

### CHRIS BENNER:

All right, they closed the doors. That means you're all trapped in here with us. So nobody try to escape.

Good afternoon, and welcome to our class. Thanks for taking the time out of your day to come to visit us. This is Increasing The Volume With Inventor Tube & Pipe.

We're going to talk to you today. This is kind of a higher-level look at Tube & Pipe, some tips, and tricks, and ideas that we've come up with to increase your productivity. So I'm going to start with asking, how many of you are already using Tube & Pipe, and have been for a while?

OK, so what you'll notice if you go to the app, or if you go to the AU site for this class, is that I not only included a handout for this class and our slides, but I've also included the handout for a class I did two years ago, which was more of a Tube & Pipe basics class. So there's a lot of good information in there for those of you who maybe haven't used it quite often. It kind of gets you started. And then you can jump right into this stuff after you get more familiar with the basics.

Basically, like I said, this is going to be a presentation of tricks tips, tricks, workarounds. We're going to look at some advanced editing techniques, just some little tricks for productivity to get you moving a little bit quicker here in your Tube & Pipe.

By the end of the class, we hope that you will know about dynamic route editing techniques. You'll know how to copy and reuse pipe runs and then make

them adaptive. You're going to learn to fill unwanted gaps that appear in your pipe routes. And I'm not going to get any deeper into that now, because that's a good topic. We're going to talk about self-training lines. And then we're going to just throw a whole bunch of other little tips and tricks at you.

The way we've structured this class is Mark and I are going to-- we're going to present each topic. We've got a few slides that we're going to quickly go through. And then there's going to be a demo video that we've recorded.

This is about me. I am Chris Benner, the CAD supervisor at Powell Fabrication & Manufacturing, St. Louis Michigan-- not St. Louis, Missouri. It's right smack in the middle of the lower peninsula of Michigan. I've been working in CAD for over 20 years. I have been working with Inventor Tube & Pipe for eight.

Four years ago, I was brought into the initial class of the Autodesk Expert Elites for spending way too much time talking to people on the forums. I've since gotten into blogging and social media. And you see my football thing over here. Now, since I put that on there, they are now in first place in their division. But I'm not ready to take it off yet. We'll see how it goes in December. So that's a little bit--

**AUDIENCE:**

I'm going to take it I like it.

**CHRIS BENNER:**

You're going to take-- you're going to go with it? Which? With the line or without the line?

**AUDIENCE:**

[INAUDIBLE] .

**CHRIS BENNER:**

That's the way I feel right now. Maybe in December, if they do better, I'll take that off of there.

This is where home is for me, Sanford, Michigan, which is about 30 miles from where I work. It's a long drive in the morning, but it's well worth it to have that as my front yard.

I work for Powell Fabrication, as I mentioned. Powell Fabrication is-- we design and build custom skid-mounted chemical processing equipment primarily centered on the bleach industry. But we work with customers that have all kinds of different processes. 80% of the bleach that is sold on the shelves of supermarkets in the US is processed on Powell equipment. And we design and build each machine custom for whatever the customer's needs are.

So as you can see, we do a lot of Tube & Pipe. Mark.

**MARK LANCASTER:**

Thanks, Chris. As Chris pointed out, my name is Mark Lancaster. And I personally want to welcome each of you to our session today. I have to say, for me, I don't get much out. So being in Las Vegas for a few days and not worrying about the normal day to day stuff is great for me.

It's been about 20 years since I've last visited this area. And if I had my badge on, you would know that I'm a first-time AU person. By show of hands, how many are also new to AU this year? Well, welcome.

I'm honored to be up here and assisting Chris with his session today. I've known Chris-- we started communicating through the forms probably about a year ago. And the funny thing is that, on Sunday, we finally met face to face in the Detroit airport as he was

catching his flight to Las Vegas.

**CHRIS BENNER:**

We've been putting this class together since June.

**MARK LANCASTER:**

Right.

**CHRIS BENNER:**

And we finally met for the first time on Sunday.

**MARK LANCASTER:**

So what I wanted to do was take a quick moment and acknowledge Chris for his commitment to the Autodesk community. Not only does Chris spend a lot of his time sharing his experience with the Inventor Routed System and helping users like yourself on the forum, Chris is also committed to improving the products that he uses. He's always looking for solutions and providing that feedback to the Autodesk development team. So I just wanted to give-- let's give him a big round of applause for his commitment to the Autodesk community.

