HEATH HOUGHTON: My name is Heath Houghton. I'm the product manager for CFD. And this is the Using New Geometry and Meshing Tools in Autodesk CFD class.

And just to give you guys an idea about why I decided to teach this class. It's because one of my main development efforts for CFD when I became product manager was really to transform some of the ills that people get, or the pain that they take, just getting a simulation model to run. So the two main pain points for people are how long does it take me as a person to get a model ready to run, and then how long does it run once I have it set up? How long does it run is a separate problem, but how long it takes the person to get them all to run is a huge issue, because that's a manpower issue.

So we're trying to inform you about some of the tools that we put in place. A lot of these tools are first-year tools, so they're Gen 1. We introduced them in the 2016 time-frame for when we launched, so they have a lot of improvement, I think, that could be made, and a lot of technology advances that could be made in them as well.

I'm going to cover the Model Assessment Toolkit, which was an informative tool that's inside of CFD. And then also SimStudio Tools, which is geometry editing and modeling, which actually is available for all the Simulation tools. But I'm going to just cover some specific features that are applicable for CFD, in my experience.

And then also, we introduce surface wrapping. In 2016, again, it's very early stages. But it does good for certain classes of problems, does really, really short-circuit the amount of time somebody uses to model and get something meshed.

And we've taken that, and I'm going to show some stuff in beta that we're trying to improve the workflow. We're working on the technology in the background. I'm not going to show much of the stuff we're working on in the background from technology, but just the workflow and how you would use it.

I'm not going to go over the key objectives. I'm not going to be in PowerPoint very much. I'm going to kind of jump back and forth. Most of this is going to be live demonstration. But I need to reference pictures and make sure I can communicate better, so I will go through PowerPoint.

The first thing we're going to talk about is the Model Assessment Toolkit. I think that because it's a brand new tool, confuses a lot of people. You know, is my model bad or good?

I'll show what it is, but basically the Model Assessment Toolkit is when you launch a model from whatever CAD geometry you have. By default, it'll actually go into this in 2016. Or you can bypass it and just do your old workflow that you had in 2015, or 2014, or whatnot, to start setting up a model.

But what it does is a bunch of assessments to show you potential problematic areas in a model. Doesn't mean it won't mesh, doesn't mean that it's a real problem. Just if I were to look at this as a meshing tool, where are the areas that might cause me to have mesh concentrations or potentially failed meshes? Because it's not simulation-ready, it's more production-ready, manufacturing, has all these tolerances and stuff like that.

So just some general takeaways. There are little nuances to the tool, because it is first. We have filter sliders, and all this kind of stuff. There's visualization options to help you kind of filter through, because it's a lot of information that it presents at first.

This presentation, by the way, available online in the class handouts. I also have a handout that kind of goes through a lot of these things in a little more text detail. I'm going to start talking about all these things live in the software. So I'm going to jump out of presentation mode.

And I'm going to start in a CAD tool and show you how you get into the Model Assessment Toolkit. It's pretty easy. When you launch by default, it'll push it into Model Assessment Toolkit.

By the way, this model is a real model. The Autodesk invert you've seen with 3D printers. This is the actual, after it's been cleaned up geometry, or mostly cleaned up, so I can just show a few key features.

So I'm going to launch into CFD, the Model Assessment Toolkit. And it shouldn't take it very long to do-- oh, it's saving the model, OK. So open up CFD, and there's a new environment, as opposed to the setup environment. There's this model assessing environment that'll open up.

By the way, ask questions as I'm going. It doesn't interrupt me. Yeah, yes sir?

AUDIENCE: In the SimStudio Tools, can we launch into the Mechanical program?

HEATH HOUGHTON: Yes, the SimStudio Tools is available to all of the Simulation products. So it could go to Mechanical, or you could just-- if you had Mechanical installed, it would have another launch icon. I should have repeated that. The question for the general audience is, can we launch into Sim Mechanical as well, from SimStudio Tools, and the answer is yes.

One of the things you should notice here is the model shows up and immediately you start seeing some action, some little icons of progress. It does multiple assessments, and it's what we call asynchronous. So we're trying not to interrupt workflow. While it's doing some geometry calculations and understanding what's going on, you can still manipulate the model and still look at the assessments that are complete at that point in time.

So it goes through multiple items, edge lengths on an individual part, surface sizes, or we call them surface slivers, potential surface slivers on individual parts, and on a model basis, so from an assemblage standpoint, model slivers. It does part gaps, model gaps, and then interferences. Interference, you just kind of need it in here, but you can do that in CAD.

