CHRIS HALL: This is my 8th AU. Many of you I've probably met over the years. I've also held many different roles in the Autodesk organization. So starting in consulting, all the way through tech marketing. I worked in education team for four years. Now I have the privilege of being part of the product management team for Inventor. And it's a great-- it's fun. And it's also an opportunity to continue to advance what the Inventor team started 10, 15 years ago.

So basically today, I want to talk about Inventor Flexible Design. All of us know-- I would say just about everybody in the room-- everybody in here know how to design parametrically? So the two things that I want to focus on is both flexible design, where we look at the hybrid.

So essentially, within Autodesk, about five years ago we acquired to T-Splines technology. Now you will find that technology in multiple products, Fusion 360. You also find it in our automotive product called Speed Form, as well as Autodesk Inventor. So as we go through here, the two things that I want to focus on with everyone is the direct editing and the Freeform modeling.

Reason I want to talk about direct editing is it's pretty powerful. And I just want to expose it to the group. So I'm actually going to bring an IGES file in and literally de-feature it so I can do an offset for a fixture.

So typically, where I start running into problems is when you try and offset something-- say you want to mill something so you're creating a cavity. As I do that offset, when you have all those features on, how many times does that fail? It fails nine out of ten times. But if you de-feature the part down to a level where it can be offset, I was able to offset the part and solve the problem for customer.

And then we'll focus on freeform modeling, which is a lot of fun. So the way I like to look at it is freeform modeling and the T-Splines, they could be your best friend or your worst enemy. So part of the goal here is for you to walk away with some tips and tricks, and also encourage you to try it, because it is truly flexible. And it can be a lot of fun. And also just the shapes that we can create in the freeform environment blows away anything that we've been able to do in the past.

So curve based modeling, one of the things I also want to reiterate as we're just going through these slides is that we continue to invest in Inventor. So in 2015 release, we started a project

called Exceptional Modeling. The goal behind that was to continue to add tools so that we increase the use, capabilities, and stability of curve based and surface modeling. Everywhere I go globally, myself my coworkers, that's what we hear from our user community. Continue to give us better curve tools and better surface tools.

So again, we're continuing also to invest and solid and surfer modeling. Now just to get a sense, how important is this to this group in here? Can I get a sense of how many of you use surface modeling? Can you give me an idea? How do you use it? Do you use it to repair? Are you folks using it from scratch?

AUDIENCE: Scratch.

CHRIS HALL: Scratch? So the product management team, we definitely want to hear from you folks what's working and how it's working. How many of you all are in our beta for 2017? How many of you want to be in the beta for 2017? All right. So those of you that didn't raise your hand, is part of the struggle being in the beta that you have to install the software? No? How would you like to do it and not install the software?

So with 2017, what we've done is there's three options. You could do a full install. Or you can do a hosted virtual through web browser. Thirdly we have something called the spoon build. It to 3.7 gigabyte executable. You download it. Hit it. You're running in a minute. You never install anything. So beta.autodesk.com, you're more than welcome. We welcome everyone to give it a try.

OK so short segue there. So freeform modeling, this is the T-Splines technology. One of the reasons we're in here is where I've struggled. So I've been doing CAD for 25 years. Watertight, who struggles with getting stuff to stitch? This helps continuity. The freeform technology allows you to get continuous flow in your geometry. Does it break? Yes. I've broken it. It can be broken.

And then once you combine it with our solid modeling workflows, it becomes even more powerful. So let's look at a quick-- let me bounce out of this. Let's look at a quick video. I promise to do stuff life, even if it-- I'll shoot from the hip on a few things. If there's something you want to see, let we know. We know these tools pretty well.

OK so here's a quick example. If you walk down into the exhibit hall, you will see three vehicles down there. There's a Porsche. There's a beautiful McLaren 007. I wish I could buy one.

They're over $1 million. And then the third one down there is BAC Mono. And part of the story behind the BAC Mono is when you get in the cockpit-- so it's an open cockpit-- they customize the seat to you.

So with the freeform tools, what this will allow is starting with a simple-- and this is the key. There we go. As you're going through this, we're starting with a simple, primitive object. And that is part of success with this tool is to start with a primitive object. As you can see, we just started with basically a plane. And I'll show an example of this.

And we call it the golden rules. You will notice it's also very simple. So when I start with a primitive, I'm also starting with very simple geometry. Also one of the goals that I want to break down for all of you is the filtering. You've got to think a little bit differently. This is not a NURBs or a B-Rep solid. This is not a polygon. It's a hybrid. It's right in the middle. It's based off of subdivision technology, so similar to what we would get in 3ds Max or Maya.