[APPLAUSE]

**CHRIS BENNER:**

Thank you

**MARK LANCASTER:**

Being a speaker is not always the easiest thing to accomplish. Being a co-speaker like myself, I have to follow somebody. So I will tell you, Chris is a hard act to follow. And I stole this from him, because I just wanted to demonstrate-- I mean, how do you follow somebody who has earned this type of lanyard at AU?

**CHRIS BENNER:**

I just pick up everything I can find and stick it on there.

**MARK LANCASTER:**

So when we were setting up this session, I said, Chris, you've got to let me go first so I can lay the groundwork. And then he could follow behind me. But

in the end, it doesn't really matter who's first or second. We've got a great session for you today, and we hope the information we provide is very beneficial to you.

So a little bit about myself-- I categorize myself as a support person. I've been doing that for most of my career. I honestly can say it's been about 10 to 12 years since I've done any actual, true CAD design work. But if you ask me to draw a line in AutoCAD, I can do that for you still.

I do work for a Autodesk reseller located in Quakertown, Pennsylvania. We are proud sponsor of AU 2016. My job title is I am a product support specialist. I support all the Autodesk manufacturing and Vault products. On a daily basis, I work with many different types of customers. So I'm always-- my day consists of supporting those customers and monitoring the forums.

Although I'm kind of new-- just about a year-- I'm also an Expert Elite. Chris had nominated me. Is there any other-- by a show of hands, is there any other-- Expert Elites in the audience?

**CHRIS BENNER:**

I see one.

**MARK LANCASTER:**

Yes, Paul, I knew you were.

**CHRIS BENNER:**

Hi, Paul.

**MARK LANCASTER:**

Expert Elites are very crucial to, especially, the forums. They're out there on volunteering their own time, answering the questions out there. So that status is well-deserved. We'll get to that.

Now, I had a section planned for one of my friends who was going to be in here. Actually, he started-- back when we were working on presentation, he started-- having a list of people that he owed a beer to. But he elected not to show up, because he knew I was going to call him out. But I have a section about that.

**CHRIS BENNER:**

So you brought his beer anyway.

**MARK LANCASTER:**

Yes. I know Chris has already asked this-- for those who are currently using Inventor Routed System, how many, by a show of hands, have been using it less than a year? OK. Well, like I say, Chris and I have a lot of information that we're going to share today. There's a lot of great information in your handout.

**CHRIS BENNER:**

Both handouts-- download both handouts.

**MARK LANCASTER:**

And we hope that you will walk away from today at least knowing one new thing about Inventor Routed System. So with that, let's get started. Remember, a few minutes ago, I told you that I had to convince Chris to allow me to go first. So I think a great topic to start off, before we get into showing those advanced workflows, is understanding the Inventor Routed System structure.

The key here is I can spend an hour talking about this information. But Chris and I decided that, let's give you a brief overview, a couple of slides to talk about it. And in your handout that's part of the session, if you haven't downloaded or looked at it, there's a very in-depth look at the Inventor Routed System structure.

When I used to teach Inventor Routed System to the

CAD community that I used to support at my last job, I always started out teaching them to understand the structure. Now, this is not a Autodesk thing. This is something that I came up to help my users understand the structure. And I break it down into four levels.

Level 1 is your top assembly. It's just a normal assembly that you're going to start from whatever template that you use. When you go into that Tube & Pipe environment, you're going into that level 2, which is considered your master pipe run assembly. That is the key that holds all of your pipe runs, your pipe routes, and your Tube & Pipe styles, and all the components that you're putting into your Routed System model.

Level 3 breaks it down into those pipe run assemblies. And then, level 4 is the individual route or routes that are assigned to a given pipe run. And the reason I bring it up is, if you take those four levels and look at your Inventor browser-- granted, this is a old slide, probably Inventor 13. So your browser may not look like that anymore with the newer. But in that relationship, that's those levels.

And the reason I talk about the level is because you're going to find, when you're working with Routed System, you need to really be-- to be efficient is to use the navigation inside of Inventor browser pane. If you've been working with assemblies and you've never gone, you know, edit a place here and there, you may not be used to that. When it gets to Routed System, to be efficient, in my opinion--

**CHRIS BENNER:**

I would agree.