All these other assessments that it does, how it looks at the model, CAD tools don't do this, because they're not built for simulation. They're built for making a manufactured part. And so that's why we think this is pretty valuable stuff.

So first thing I'm going to do is look at edge lengths. All this is doing is looking at the model. Where are there small edges in this model, really small ones? They don't necessarily prevent you from meshing a model, but if you have a really small edge, you could have a mesh concentration and an inefficient simulation model. So everything you see here, it'll always say potential model issues. It's not necessarily a guarantee that it's a problem.

One of the things that you'll notice is, with the default resolution sometimes on these large models that have small parts in them, you might see a ton of potential issues. That's why we give a filter. And I can filter this down and say, what do I really care about in here? So I'm going to look at the really small ones. If I just use that filter, I can drag over and not be overwhelmed with too much information.

So here, if I click here-- let me rotate a little bit-- you'll notice as I click through this table, it'll start isolating different parts, or emphasizing them. So there's three visualization options that happen. I can-- first order-- have it emphasized, so it shows me which part it is that has that edge that's small. I can then even isolate it, if I have a really complex assembly, just

automatically hide everything else.

And I can actually even have it zoom in. So it'll zoom in. Of course, it'll zoom into a really small line, so I might need to back up just a little bit.

So if you could see on a length scale, that's a really small edge compared to the rest of the model. Not great for simulation to get stuff like that. Doesn't necessarily mean you're going to have a non-meshing model, but there's a small edge there, all right?

So that's just the information, doesn't mean anything, really. Just OK, there's a small edge there. And when I looked in there, I could automatically tell that there's a gap in that part, that rip in that sheet metal. It's there.

So usually when you have a really small edge length, you might have a surface sliver. So if I go through the surface slivers for the next thing-- yeah, it shows me there's a surface sliver there as well, showing that there's a really small surface in that part. So that's one thing that you would notice, is that wherever there's a small edge, there's potentially surface slivers.

And if I actually look at this on a part-by-part basis, it's kind of coloring up like a little Christmas tree, all these potential little surface slivers. But again, I'm at the default sliver size filter, so this is one thing I think that we could probably do a better job of, is helping it auto-filter. Maybe we should not be as aggressive at showing potential issues. I think that's one of the feedbacks we have had.

But if I pare this down, I could really knock down the number of things I might want to look at. But then you can see that there's just a few parts that have some potential surface slivers. By the way, as I've been talking-- and I guess I should point with my mouth, so not with my hand-- I don't know if you noticed, but these icons were grayed out, and they start being un-grayed out, because it is doing those calculations. So now I can start looking at the other assessments.

If I were to tell somebody that doesn't want to look at every single one of these little assessments, what is the most important part? I would say, part gaps and model gaps are the ones that really potentially cause mesh failures in a fluids stimulation package. Because when you're meshing fluids, you have wall layers. And when you have gaps, and you have multiple elements that need to fill those gaps, the closer they get, they could interfere with each other and cause a mesh failure.

That's the most common thing. These other items are really for efficiency, mostly. But the part gaps and model gaps are the most important to me, from my experience.

So let's look at the part gaps. Let me go over to that assessment. And again, we're at this default resolution, and it's like 64 different things I need to look at it. Seems like a little much.

One thing to point out on this tool, CAD models-- it's an analytical surface. It can't tell you, this point is this far from this point just by default. We have to actually in the background, we're discretizing this model, or we're faceting it, with a really fine faceting. So there is a potentially-- we're looking-- and then in the vertex is what we're actually measuring, there's a potential for it to have false positives, I call them, on these gap assessments. So hopefully we can get better at filtering them out.

But the reason I say that, you see a lot of this stuff. I mean, there's no gap here between the part on itself. But it's seeing a vertex here of right there by that edge.

And it's seeing another vertex real close. Oh, there's a gap there. Well, there's not really. So if either-- you're seeing these little tiny points, that's noise. But if you see large swaths of color, then that's a true part gap. And the visualization often should help us do that.

So let me pare this down a little bit. And then I'll go ahead-- so all these little tiny ones, 1e to the minus 5, those are noise. And these larger ones are not noise.

So if I look at that one, that's the same spot that I showed the small edge, the small surface sliver. It's also a self gap in the part, because of the rip. So if I had gone to part gaps, I'd have seen that automatically anyway. The other-- so that's this one, and I isolated and zoomed, and all that kind of stuff.