But this will change over to a NURBs or a B-Rep solid. So the key is start with making large movements. Then the further you get in, you start refining it. Now that's one of my favorite tools. That's a bridge tool. I picked faces on the front, faces on the back, and I let the software bridge between them.

One of the most pain points that I have experienced over the years is this right here. So everybody in this room, we can probably model that top shape in about five minutes or less. Than you start looking down here at the handle. This is where things start getting difficult. And then the difficulty level continues to go up as these transition back into this, also down here. So if you look at this, even if I have to mock this up, think about how long that would take us with traditional tools today.

So I'm going to use this as an example, just show you how to rough it out a few different ways, just to set the tone of trying to give you differ different options to use the tool. And then, the other example I have here is I've been working with Kalitta Motorsports. And they have their injectors. So they're carbon fiber, and they're about this tall. But they transition from three 5.5 inch rounds all the way to a square. So again think about the work with traditional tools that that would take.

So what we'll do is spend some time with freeform open sheet and conversion. Basically conversion, that's taking a model you have today-- I'll use this as a good example. I can convert this to a freeform object. Basically it'll take this top surface, unstitch it. But it'll allow it to

be then modifiable using the freeform tools.

Thicken, what's your success rate with thicken? What if I can give you 80% to 90%? The way that's freeform thickens, I get a solid, just about all the time. So faces, Delete Face, these are all the tools. What's going to be the most important tools for this group right off the bat? It's going to be editing form. And it's going to be starting with the primitive tools.

So let's jump to right here. And then we'll jump into this. And then as we get towards the end of the session, I want to make sure we spend some time with direct modeling. So start with making large edits. Basically what you're going to do is you're going to block it in with a primitive object. Faces and edges, that's right here.

For more refined control, I use-- so it's kind of like the circle of influence. And it's probably better if I don't talk and I show you guys at the same time. Let's trade in a part real quick. When I create a freeform object, basically you can either convert, create a flat face. I'm just going to start off with a box. It's always going to ask you for a starting plane, just like a sketch. And I'm just going to grab the center point.

Now one of the things you're going to see is because it's always trying to maintain smooth, a box is going to be a box with all edges filled in. So this is how I like to look at this, when I go into the Edit Form tool. So the key tools are going to be Primitive tool and Edit tool, left to right. I would start right there. So when I go in the Edit tools, the best way to explain how the freeform tools work is what they're made up of. What is this geometry made up of?

So the key factors, if we dive in a little bit here, are faces right here. Now when you adjust a face, think about the circle. Think about the influence when you're doing the face. Everything those edges touch, everything that face touches, it's going to affect. Now one of the things to consider, imagine a circle. The further out you get from the circle, the less effect it's going to have. And essentially that's the influence.

So if there's a circle here, I typically use these radiuses or the rotate to address those. Notice way down here, I'm outside of that circle of influence. When I go to edges, anybody want to guess what happens to my influence? It gets smaller. So now, I'm adjusting even finer. Then I get down to a point, very fine adjustments. So these are three key areas for you to watch. And once you get to a certain point, that's where we can move to the next set of objects, insert an edge, for example. If I pick this, it's going to insert an edge half inch way.

Now one of the things that I have gotten asked about a lot is what? Accuracy. How do I get accuracy with these? So what I'm going to do is I'm going to jump out of my freeform. I'm just going to roll back. I'm just going to create a quick sketch here. Let's just create a circle. Actually what do we got here? Yeah, we'll just do a circle. It's easier. So once I have the circle here-- let's just roll this forward. I think I need my circle a little bit bigger.

I can right mouse button and go back into Edit Freeform. This is one of my favorite tools also. I can say OK, let's match an edge. I'm going to match this edge to this target. And that's not going to work for me. Let's do this a little bit different. Let's create a cylinder, because this usually works out pretty well.

Now if you have lofted sketches, you can actually line up. So if you want freeform on the end and tight in the middle, you can actually create this object and take each one of these edges and match it through and then have freeform. So you can actually have a mixture of matching and also having it freeform.

Now one of the things we introduced in 2016-- and I was really happy when we did this-- is in 2015, we had free form tools integrated. But they were only closed body. And that actually can be harder to work with in some instances. So now I have the ability to have an open body, which gives a lot of flexibility. So now if I match this edge to here, flip to my target.