**MARK LANCASTER:**

--and Chris will assume that too-- is that you navigate inside of the browser pane.

Three other key components of a Routed System structure is the pipe runs, the pipe routes, and the Tube & Pipe styles. Same thing-- I could spend a lot of time going over that information. But we elected to take that in-depth aspect and put it into your handout. Because we're really here, you don't want to listen to us talk about that stuff. You want to look at those workflows that we're promising you.

So what are the things you want to consider ahead of time? I kind of relate this-- and it doesn't matter if it's Inventor Routed System or you're learning something Inventor-- I kind of relate to taking a child and teaching them to swim in a swimming pool. You don't put them in the deep end of the pool. You teach them to get in, take the baby steps, learn to swim, and then go up to the deep end of the pool.

And I see a lot of times, especially out in forums, people who are new to Inventor, they're trying to create this complex surface. And you ask them, how long you been using Inventor? Oh, I just learned it two hours ago. And I consider that, why are you jumping off the deep end of the pool? And take that concept when you are working with the Routed System. Don't try to do the biggest product out there. Take small projects, and work yourself up.

If I ask this question, say, raise of hand, how many times have you heard this, probably a majority of the room would raise their hand. Keep that same mentality when you're working with Routed System to

save every so often.

**CHRIS BENNER:**

My key phrase when I'm training people is "save early, save often."

**MARK LANCASTER:**

Right We're all humans. We're going to make mistakes. For as long as I've been using Inventor Tube & Pipe, you do make those mistakes, and you have to undo. Too many of them, just keep in mind, will cause corruption in your model or [INAUDIBLE]. It's not as bad as it was years ago, but it's still [INAUDIBLE].

**CHRIS BENNER:**

It's still there.

**MARK LANCASTER:**

And this kind of relates to that, those four levels that I talked about. I believe, to be a very efficient inside of Inventor Routed System is understanding the model browser tree, to be able to navigate through them, and to understand where you are. Routed System is based on Inventor adaptivity. Chris is going to show you a demo later on where there's going to be a case where you don't want a pipe run to be adaptive. But if you don't understand what Inventor adaptivity is, I recommend that you take a little crash course on that. Because the Routed System structure is fully based on that.

A couple other things to know, although it's not 100% of time-- and actually, when we were setting up this presentation, and you know, we were viewing each other's information, I actually learned something new from Chris that I never knew that was out there. And it has to relate to content center. Routed System is fully based on content center. But you're going to see demos where it's not always 100% that you need

content center.

If you don't have access to content center, you don't know how content center works, same thing. You might make sure you get that all set up. And take a crash course on content center.

This kind of goes to that first bullet point about having a plan. Don't go far too far ahead of yourself. I see, a lot of times, that people have problems. And it's, that red cross is lit up next to the quick access toolbar. You're going to find, trying to do too much at one time in Routed System is going to lead to issues.

And same thing that I just pointed out-- don't just say, oh, I'll get back to fixing that pipe run. Try to get it fixed as soon as possible.

**CHRIS BENNER:**

I would agree with that.

**MARK LANCASTER:**

And with that, I'll hand it back over to Chris for our first demo.

**CHRIS BENNER:**

All right, this is going to be our first little tip. And this is not actually-- I can't take credit for this tip. I got this from a friend who is also an Expert Elite who-- he put this into his blog, and I read the blog post, and I thought that's just fantastic. I've got to try this out. And it works great. Now, I'm going to warn you ahead of time, the videos that I recorded, I hate the sound of my voice on tape. So please be gentle with me.

When you're using dynamic pipe route editing, what it really is, it's a way to edit a pipe route without actually activating the route and getting inside of it. Because when you activate a route, what you're looking at is the sketch, with all the dimensions and the nodes

attached to it. And when you make changes to the dimensions of that sketch, you can see the dimensions changing. You can see the nodes move. But you can't really visualize the fittings, or the valves, or the instruments that you've got in your pipeline moving.

So you have to get back out of the route and get the solid showing again so you can see what the result was. And if it wasn't what you wanted, you get back into the route, and you make some more tweaks. This is just a much easier way to do this where you can see the results in real time.