Let me take a step back. I think I can show another example of another small part gap. And I never would have seen this without straining my eyes and just looking through the model 1,000 times.

This is a true-- so you see, it's got a large swath of color. There's a chamfer there. And it's kind of hard to see, but that edge-- there's a little tiny gap where that would be filled with fluid. And it's a potential area, where I could really easily fix that by just fixing that chamfer off there. And you would never get that from a CAD system, so that's why we include these things in the assessment. So for me, just wanted to show that tool.

Then we have the ability to show model slivers. This tool here, I think, is one of the most-- how do I say it-- confusing one of the assessments. And also to me, it's not as useful as some of the other assessments. So I would almost skip this in this class other than to show what it does.

It's meant to show, without doing Booleans and imprinting, to show when you imprint a part on another, if they're barely off. That's what it's meant to show. Not that there's a gap, but there's an edge that's not aligned to an edge, or something like that. That's what it's really meant to show.

And it doesn't happen a lot. Sometimes you do, on-- if you're doing electronics, and you're trying to line chips. Sometimes you do mess up a little bit there. And that's what it's meant to show.

So this one, I filter it out and just kind of try to look for the real small stuff and see if there's anything that's potentially misaligned. So I might drop this all the way down, might look at that. So again, there's two parts that are real close to each other. That's a false positive. I know that that one's fine, but. So I tend to skip over this one when I'm actually doing things.

The really important one for me, besides the part gaps, is model gaps. And again, if you've seen a lot of these, 1e to the minus 5, sometimes those are noise because of the discretization. And what we're looking for is large swaths of color. There's a big gap-- oh wait, no, a small gap between two parts that are large. That's generally not good.

So let me-- if I just kind of hover over this model, I can see a lot of color in here. I can see some color in here. And if I want to look at that, I'm just going to filter down.

One thing you should notice is, as I filter down, stuff starts disappearing, because I'm taking it off the screen there. But I'm going to start looking at things that are, like, 0.01 millimeters or 0.1 millimeters from each other. So here we go. Yeah, range. It modified my range for me.

By the way, this is much like any other simulation tool. I can modify the range if I don't like the slider bar. The graph, the little legend for the color changes. I'm going to change it to 0.15, so I can get back where I was.

Live demonstration, don't get nervous. So if I click on something, right, then I can start seeing it's going to isolate. And, or in this case, emphasize or isolate what's going on. So take a look

at that.

So you can see it better on the screen, I'm going to change this range really high, so I can get the color on the legend adjusted a lot better. So there's a gap between two parts that covers a majority of this board. And when I look at that, it's between these two parts.

So there's two, actually. There's a fan, and then there's two parts. And that's a huge, huge amount of red that's only 0.1 millimeters of separation. And I wouldn't have seen this in CAD, because if I do an interference check, it's going to show interference. It isn't going to show that. So there's a small gap there, and it's on a huge part.

Actually this mesh is in CFD, it worked fine. But if I were to get a fail mesh, that's the first one I would look at, all right? It's a huge, huge area with a gap.

As a matter of fact, I might even look at stuff like that. Two, three other parts that have a gap in them between the board, not mated correctly. And I did that on purpose just so I could show what happens when you don't mate properly. But those are the items that you might see.

Not going to go over interferences. This model doesn't have any. But this is just information. I don't have to use this tool.

By the way, if you launch into it, and you're like, oh, stop, you can stop at any point in time. You can actually tell it as it's assessing to cancel the assessment. So if you don't like the timeframe that it's slowing you down, you know your model is fine, you can bypass it directly in the launch. You accidentally launch into this, you can go straight to the setup. So it's meant to be informative, and if it's too intrusive, OK, I don't like it, just get out. So you would just transfer to setup and run your model, if you thought everything was good.

But let's talk about the SimStudio Tools for a second. So that's the assessments, and then I'm going to talk about what the SimStudio Tools are. And then I'm going to kind of show working on them in concert to clean up a model. And I'm 15 minutes in, so I think I'm good on time.

Did anybody have any questions about the assessment tool? I'm going to show it a little more. Any more questions about that right now? By the way, you're going to get a prize at the end of the day for your questions here. Plenty of prizes up here. OK, so there's no questions.

What I will show then is a couple of other things about SimStudio Tools. Ever get a model that looks like this? Pretty complex. You don't know where to start. It seems pretty daunting.