What happens if that changes? So if I come back into my sketch here-- let's get that sketch real quick. Kind of lost home momentarily. If I come over here, back in to Edit-- went in the wrong one. Edit, expand this out. This has matches, Rematch and update. When I edit, when I come out of this Inventor recognizes this as an open body. So all I would use at this point is patch, stitch it. Now I have a solid.

So let's come all the way back here, and let's edit this. All right, Edit Form. And if I grab this triangle right there, I'm going to bring that in. Say OK. Everything updated. So to add even more accuracy, I can bring a sketch in here. Match it up. And then as I'm going through, I'm actually building intelligence into a freeform model.

So let's see what we can do with this. If you don't want to start with a sketch, and you start with a freeform object, you can basically-- I'm just going to start with a cylinder. And pick what I want. Pick up the origin. Turn off capped. Also one of the most important things is also turning on symmetry. So I'm actually going to leave it off. And I'll show you how to apply it manually. But symmetry, when I've been working with these things, it becomes pretty important.

So some of the key rules-- if we go back to the golden rules for a second-- is start with making large edits. So I'm going to start with a cylinder. And I'll show you actually some tips and tricks how I break that up, so that I'm building for those other objects, the other objects that are emerging in. You'll see I typically will adjust things down at the point level, because that gives me a lot of flexibility. Because I can grab a group of points and move them, where I get the same type of influence where if I'm moving faces or edges but more finite control.

You'll see me doing this a lot. 2D orthographic views are going to be your best friend. This here, Toggle Smooth, basically when I Toggle Smooth right here, this is a box representation. So this is what's going on under the hood. Once I smooth it, these are the smoothing algorithms that are taking that and giving us our curvature. I only use that if I run into a problem where points are starting to cross. So just like in sheet metal, when you non-un-foldable geometry, the same thing can happen here with freeform objects.

Where you get points crossing or edges crossing a good way to diagnose those is use the Toggle Smooth. This is also a cool tool. Toggle Transparent, right within the window. How many in here would like that, if we added that in Assemblies in Inventor? Any of you in the class tomorrow where we talk about what's new or what we're working on? Well we may be working on something like that.

Keep the CV, so keep the layout uniform. So again, these go together. And what we mean by that is as I'm going through this, I want to keep things uniform in nature. Let's look at a quick example of that. One of the things I can do is, I start off really simple. But now what I want to do is to keep that concept in mind by keeping my layout uniform. What I want to do is actually put some boundaries in for myself. So I can pick this center edge. And I can say Insert. I want to insert on both sides. And I'm going to say, OK.

What I'm doing is I'm actually breaking the object up, because now you'll notice I have an area where I could connect that in. I need to do a little bit of work back here. So if I grab this, we'll go in to Edit Form. I'm just double clicking on the edge. So when this is selected here, you can pick points, faces, and edges. What I'm going to do is just slide this this way. And I'm going to take this and slide it this way.

Now one of the-- caveat might be the right word, it's still early-- is when I'm moving this, what's happening. See how it's moving that edge right there? Or if I'm moving this here, it starts to affect that edge back there. How do you stop that> all I have to do is pick this edge.

Remember the whole circle of influence? If I pick this edge, and I say Insert, watch what happens. When I start to move this, what's happening to that edge all to the right? This edge isn't moving. Basically, I cut off the circle of influence by adding this extra edge in here. Does that make sense?

So same thing up here. If I want more control-- maybe we should be making more noise-- here is I'll insert an edge. I'm going to say minus, because I want it on the other side. Grab that. Now what I'm doing is I'm helping keep this edge where I want it. So if you think about the workflow I'm doing, it's very similar to creating sketches. But everything is interactive right from the start here.

Now in order to continue to maintain some of the shape here-- if this blows up, I don't care. It'll be good if it blows up, because I can show you how to work out of it. So just rewind real quick. We started with a primitive shape. I'm basically laying out how I want things. And then what I'll start doing is start making modifications. Now I have used these freeform tools. I've done a bike helmet. How long is it going to take you folks in the room to do a bike helmet surfacing? Week? I did ten iterations in one day.

So that's one of the other things that I want to have everyone grasp onto. It doesn't stop here, because I can iterate. If I don't like something, watch what I can do. And this is where things also become-- I like to do this. Control-C, V, I'll just slide this out of the way for a minute. I now have two new objects. So if things go haywire here, I can drag this one right back in and make modifications to it. Or I can start adjusting this one. Review the shape. And I can iterate and have five versions in about an hour.

