was check out a laptop from work, take the 10 minutes (!) to install Fusion 360, then log in with my user name and password.
All of my files were there – even a PowerPoint that I had saved to the project.
And most amazingly, all of my interface customization was also there.

Summation

- Remember when CAD was fun? Fusion 360 was fun to use.
- T-splines rock!
- The hybrid cloud interface of Fusion 360 is collaboration heaven. No ECR to make a change – I can just make it.
- Device independence is a life saver. I can work at my office, at home, or on the road and always know I am on the current rev.
- Fusion 360 is a feature rich product at a price that blows my mind…

It is in my personal self-interest if everyone in the world would just agree to make SOLIDWORKS the single CAD standard. I'd have an 18 year head start on new adopters, and would be sitting pretty to sell design services to them.

But I have to be honest: For its low cost, and the richness of features that already exist in Fusion 360, and my experience on this project, Fusion 360 is something that I think companies owe themselves to investigate and critically evaluate to see if it is a fit for them.

If my customers do, I'm fine with starting from the ground up again like I did with SOLIDWORKS 18 years ago. It'll be fun.