And you don't know much about the model, right? It's from somebody else. If you get a model that's in a step file, probably not going to be colored up. You don't know what parts are connected to each other. So there's a few tools that I use that are really helpful from a visual standpoint, even. And then selection aids and other things we do from a simplification in SimStudio Tools.

So the first thing I would do is turn on the component color cycling. So now all the individual components get their individual colors. I can see what's connected to what. So here, I can see that, for instance, this blue chip is not part of the board. It's its own component.

But one thing that you might not see here is what's a surface part versus what's a solid entity. This was surprising to me. This is also, by the way, real geometry for the Ember. And they had done it and this all works. And I put it in here.

Everything that's in transparent, those are all surface parts. It's starting to look more like a nightmare to clean up, because surface parts don't do any simulation factors good, unless you meant them to be surface parts. So this is looking a little more nightmarish to me. Do I start over? What do I do?

But the tools that are here should help clean stuff-- as a matter of fact, I cleaned this board up, I think it took me about 20 minutes. Which is, to me coming from where I am, pretty astonishing. If I had tried in other tools, I don't think I could have done it nearly as fast. So I'll start to show a few of the items that would help me.

By the way, if you take a real close look on this-- and I'm going to turn that transparency up-- there are a lot of small components on the bottom of this board. So one of the things that we would do is just select by size. So I can select a size range of components. Here, I'm going to type in 2.5. All these little tiny pieces that I could care less about from an electronics cooling standpoint, I've just selected.

I mean, I haven't selected all of them, but I selected, by and large, most of them. And so, I just hit OK, whatever, I select-- I could suppress those guys, and they could stay part of the model. Or I can delete them. Here in class, I'm just going to be mean and delete them. So I'm going to delete all those components.

And then all of a sudden, the board doesn't look nearly as bad. Now I can see the major stuff that's important. But they're still real complex. They're still surface parts. So how would I-- what

would I do here? So this is pretty simple.

Let's look at this part here. I'm going to introduce a couple things I didn't show in the Word document or the presentation. But one of the cool things about the way SimStudio works, is if you click on something and you hold down, it gives you this depth peeling. So I can click on different faces. I don't have to keep moving the model around. Or I can go to the parents, and say, OK, that face, that body, the component, the assembly it's in, all that kind of stuff.

If I double-click, it's going to select the body automatically. So I'm going to double-click that body, and one of the items here is replaced with primitives. So that's what I would do in CFD, I'd go manually create these boxes that look like they're a shape, and that's what I would do for modeling this.

Replace with primitive. It'll automatically make the box that encompasses that volume. Now I can modify the box before I say OK. It'll suppress the part and put another component there in its place.

So it doesn't delete the stuff out, but it takes it off of what you would send over to a simulation package. So I can do that. And if there are multiple occurrences, you can have it do for all the occurrences of that part in the model.

Here, it's a box. It could be cylinder or a sphere. All that stuff. Like I said, you could adjust this if you wanted. This one looks like it's the right size, so I'm OK with that. So it just does its job.

And I'll show it on another one where there's actually a large instance. So I'll repeat that. Don't have to move my mouse too much. I'm going to replace all the occurrences.

And when I do, cha-ching. If it worked, all of them get replaced. There we go. So it's a pretty quick way to start cleaning up.

Now you'll notice when I grab some stuff, this is a little larger than 2.5 millimeters, so I might need to do a little bit of extra grabbing and deleting of these little faces. So I might come in here and delete those guys, or whatnot. Actually, I just grabbed faces. I'll select body priority, change my selection, delete them. I hit Delete key on my keyboard instead of going up to the delete button, so.

But that's what I might do. I would do that for all these components. It's pretty quick and easy, and that's how I got this thing done within 20 minutes. Now I have a bank of these little fuses.

I'm just going to show a little more functionality of this, replace of primitives, because I think it's so valuable.

Do I want each one of these guys be a box, or do I want the whole thing to be a zone? Kind of check this out. So that's one box. I select another thing in addition, now it's the whole thing zoned in. So it's going to take that whole body in. That's one item.

Going to go and reference my presentation just for a second, so I make sure I don't forget anything that I think is valuable. Yeah, select by size, selection, OK. Yeah. So one of the things that I didn't say that's pretty important is when you're going through this-- if I'm deleting a whole bunch of components, I might have a really long feature tree, because this is hundreds and hundreds of thousands of parts. We have scripting capability to take care of some common tasks that you might have.