So by the end of the day, when I did the bike helmet, I had done ten iterations. And I had final renderings. And it was a proof of concept, just to prove how the whole process works. That is one of the other golden rules here, is iteration. Like I just did, I made a copy. That way I can always-- rather than undoing, what happens if I like step five? I can just go back. So this is just a tip and trick that I've learned over the years with of using these tools. Yes sir?

AUDIENCE: Is that a copy? In the tree, it didn't add another form.

CHRIS HALL: So at that point, it would be like multi-body solids, but you don't see them. So I still have two objects. But they're still two separate objects under Form. Any other-- so we can pause for a minute. Is there any other questions? Yes?

AUDIENCE: If you were basing this on the sketch, could you still do that same copy and paste?

CHRIS HALL: Yes. How I would do it though is one of them would be related to the sketch. And I can easily go back and attach it. It just depends where you're at in the design process. Right now, we're just laying out the initial and trying to get the shape. As you start getting further down, you'll finally get to a point where OK, this is what I want.

Even when I do surfacing and do reverse engineering work, I will model something. I will go ten steps forward and five steps back. Because as I'm going through things, even when we do parametric solid modeling, history parametrics don't line up the way that I want them to so that the part updates correctly. I run in the exact same things here, where I'll go ten steps, have to come back a few. But then I can go ten steps forward.

So it's just that constant-- there's no magic bullet would be the easiest way to for me to explain that. Let's insert another edge here, because I just want to hold that. And then what I'm going to do is I'm going to insert some additional edges on both sides.

But before I do that, what didn't I do? I didn't turn on symmetry. So before I make any modifications to this, if I don't have symmetry turned on, I'm going to get to a point. And I'm going to be in big trouble, because there's no guarantee that I'm going to be able to get exactly matched side to side, even if I cut this in half and re-weld it all together.

So all you do is you pick faces. And it puts the symmetry in automatically for you. So now when I add in edges, it adds them in on both sides. Now at this point, I'm really not worried about the shapes that I'm getting. That's absolutely fine. Because if you look at it where I'm headed-- so I think we can move to a point where we can start modifying this.

So now I'm going to start editing this form here. And I'm going to use the points. Toggle transparency. So you'll notice I'm always using Edit Form. Now I just told you my trick a little while ago. Here we go. Now why I'm grabbing that whole set is so that I'm trying to just maintain some level of flow. So now I can grabs this.

So if you go back to our golden rules, what we're doing is we're making large movements. And I'm also working in orthographic views. So it's like a rubber band. When you move a rubber band in one way, it's going to move in a different axis. So sometimes it's easy as just coming back and making those modifications. yes, sir?

AUDIENCE: Is there a way to temporarily ground points so they don't move when you don't want them to? Because when you moved it, you moved that down to the side. And then when you went back to the front, it was wider again.

CHRIS HALL: This is where if I want, I can use what's called soft modification. And this is where I can truly get really granular control, where it's not going to affect it. So basically what I would do is I would-- the influence would go from the red. So basically, as I change these radiuses here, this is where I can get even finer control and also controlling the fall-off. Do you want it smooth, linear, or more spherical?

See the gradient right there? see how that moved? So when that's there, it's almost freezing things. But I also build that intelligence into my model also. That's why I have these extra edges in there, so that then if I want that even deeper control with the fall-off, I have it because I have the edges in there. I know I should be using marking menus a lot more and I'm not.

All I'm going to do is gradually-- so basically this is just like sculpting things. Because as I bring these in, what's happening is it's tightening up. Look at what I'm getting. See how the closer these get, you're going to start to get-- it'll pinch. So how we fix that is this is where we just start working with these tools back here. And now as you saw from when we were talking about, I'm getting that finer control here. So it's an iterative process.

I'm going to take this whole row here, move that out. Now I can so scale those all together when they're selected. So I'm going to grab these here and just move those in. We'll get it close. Remember I said they are fun. So I'm just going through, and we can make this a little bit more circular up front. So let's just grab these points right through here.

So one of the parts I want to point out at this point is think about all of the lofts. Would we be even close to this shape? Now remember I was talking about the Thicken? This is curling up on me just a bit. Let me fix that. I'm just going to take this and just do that. There we go. Typically this will probably thicken within the tools that we have today. But what I can do here is let's add in another set of-- let's have a little fun here for a minute.

What I want to do here is I'm going to-- I'll see if this is what I want to do. So basically, what we're going to do is we're going to create this really quickly using a cylinder. But before I do that, I'm going to grab this edge. And I'm going to insert an edge there. It's going to throw that off a little bit. But I'm OK for right now. Because what I'm going to do is delete this out of here like so. Yes, sir?