The key to it is that I only use this for fine tuning. It's not for designing. You still want to use the standard routing tool for getting your designs laid out. This is for when you've got all your pipe runs in place, you've got all your routes there, and you need to just start sliding things around a little bit to make it look-- to make sure there's no crashes, everything's where it's supposed to be, and because, like I said, it's, frankly, quite cool.

The things to remember about it is your pipe route should be already basically completed and fully constrained and dimensioned. If you don't have your route locked down and dimensioned, using this you could create a number of headaches for you. So just make sure-- before you try this, make sure-- you've got a route that's fully locked down and fully constrained.

What you need to do before you start doing this is you do need to activate the route. Select dimension visibility on the route. And you do that in the browser.

You right-click on the browser, and you select dimension visibility on the sketch. And then you need to go to the View tab in your Inventor, and select object visibility, and turn on both 3D sketches and sketch dimensions. That all needs to be set up before this will even work.

Then you can activate the pipe run containing the route and just do your editing right there with the dimensions visible on your screen. You can just start tweaking the dimensions. And as you do so, the fittings will slide around based on those new dimensions. And you can actually see where they're going to know if that's what you want or not. You Shift right-click, select sketch features, double-click the dimension that you want to change, and then you watch the pipe route update right before your very eyes. And you'll have that same expression on your face.

So I have a quick video. And it's going to skip right past it for me. Again, please [INAUDIBLE].

**MARK LANCASTER:**

One of our pointers will automatically play the video, and the other one--

**CHRIS BENNER:**

And this one does not. So I'm going to just manually hit play on this.

[VIDEO PLAYBACK]

- This is a video demonstration of dynamic route editing--

**CHRIS BENNER:**

I hate my voice.

--in Inventor Tube & Pipe using Inventor 2017. I have a small assembly built here that I'm going to use to demonstrate this. This technique is best used with a pipe

run that has a fully constrained and dimensioned route so that the behavior can be more easily predicted and you don't end up having your pipeline blow up on you.

I'm going to edit this pipe run that you see right in here. And going to just simply open that run up for editing. Now, I want to edit route 17 here, which is the route that controls the main bulk of this line.

So the first thing I'm going to do is right-click on that route and select dimension visibility to make those dimensions visible. Obviously, you see, nothing happened. That is because you also need to go to View, Object Visibility, and turn on 3D sketches and sketch dimensions. Now the whole sketch is visible. All the components are there.

The next thing you need to do is set your selection priority to select sketch features, which mine's already checked for. Ordinarily, you would probably see is set on component or part. So just select sketch features.

Now, without even opening the route, I can edit it just by simply double-clicking on the dimension and changing the value. And you'll see, it moved in real time. You can actually see the fittings move. And that's what's nice about this technique is it's good for tweaking the positions of your valves and your fittings, getting the route put back together the way you want it after you've done some of the rough design, OK? We all want to make these nice, even numbers.

I can even change the length of this-- if I can get it-- the length of this leg down here from 12 inches to 16 inches. And you'll see, the whole thing will just change right in front of me. That's much nicer, in my opinion,

than editing the route, and all you can see are the nodes moving. This way, I can actually see the fittings moving. And I kind of get an idea if everything is positioned where I want it to be.

Perhaps I'm trying to get around another pipeline, and I need to see whether or not I've got the clearances that I need.

**CHRIS BENNER:**

You Can tell I'm using the 3D mouse.

- [INAUDIBLE] technique for that type of editing. So that is what we call dynamic route editing. You can also do this up one level at the master pipe run assembly. But you will not see the fittings move. I'm still in select sketch features. I can still change this dimension. But now it's going to require an update before you actually see the fittings move. And that's the only difference.

So that's dynamic route editing. Thank you.

[END PLAYBACK]

**CHRIS BENNER:**

What do you think? Something you might want to try out?

**MARK LANCASTER:**

One think I'll point out-- not to interrupt-- in your handout-- and I know, watching the video, you were going, yeah, that was great. But how is that going to help me go? In your handout, and each one of our-- we tried our best to follow all those steps that are there. So you can that handout.

And also, the PowerPoint is there. You can look at that and review that. So just because we have a demo doesn't mean that we didn't provide the steps to you. So I just wanted to point that out, right?