One of the scripts that I want to point out to users, because they're like, man, I just deleted 1,000 components out of here. My tree is so long it's hard to manage. Do you want to go through and individually delete out empty components? No, we have a script that'll do it for you. So one of the scripts is delete empty components, and it'll go through and--

[BLOWS AIR]

--just wipe out, clean up your feature tree.

Other things that are here, an IDF importer. So if you are doing electronics, you need to import an IDF, there's a script to do that. There's other-- so this is meant to take care of mundane tasks, so obviously scripting. We supplied a few that are pretty important. But you could add other things as a user or as an organization.

OK, I think we're doing pretty good on time, 30 minutes. It's about halfway through the class, and I'm about halfway through a couple of the tools. So I'm not doing too bad.

Are there any questions about this tool? Because people might have been exposed to this, using any of the Simulation tools. Are there any questions about some of the stuff I showed or other questions? Yes, sir.

AUDIENCE: Can you import CAD models [INAUDIBLE]?

HEATH OK, so the question was, can you import a CAD model after you're done setting it up for--

HOUGHTON:

AUDIENCE: Yeah, like let's say you forgot to put a chip in there.

HEATH HOUGHTON: OK, perfect. So yeah, the question to repeat for the audience that's going to listen this later is, I clean this model up, there's a few components I need to add to it. I need to conglomerate more models into it.

Absolutely. You know, you open up a model, but you can always insert more files, more components. So I can insert more components just right there. And I can align them and make sure it's put in the right spot, and all that good stuff, so.

Yeah, there's a couple other really cool features. I'll show some other features here that really help in clean-up. This is a featureless, or direct modeling is really the term. And you can drag and drop, pull, move faces, change angles, all that kind of stuff.

So there's a lot of other things from a modeling standpoint. Most people who have opened this tool kind of get that right off the bat. But these other simplification tools are a little bit less, I guess, immediately observable, unless you know that they're there.

One of the things about this interview, by the way. If you do open up SimStudio Tools, it may not look like this on the top toolbar for you guys. I always advocate, guys, that you make it easy to find things. If there's something that you use often, you can populate it up to the advanced-- to the top toolbar, so it's always accessible. And you can take things off that you never use. You can customize the interface, basically.

So that was SimStudio Tools. And I used them individually. So now I'm going to go through and show a couple of ideas of how we would use SimStudio and the Model Assessments Toolkit to fix a model.

So we'll go back to that assessment that I showed earlier. One of the assessments that we looked at was this part gaps, right? And the part gap in particular that we looked at was this one right here. There's that self-gap on its own. How would I fix that in CAD? I might have to go back and do an extrusion, or profile, or whatever.

In SimStudio Tools, it's pretty simple. I just-- I'm going to go to that model, and here it is. So again, remember-- I said, if you-- whoops-- click on a face and you hold it down, I can kind of zoom through where I'm at. I'm going to click on that face, and one of the items is Press/Pull.

It's pretty simple. I'll press Pull.

Now I can go make it bigger. If I want to keep the rip, if I want to close the rip off. Then I can actually snap it to the other face, hit OK, it's cleaned up. It's pretty easy. So quick clean-up of that guy.

And there was one more that I showed, right, that we have from an assessment standpoint? There were these primitives that were model gaps, where they were separated from each other. So these guys, right? All three of them on that board. So there's only three of them that were on there.

Of course, I did that. It's kind of fictitious, but that happens by accident all the time. Especially if it's not your model, right? Our modeling's perfect. It's other people's models.

Again, we're going to go to that toolset and look at where that is in the model. So there's some tools. There's a number of ways I could fix that. I can just drag it and pop it to the face again, like I did to all the others. I want to show off a different feature.

So here, I'll show off this align tool. So it's in the Modify panel. I'm going to align. I can align bodies, I can align faces, I can align parts. I'm just going to align this face.

And I'm going to use that left-click and hold-down to get to the face that I want, without trying to rotate and get to that tenth of a millimeter gap, and all that kind of stuff. So I'm going to align that face to here. And it's going to move it.

Was that visible on the screen for everybody? OK, so that's good. So then I'm going to repeat that align. I'm going to do the same thing for all three of these. I'm going to repeat.

So having this wheel right here, really accessible right-click can-- mouse fatigue is really bad when you're really cleaning up a model, but you can do it really quickly with minimal mouse movement and take care of that. So I took care of all three of those really quickly. They're done.