AUDIENCE: If I want to bond, match to the shape, would you drop down?

CHRIS HALL: It dropped down a little bit, because of the move I just made. You're saying because--

AUDIENCE: You had it on the extra second, but if I bond my match to it--

CHRIS HALL: Yeah I can--

AUDIENCE: --would it drop down? Or would it stay fixed?

CHRIS HALL: Let's give it a try. So I'm just going to use something like that, just something to give me some guidance. All right, so let's finish that sketch. We'll go back in here and edit this. Let's match this edge.

So that matches that there. All I'm going to do is just come in and Edit Form. I'm going to straighten that out a little bit. Now when I did that, I did lose symmetry at this point. So let's turn symmetry back on. There are certain commands that you do-- bridge, match-- where you will lose symmetry. So just pay close attention to your model.

AUDIENCE: Is there a [INAUDIBLE]?

CHRIS HALL: No there's not. But so visually, actually there is. This dotted line goes away. So it's visually there. But I think that would probably be a good suggestion. How many of you are familiar with Idea Station? To have that in there, I would actually like to have it tell me OK, if you do this move, you're going to lose symmetry. So I think it's a matter of giving you folks better communication of exactly what's going on.

So probably what everybody's noticing, as you start making changes similar to this, this is why you start simple. Because now what I'll do here is just try-- let me just get some of this back to where we were. Because everything's constantly linked, and this is part of-- if you remember in the beginning, I said they can be your best friend or you worst enemy-- you're seeing this is an area where you're starting to get deeper in. And everything influences everything. And it's just a matter of being patient with it.

So now what I can do, even though I have symmetry turned on, you still have to select all the faces to delete. See, it did hold that edge. It held that right there. But now when we talk about things staying uniform, see how some of this is starting to not be as straight. One of the tricks that you could actually do here in Edit Form is if I pick this edge, and I actually scale in a

direction, I just made that all parallel. And I can do the same thing with this edge back here.

Now to be fair with everyone, it I was an alias guy at one point. So what I do is I take some of what I've learned with surfacing, and the same things apply. Because when I look at this, and I turn on Edit Form and I turn on the points, what I see here is I see surface structure. So this is something that we typically don't expose inside of Inventor on the surfacing side, but on the freeform side, if you think about that, I have G2 continuity. And I can see my path structure basically. So that helps me see how things are going to flow. Yes?

AUDIENCE: Is there a good workflow where you pair alias for servicing with Inventor at this type of quality?

CHRIS HALL: Absolutely so the one question I would ask is do want to be able to modify the surfaces in alias and have them update in Inventor?

AUDIENCE: Yes.

CHRIS HALL: In Inventor 2016, we introduced new technology called anti-CAD. And essentially you bring the alias data in. Any changes it sees the date stamp, and it updates. In all of the solids update same thing with SolidWorks parts. You can bring a native SolidWorks part and assembly in. Any changes made to that SolidWorks part, and you don't own a seat at SolidWorks, vendor sends you a new part, it will update in a minute.

So either myself or one of my colleagues is actually doing class tomorrow afternoon on that. I have a conflict I'm trying to work out right now. Or what you can do is you can bring the surfaces in. Use the convert tool. It will un-stitch them. But then you can make modifications. It's definitely something to play around with a little bit.

Keep moving forward here. What I'm going to do is I'm going to create a cylinder on this plane here. Turn the cap off. I typically like to just start right at the origin, and then move it to wherever I need in place. Now as you create primitive objects, this is going to ask you for how many faces. Again, this is going back to the golden rules and keeping it simple.

If you notice the other one, I started four by two. Blocked out my basic shape, then added in additional control geometry. It takes time to understand how freeform objects respond. Experiment. I definitely encourage you to experiment. I've been working on these for about two years, and other stuff I've done. But just you got to give it a try.

What's something really simple to start with? A joystick. Think about a pilot's joystick. Think

about that handle. If I just start with a cylinder-- so I would encourage you all to give this a try-- let me just move this-- as you're trying to learn this.

So if I want to make a quick handle, first thing you're going to do is insert edges. And then now, the grip is only on one side. Again we'll say Edit Form. I'm just going to grab this here. Let's take this edge here. Let's insert another one above it. Just start simple, as you start to get into this. I'm just showing you the heat gun, just so you can see what's really possible the more that you get your head around this.