**CHRIS BENNER:** Yes.

**AUDIENCE:** Are the videos available as well?

**CHRIS BENNER:** I believe the videos are attached to the PowerPoint.

**MARK LANCASTER:** Yeah, the videos will be in the PowerPoint.

**CHRIS BENNER:** So if you down--

**MARK LANCASTER:** Yeah, I was going to say, if there's been some cases--  
- and we ended up having to use my laptop, as some older versions of PowerPoint will not play the video.  
So we can--

**CHRIS BENNER:** The slides were created in PowerPoint 2013.

**MARK LANCASTER:** Right.

**CHRIS BENNER:** So I think anything-- I'm not sure where the cut-off is.  
But I tried running these videos on PowerPoint 2007, and they didn't play. But all of these videos are available on the Autodesk Knowledge Network. If you go under my profile or his profile, the videos that we recorded for this demonstration are on our profiles on the AKN.

**MARK LANCASTER:** But also, in the handheld, we have the links to [INAUDIBLE].

**CHRIS BENNER:** Yeah, we have the links as well, in the handout.

**MARK LANCASTER:** So the order that we're going here is in the same order as the handout. And at the end of that section is the link to--

**CHRIS BENNER:** There will be links [INAUDIBLE].

**MARK LANCASTER:** --the video that he created or the video that I created.

**CHRIS BENNER:**

One way or another, you can get to this video, and take a look at it, and slow it down.

All right, the next topic that I wanted to talk about is copying and reusing pipe runs. There are times when you need an exact duplicate of an existing pipe run. You don't have to go in there, and create a new pipe run, and start over.

I say in this second point-- it goes against my own rules, and I'm going to hit this rule again later on-- I usually tell people, in routed systems, never, ever copy and paste-- ever. But in this case, I'm going to tell you, go ahead and copy and paste. Because you're copying and pasting an entire pipe run, not an individual component. And you'll hear more about that a little bit later.

So what I usually do is I just copy the pipe run, paste the pipe run, and then constrain it using standard assembly constraints. And then, any changes I make to the original will be visible in the copy. So the example I think I give here is two suction pump suction lines right next to each other. They're identical. I just create the first, copy and paste it. And then if I make changes to the first, it shows up in the second.

But how often do things in life not change? How often can you rely on that second pipe run being identical to the first? How often does an engineer come up and say, you know what, I want to add something to this second pipe run, which you just copied and pasted? And now you're thinking, great, I have to start over. I have to create it again.

No, you don't. You can select the copied pipe run, the one that you pasted and constrained. And you can right-click and make that adaptive. You rename some of the files that are created, the non-catalog files, the non-content center parts. You hit Save. And bam, you've got a new pipe run that is a standalone pipe run, which you can edit independently from the other one.

And again, I've got a video

[VIDEO PLAYBACK]

- OK, I'm going--

**CHRIS BENNER:**

Oh, this one's going to start playing right away.

--to show you how easy and quick it is to reuse an existing pipe run that you want to have as an identical pipe run, and then, how easy it is to then take that pipe run and turn it into a standalone which can be edited in its own right. So I just have a real quick layout here with a couple of tanks, and a couple of pumps, and a pump suction piping line. I want to have the same pump suction piping line over here on tank number two.

So I'm simply going to edit tube and pipe runs. And I'm going to right-click on the pipe run that I would like to use and select the copy option. Then I can select anywhere on the screen. And using my Control-V, I can paste it. Now this is an exact copy of this pipeline here. If I make a change to this one, it's going to be reflected here.

So now we just want to return to the top. And of course, we're going to have to constrain that at some level. So I'm going to put some constraints in on this.

And just for the sake of being quick, I'll choose use a couple of insert constraints just to get it into position so we can see what's going to happen.

This is the tricky one.

**CHRIS BENNER:**

If you don't have a 3D mouse and you're going to be doing Tube & Pipe, I recommend getting one.

- OK. So that locks it into its position. You can see it's sitting exactly next to the other one. Any changes I make to the first will be reflected in the second. Done. Except, what happens if somebody comes along and decides they want to make a change to pump section number two? Maybe you want to add a fitting or an instrument in here that they don't want in the first one? Well, now you can't do that, because they are identical.

There is a way around this. You can simply select that Tube & Pipe run, which, as you see, has the icon of a standard assembling, not the icon of a pipe run. You can right-click on that and select make it active. Existing document will need to be saved. Yes, I want to continue.