So that's another tool that take care-- so that's how you're supposed to do it. You look at the model, it tells you this is potentially bad. Go to the CAD, clean it up. You could relaunch it to make sure there's not anything else that you missed, to sure you did it right.

But that's kind of how the Model Assessment Toolkit is meant to be used. To use the CAD that

you have available, the one you're used to. And if that package isn't good enough, we offer a really good cleanup tool called SimStudio Tools to clean up the model.

Now that's if-- so to me, there's inherent advantages to dealing with CAD and then using that for simulation. Sometimes, the cleanup is way too much. Then that's when surface wrapping can come into play. We're on the very beginning of surface wrapping.

So surface wrapping, what is it? People might ask. It is taking that CAD model and kind of just paving over it and kind of glossing over the fine details and getting something that you know will mesh.

So we introduced it in 2016, and it looks like this as a standalone application. Actually, I would have liked to have had it in the CFD file, because it's integrated from the beginning. But it was valuable to a lot of our Labs customers, and we didn't have time to just redo the whole UI that would be needed. So we just said, OK, we'll include it and give them the benefit.

So this is a car. I have a video I could show. I'm not running low on time, so I'll do it live. But I'll probably show a little bit of video, because actually, there's analysis that goes in when it does this surface wrapping. It's actually a meshing operation.

But this model-- what's the workflow? I would open up the geometry, and then I would try to wrap it. By the way, the surface wrapping application in 2016, really only good for external flow volumes. If you're doing an internal flow, it's not there yet. So it's really meant for external flow.

So what does that mean? The guys that are running external aerodynamics might get some benefit from it. A lot of our AEC customers get a lot of benefit from it, because they're doing these large topography and buildings and looking at wind/wake.

And these buildings are so complex. They're coming from Revit or whatever, AutoCAD, and they might have SketchUp models that are surface models. Surface wrapping can take care of all that for them without doing all this cleanup. So it's-- we saw the most value for our AEC customers.

Now, are we going to go to the internal surface wrapping? Of course. Are we going to get it to work and do an electronics model like this one? And, you know, we're going there. The timeframe, I can't offer. But that's where we're headed with this, is you can handle it with geometry, you can handle it with surface wrapping.

Surface wrapping doesn't handle everything. Geometry might take a long period of time, or you may not have the skills, or expertise, or the tool from which that thing originated to clean up. So we're kind of meeting in the middle. And we're trying to offer the full range. And I think the meeting in the middle is where you get minimal, minimal time. And once we get there, I think we'll start seeing some dramatically improved workflow, as when it comes to simulation geometry handling.

At any rate. So I import this in. I can change the bounds, the size of the box, orient the model, push it to the floor, all that good stuff. But the main function of the tool, again, is surface wrapping.

So the way this tool worked is that you specify surface mesh settings. It's really powerful. There's only one thing that really manages the resolution of the wrap. It's this one button, this one number that's 2,500. All the rest of it's about surface meshing, because this tool actually meshes the model, and we import a full mesh.

So for a user, to me, great. It's powerful, and I might just leave it at defaults, because I don't know what these things mean. And it will give a good mesh.

But for me as a product manager, I don't want somebody to have to learn something else that they already do in the other tool. So I'll show some improvements we've done to eliminate all these questions, I call them, that people have to input. But anyway, you would hit OK, and it would surface wrap it. And then you would go to the next step and start generating your volume mesh.

I'll show that in a video, because it does take time for the item to run. You might have seen this video if you ever looked at the Labs project back when. But I'll skip through a bunch of-- this is only like a 30 second video, so. This is when I was trying to show people what is this tool. So let's get past a lot of that.

Again, in this model, little gaps. So there's a gap right there, a panel gap. You couldn't mesh that, typically. It's just going to-- there's too small of a gap. It might cause those, like I said, those mesh overlaps.

But the surface wrapping will heal and paper over those gaps and try to still represent the rest of the geometry well enough. And so that's the surface mesh, the shrink wrap, then you have to do a volume mesh. Again, more inputs. So foreign to our users, but you get a volume mesh

out of it.

And then the workflow would be, oh, I import this volume mesh, which is kind of heavy. Then I go into CFD. Little bit of some heavy workflows there, from it's a new tool I have to use, or whatnot. But if I had to clean that up manually, it might take me two days. Surface wrapping, it takes the computer maybe 30 minutes, maybe. Because it is actually doing a full mesh.