Simple movements. Now we'll take this here. And we're going to just drag these in like so. So that is thickening on the inside. There's a solid. Then I could come back to my form and edit it. And then it'll all update. So start with a simple example. Then look at different organic shapes.

A good example, look at a Gillette razor. Look at some organic forms along those lines. And think about a steering wheel on a car. Start off with the round. Where does it become difficult? As you move from the center outward, because you want everything to blend. And then just keep moving upwards in your difficulty level. In fact, I think one of the tutorials might actually be a grip similar to that. Question, yes sir?

AUDIENCE: How do you get the handle to [INAUDIBLE]?

CHRIS HALL: How do I do what?

AUDIENCE: Connect them. Are you planning on--

CHRIS HALL: Yeah I'll show you how to connect them. I'm to just do that really quickly here. So Edit Form, not only where I can edit the points, but I can also take the entire body and translate it, and also rotate things into position here, so your typical transformation tools. Also while I'm in here, we can also extrude and add. So I want to extrude this up. So I'm just going to grab-- turn that off. I'm going to grab this edge right here. Now I can hold the Alt key and grab and extrude. I let up on the mouse button, grab again, and I can extrude that up.

Now what I'll do is I'll come in here, and let's fine tune this just a bit. Let's take that edge. There we go. I'm just going to drag this down a little bit here. So we talk about transitions. What I'm going to do is I'm going to bridge this with this. Now the key thing is make sure these arrows are going in same direction. And it blended them.

Exactly. Now this is where I put my money where my mouth is, thicken it. Typically, when you

thicken on the outside, we get success. Let's go on the in. Finish. Let's turn that off. There we go. And then if we go to here, that's not too bad.

AUDIENCE: Explain what these things are doing. [INAUDIBLE]

CHRIS HALL: Is there a laser pointer on this? So what I'm seeing here, this is basically one of the analysis tools for surfacing. So right here, if everybody looks at that right there, is that a problem? I know you'll agree. I could probably do a little bit of work there, because in the end, the goal is to have smooth highlights. So this tool helps us analyze the surface flow.

I'm actually glad we brought this up. Another way to analyze this is the curvature analysis here. Because what I can actually do is I can cut a section view of this. I'm going to do this a little bit-- I like doing it better this way. I'm just going to create a quick 3D sketch right down the middle of this to analyze this. And I'm just going to project the cut edges. Because now, what I want to do is I want to really get even deeper and take this curve here-- am I still in the sketch. No. I can grab that sketch there, though. You dirty thing, you.

It's not letting me pick the-- that's something I'm going to have put in Idea Station. Because what I'm trying to get to do is I want to be able to actually analyze visually what that flow is like. So it's not working the way I wanted it to. But that's all right.

This is a tool that we use a lot in surfacing and alias, so that we can actually literally see transition from the bell curve of how surfaces transition from one to another. The thing that I need it to do though is pick curves not edges. But to save time for right now, I'll keep moving forward.

So this is where we have multiple surfaces coming together. Depending on the way what you're doing-- so imagine a hairdryer and putting a gloss finish on it. And you walk into a room like this. And as you move it around, even this year how the light hits this, this is essentially mimicking that same type of environment, how the light's going to hit it.

So again if you go in the exhibit hall, and you look at a car and you look down the lines, those lines, nice and smooth right from the bottom of the window down. Even when you're doing part design, you want to see the same things in here, inside of whatever CAD tool you're using including Inventor. so this is just one of the analysis tools. Let's delete that. question?

AUDIENCE: Can you use some of the parametric tolerances to help manage some of that? Say, the

underneath, where it goes into the handle needed an [INAUDIBLE] like a half inch radius.

CHRIS HALL: This is where I would probably use sketch tools, just like we did with the matching, so that I can get that more accurate. So whenever I've done surfacing work, what you can also do is you can try to work to hard edges and then you literally use a half inch fillet. Typically if you want to get a half inch ball and mill, or a 5/8 in there, so you do get that half inch radius, this is where you need to plan a little bit more. And this is where I'd actually start using zero thickness surfaces to chop this up, and then give myself that additional control.

It's going to be pretty hard to get an exact half inch in there, unless you are using the fillet tools. But again, this is getting really at the far end of freeform. But there is a way to bring it back just a bit and do that. So what does everyone think of the freeform tools? They're cool?

[APPLAUSE]

So we've got about 20 minutes left. Here's another challenge. How many of you folks get data in from external sources? How many of you have to modify it? So what I need to do is I need to create a cavity for this part here. And right now number one, the main problem is it's not even a solid. It's in IGES. I personally hate IGES files now. I don't understand why people still use them.