This has the tendency to produce some pretty heavy meshes, so. When I say heavy, some fine detail in the whole volume. Because it's not done in the same manner as our traditional CFD mesh, which tries to be really, really, really efficient on the mesh distribution. So that is the surface wrapping in 2016. Like I said, it's a standalone application. We import this model and all of that.

What I want to do is spend about 10 minutes, maybe 15, on what we're doing in the beta to try to improve that workflow. So I intentionally pointed out some things I don't like. I'm not bagging on that surface wrapping tool, because it saves people a lot of time for that application. But I'm trying to show what we would do if we had infinite amount of time to get it out. And this year, we concentrated on this pretty heavily.

So now you go to Model Assessment Toolkit. You can actually push it to surface wrapping, if you think there's too many issues, and it's the right application for you. Or if you're opening a model type that, for instance, we can't actually mesh. Can't mesh a SketchUp model. It's all surfaces, and it's not a format that CFD supports natively. But we support Surface Wrap, so we could surface wrap it and then bring it in.

So alias wireframe models, again, or surface part models. So this is a wire-- this is an alias model. It's that same one I showed in the video, but now I'm using the interface in CFD.

One thing you should notice is that-- only a few buttons here. And we try to simplify down the process for people. So I need to create an external volume. I can snap things.

We're going to add extra buttons here. So this is beta software. I'm not scared to show beta. If it crashes-- it won't.

[LAUGHING]

No, but it won't crash, so. Beta software, everybody gets scared. You're showing beta? Yeah, I am. So I'm going to--

AUDIENCE: So this is within the CFD environment?

HEATH HOUGHTON: Yes. So this is within that Model Assessment Toolkit. And I call it, kind of, it's a different shell of an environment, doesn't have-- like, all the setup stuff that's kind of hidden from everybody. This is just the Model Assessment Toolkit and surface wrapping, so.

I had the ability here to, again, the same type of controls to make the size of it, and it looks, all that good stuff. And we're going to start offering some kind of cool "hey make my box always this size x of the model," and all that kind of stuff. We're going to add some extra features before you actually go to release.

But by default, it's telling me how big this volume is. What is that one number I said matters, right? That tells the resolution factor. And then, if it's already meshed, surface wrapped it tells me the count. Well, I haven't wrapped it yet, so there's no count there. So I'm going to hit OK.

The next step is that resolution factor. So remember before, it was like seven different items I need to type in numbers. Had all these to either the fifth decimal place, or whatever.

Now it's just that one number. So how fine do I want it, you know? Real fine or coarse? Obviously, coarse will mesh faster, or surf wrap faster, but include less detail on the model.

So I hit OK, and it's just going to tell me what the factor is. And then the next step would be just hit the Generate Wrap button. It'll do its thing. And it will show you the wrap. And once you're done there, you would then just transfer it to the setup environment as, and we're thinking of it as geometry at that point. Does that make sense?

So get rid of all those extra controls. What does it look like when it goes to CFD? Looks like a regular model at that point. And you would do the same things you normally do.

I'm going to click on this-- let me go set up here and make sure I'm in Material. So I might put my air, make it air, make it solid. Put my boundary conditions on it, everything else. The one thing I want to highlight, though, is the meshing.

So let me-- instead of using meshing tools that are foreign to a user that uses our tool already, now we're going to use tools that are very similar for getting the sizing of the mesh and all that. Let me go ahead and remove these mesh settings. Actually, I'll just start over.

So again, auto-sizing is the default meshing mode most everybody uses, from a CFD

standpoint, for our software. They're used to seeing these blue dots to show kind of what the distribution is going to be for CFD meshes. As a matter of fact, they're used to this dialog box actually being bigger and more stuff. We're actually trying to streamline the meshing dialogs, even, for our users. And this is a testbed on what the UX should look-- the user experience, from a meshing workflow should look like.

We're trying to get rid of nomenclature that nobody understands. Mesh enhancement, what does that mean? What is advanced? It's kind of scary. So these panels that we have in our traditional meshing environment that kind of throw people off.

We're trying to make it more intuitive on the name, even. So now we call it the auto-sizing basis. And they're just telling you what-- here's the main things that make up what auto-sizing does, you know?

The wall layers-- OK, it's not meshing enhancement. What is it doing? It's telling you how many layers I have on the wall, you know? So we're just trying to show things that are important.