What's very interesting about this story-- anyone want to take a guess what software the customer was using? What's that? Mechanical desktop. I figured you'd all get a kick out of that. now what's nice though is I can stitch this. And I get a solid out of it. So we'll just copy this out.

So now my challenge is in years past-- I've got a lot of CAD folks in this room, right-- how in the world would you de-feature this part. Probably take this. Create a sketch. And start filling. So over the past couple years, what we've done is this is direct modeling. What I can do is let's just window select those objects in there. And let's just start to get rid of them.

Now one of the things I've talked to the dev team about is that I think that we should give our users the option to get rid of history. Because I can easily roll this back, and I get all of this back. Well what happens if I don't want this? Because one of the things that as this starts growing here, I have seen some performance impact, because it's constantly trying to re-think about that. So I've talked with the architect and said you know, we should give them an option on being able to-- do you want history, or history free.

AUDIENCE: What did he say?

[LAUGHTER]

CHRIS HALL: He said good idea. Because we actually were able to take a more extreme example. We took a motorcycle yoke and completely de-featured it down to the base, using the same--

AUDIENCE: Question.

CHRIS HALL: Yes?

AUDIENCE: Why are you only going left to right? Wouldn't going right to left just grab that whole--

CHRIS HALL: I could. I'm just--

AUDIENCE: [INAUDIBLE] Do you see the problem?

CHRIS HALL: What's that? One of them's not-- in and part of it's my fault too, because I didn't get rid of these extra items in here. But let's see what it does. What's starting to happen as this is building up here-- and this is exactly why I had that discussion with them-- is that there's more and more there that needs to be solved.

AUDIENCE: Could you save it out as an IGES?

CHRIS HALL: I could save it out as a step and end probably help that process. One of the things-- so I started as a product manager in June. I honestly and truly, when you folks tell me you're using a workaround, it just makes the hair on the back of my neck crawl. Because if you're doing a workaround, that means we need to look at what you're doing, and look at what everybody's doing so that you're not doing those workarounds.

Now sometime like when we get into large assemblies and different things, it's not workarounds, it's workflows. And hopefully also part of this week, a lot of you-- including with the freeform and the direct modeling-- hopefully we're helping with workflows so you're not doing the workarounds.

Fillets can get kind of painful. But as I go through here-- actually let's do these up here-- I can actually start taking these fillets out of here, just so you get a sense for. And that's another tool that has been added in, is tangent propagation. So what you'll notice is as I'm going along the

path, to continue the process, it will pause. And say OK, you need to pick an additional set of faces. And then it will continue to remove those faces. So this is why I prefaced. Everybody can see my machine starting to recalculate things. That's because it's trying to continuously recalculate what's going on here.

Let's look at this area right here. I can take this whole thing in one shot. Not sure why that one didn't work. Worked last time I did it. So how many of you knew about this tool and have used it? We're at Autodesk University. What does university mean? Homework.

It's about 9:15. So I'm going to pause at this point. So chris.hall@autodesk.com, I want to hear what's working, what's not working. I'd love to see all of you on the Idea Station and the beta. We can't make the product better unless we're hearing from all of you. We can assume what you want. But I want to hear-- we want to hear-- from you folks. So any questions on the direct modeling besides getting rid of history or the sculpt tools, freeform?

AUDIENCE: Is this something from 2015 or 2016? When did this come?

CHRIS HALL: We started actually adding it in 2014, and then finished it up more robust in 2015. So over the next, as you see releases of Inventor, you're going to start seeing us finishing things. If I've heard anything from the user community, just finish it. Don't give me anything new. Just finish it. So that's one of the things we've been concentrating on.

Hopefully you'll see and hear more from the product team and the dev team. And our goal is-- and all of you are Inventor users. Just reinforce my counterpart from marketing's in here. Fusion's an awesome tool. But we're continuing to invest on this side too. So everyone has a choice what they want to use. I completely believe in everything we're doing.

AUDIENCE: How does some of that translate into drop and drawing? Because when you're moving in freeform like that, you're not necessarily getting exact curvature.

CHRIS HALL: It'll drop right in the drawing. There won't be any issues with it going into the drawing.

[INTERPOSING VOICES]

Yeah you should be able to dimension it. If you do a section view, you're going to be able to dimension those things. But unless you're locking it down to sketches, like I was, and taking some time to do that-- once you get the shape you want, I would probably then go back and start dialing in a little bit more. Because as you probably saw, I can create five versions of that

like that. Take it to the customer or management and say, what you guys like? What do we need to do different? Make the changes. then add in a little bit more. I think you're still five times as fast, even with that process. Any other questions? Yes?

AUDIENCE: You said you don't like IGES anymore. They added step as an import option entering this [INAUDIBLE].

CHRIS HALL: So under Manage, you can import here.

AUDIENCE: Step and [INAUDIBLE]?

CHRIS HALL: If it's not--

AUDIENCE: If you start at the All Files then you'll be able to stop step.

CHRIS HALL: I know I have a step file right here.

AUDIENCE: And then for that work--

CHRIS HALL: How many of you have installed R2 and R3? How do you guys like what we're doing? You can be honest. So what happens if that continues, that same type of theme?

AUDIENCE: Just like every release, do you mean?

CHRIS HALL: What happens if you saw a release three times a year?

AUDIENCE: How does that effect the users?

CHRIS HALL: No migration.

AUDIENCE: Sweet.

CHRIS HALL: So let me preface this.

[LAUGHTER]

When you move from 2016 to 2017, you're going to have to do migration. But when you see a release like an R2 and R3, there's no migration. There's nothing that's been done to the IPT or IAM file that it's still the same model here.

AUDIENCE: Right, but every year would you go through a major release, and then there would be

migration?

CHRIS HALL: Yes.

AUDIENCE: If you, in principle, every time you open it up, there's an update?

CHRIS HALL: But ours is subscription. So as many of you know, we're moving to a subscription model. So as a benefit to subscription users, we want to make it valuable to you. That's why we're trying to move to more of why should you wait 12 months, when we can get things to you in increments that doesn't affect. Is everybody going to use that? No. But you're going to see new functionality.

So we're talking about new functionality today that came out in April. But as we move on, we're going talking about a new functionality that just came out last month, which actually Shape Generator, the Force Effect add-in. R3 is being released this week, which has additional functionality.

AUDIENCE: With subscription, would you have to do migrations? Or would there be--

CHRIS HALL: Only if you're changing model year. Yeah?

AUDIENCE: So why would I use Fusion 360 versus this? What's the upside of it?

CHRIS HALL: What are you trying to do?

AUDIENCE: Well, we're mainly doing architectural models. So we're outside the regular scope of a lot of these modeling tools. But largely, we see [INAUDIBLE]. We see a lot of the same kind of organization. Why would I go Inventor over Fusion?

CHRIS HALL: Well--

AUDIENCE: Is it a cloud-based thing?

CHRIS HALL: So it comes down to what you want to do as an organization. Where do you want your files? Currently right now, on Inventor, we have folks in here that are using our data management system. So everything is desktop. That is their preference. We have enterprise customers that cloud doesn't exist to them because of security.

On the other side of the fence, we have folks that want to use the cloud tools. And it also depends on, if you're doing 50,000 part assemblies, I think any of my counterparts on the

Fusion side would probably tell you to use Inventor too. But if you're doing smaller things, Fusion may be the better. Plus, it's multi-platform. So it depends on what problem you're trying to solve.

AUDIENCE: Is there any difference in functionality? Does Fusion have better surfacing or modeling?

CHRIS HALL: No, they're--

AUDIENCE: They're basically the same?

CHRIS HALL: Yeah. Brain, you have anything to add?

BRIAN: I think well Fusion is about two years old. So I think from a maturity standpoint, you'll see things in Inventor right now. We're obviously investing a lot in Fusion. We're also investing a lot in Inventor. And the unique thing about both of them-- or the interesting thing-- is a lot of Fusion users are new to Autodesk. They're people that haven't used Autodesk software before. And they're just as engaged with the development team and project managers as our Inventor team.

So it's really a lot of the users that are helping guide these products to be what they need to be for the people that use them. And so right now, I think there's some similarities. There's some major differences. But I think [INAUDIBLE].

CHRIS HALL: So there's definitely some overlap. but being an Autodesk employee for almost 10 years, I'm excited. Because what you're seeing right now is you're seeing an investment in the future, and an investment in what we have now. And Brian couldn't have put into any better. We're getting to a new user community. So we're taking care of you folks, but also getting to new folks. And it's a really fun time in the company right now to just watch innovation and disruption on both sides of the fence. It's not us versus them. It's what's the right tool for you folks to solve the Problems Any other questions? Excellent. I appreciate your time this morning.

[APPLAUSE]