But the main thing I want to show is the way we're displaying the information. So there's three levels. This is going to give me the-- where more features are, obviously, I would have more mesh. This isn't the mesh. This is kind of a representation of the relative density of that mesh.

One thing that we've added is to actually show you, if you want, with some hot keys, and we're going to add some icons that help people discover this. But yeah, what is the actual mesh size going to look like? So we're not going to-- we're working on the glyphs and what they should look like.

Right now, they're circles but where that bigger circle-- that's the actual diameter of that tetrahedral triangle, is what it's going to be. Smaller circle, that's the actual, what it would be. So really quickly, kind of scan over and say, what would the mesh look like, before I ever hit Solve or Mesh, where it might take a few minutes, especially on a large model.

Of course, I could have, like, a little tiny glyph that just kind of goes around. But you know, if you want large swaths of it to understand what's going on. That's what we would do.

At this point, you could even go a step further and hit Preview, and it would show the surface mesh. I'm not going to do that, because it might take a little bit of time. But so that's kind of the workflow there.

At any rate, one of the things that this will afford that the other workflow didn't, which I consider to be extremely, extremely valuable, is the other workflow gave you that really heavy mesh, and that's what you're stuck with. You can do mesh adaptation now with this, like you can with regular CAD, because of the way we're handling it. So should make it a real simple process. If I have a really complex thing-- and again, this is only for one kind of class of problem right now. Think of it in the future as we advance.

I get my surface wrap, it looks relatively good, it looks like my geometry. I'm happy with it. And I'm going to mesh adaptation, so I don't have to be a meshing expert at all to get an accurate mesh for my physics. So that's where we're going with it. And that's why I want to introduce it and show it. Right now, external arrow, internal flows coming, and then we're going to keep building.

So anyway, 15 minutes early on a Thursday afternoon. I went kind of fast. I had a little bit of coffee before class. Actually, I want to leave some time for questions. So I can go back into any one of these individual products or parts of the product, if you had questions, where I could get real detailed. Yes, sir.

AUDIENCE: Is there any [INAUDIBLE] beyond the mesh [INAUDIBLE] tool we'll get from SimStudio Tools? Because it seems to be [INAUDIBLE] switching out [INAUDIBLE] where you are [INAUDIBLE]?

HEATH HOUGHTON: Absolutely, that's a great question. So the question is, we're switching back and forth between two interfaces. There's SimStudio Tools, and you're using this environment just to look at the potential problem areas.

The plan would be that we would offer these assessments inside of SimStudio Tools. Now our customers all don't use SimStudio Tools today. So we need to have the affordance for them to do this for UG NX, Solidworks, Inventor, whatever, but as we move forward, you should start seeing these assessments.

And a matter of fact, these assessments, these are very CFD-specific. But Tools is for all of our Sim tools. Like for instance, you might want something a little different when it comes to part gaps or assembly gaps for a mechanical product, where you might be linking them or having contact automatically applied. So there might be different flavors of these tools. But yes, that is a plan. Yes, sir.

AUDIENCE: Is it possible to mesh, enhance what we're finding through all that, and then go in and manually tweak it in some areas?

HEATH HOUGHTON: Yeah, so the question is-- was the question about having to do a mesh adaptation, and then you go and manually change that mesh? The answer is no, because a really good mesh adaptation scheme would give you the perfect mesh. So you shouldn't have to go back and do it.

You can manually tweak these mesh and then adapt after that. That's a workflow that we afford. So you can start off with almost an ideal mesh, and then let the adaptation make it ideal. Or you could just say automatic, and then adapt.

One of the things we would recommend is, we do mesh adaptation cycles. And if you have a pretty good mesh already, then in the adaptation, maybe you only need one adaptation cycle instead of three, if you start off with a really coarse mesh, you know? So the workflow, we try to make it to where yeah, you can do your tweaks. But once you adapt, you shouldn't have to do any tweaks based on that physics. And so we don't allow it, you know? It just seems like a weird workflow.

Any more questions? OK. Well, hey, it is a Thursday afternoon. I'll be here for another 10 minutes or so. I have a flight this afternoon, so I won't be at the party, I'm sorry. I'd like to hang out, but I can't do it.

Yeah, I have a bunch of stuff up here. I encourage you to come and get it. And if you want to ask questions, just personally, or whatever. If you need help, I'll be here for a little bit, so. I appreciate you guys.

This is a big turnout for Thursday afternoon. I expected about 10 to 20 people. But you know, it looks like there's about 25. So thanks, guys, appreciate it.