So what it does is it brings up a dialogue box that gives you the opportunity to give a new name to all of the individual components of the pipe run other than library parts, which will simply be copied. It offers you a new name for each. You can choose to accept them, or you can change them as you see fit. It's also going to give a new location for this new pipe run. You can make changes to any of this that you feel you need to, or you can simply accept the defaults and hit the OK button.

Inventor's going to work a little bit of magic. You'll see

it took on the color of the pipe runs. And now this is a Tube & Pipe run. You'll see the little icon has changed. And it can be edited apart from the first one that it was copied from. Now that one stands alone. So now, that's just how quick and easy it is to copy one, and then turn it into a standalone, and make it adaptive in its own right. And that concludes the demo. Thank you.

[END PLAYBACK]

**CHRIS BENNER:**

All right. So that's another one of my favorites. I use that one quite a bit. And now, for part two of copying and reusing, we go to Mark.

**MARK LANCASTER:**

So I'm going to take this last workflow that just Chris had shown, and we're going to do something different with it. A lot of times, when I was teaching Routed System to the CAD community [? dice ?] [? board, ?] they sometimes forget, designers may not remember that pipe runs may-- you know, they them too long. In a design review, they're going to say, wait a minute, this pipe run is too long. Our vendor, or our shop floor, cannot manufacture this.

So then, everybody says, you mean I've got to go and redo this pipe run again? Well, that is one option. In this workflow, I'm going to show you how to take an existing pipe run and split it into two separate pipe runs. So you could go back and say, although I did this, I can go, now, and split this into two.

I'm like Chris. I don't like hearing myself. I don't even like hearing myself through the speakers. But I took a little different approach with my videos. I have words on the videos of the steps that I'm doing. And then I

have music going too, so hope it's good music.

[VIDEO PLAYBACK]

[MUSIC PLAYING]

[END PLAYBACK]

**MARK LANCASTER:**

Whoa, what did I do to you? Sorry about that. Tried to hit the volume. Sorry about that, folks. That was my bad.

[VIDEO PLAYBACK]

[MUSIC PLAYING]

**MARK LANCASTER:**

Cut. Cut. Actually, I'm going to keep my hands off it for now. This is the dialogue that Chris was talking about. If you ever have any red fields, that indicates that the same name already exists in that location.

Even I'm learning something new today.

[END PLAYBACK]

So as you can see, I took that one given pipe run. I said, from this point past the valve, that's going to be my new pipe run. But I want to maintain the original one as my first part of the pipe run. So I inserted a node on either side of that and deleted the piping segment-- or the pipe route segment. When you do that, it removes-- anything that you have there is going to be removed. And that's how you take-- in Chris's workflow, you copy and paste. And then you're splitting it apart. Yes.

**AUDIENCE:**

Any way to do that and not keep the second copy of the valve in the assemblies?

**MARK LANCASTER:**

That's the thing is that when you're doing that split, any of those components that are [INAUDIBLE] past that-- like I said, the node went across past the valve. You have to turn the visibility and set the building material structure for reference of those.

**AUDIENCE:**

You could put the node on the right-hand side of the valve and have it work successfully?

**MARK LANCASTER:**

Well, you have to be on the far enough out. So that pipe segment, it has to be there.

**CHRIS BENNER:**

To do this without having both of the valves in there is a workflow that-- you might as well just start over at that point. Or take all of the fittings out, leave as much of the route as you can, and then reinsert your fittings after you've made the split. So if you want to do this without having to remove anything, this is the way to do it.

**MARK LANCASTER:**

Any other questions? Yes.

**AUDIENCE:**

I've never used [INAUDIBLE].

**MARK LANCASTER:**

Yeah, so in the routed--

**AUDIENCE:**

[INAUDIBLE].

**CHRIS BENNER:**

What's that?

**AUDIENCE:**

You know, if you delete it, it'll just sketch that top portion of the pipe run.

**CHRIS BENNER:**

But remember, he made a copy of that pipe run and laid it over the top of the original. So what he deleted was the sketch from pipe run number one and maintained it in the second one so that--

**MARK LANCASTER:**

So they were basically sitting on top of each other. And then I would just turn the visibility on and off which one I was working on. And back to Chris.

**CHRIS BENNER:**

All right, this is one of my biggest problems, I guess. Backfilling gaps in pipe runs-- people always say, well, what are you talking about? And it is so hard to explain, because the causes of this are so many. And quite often, I do it to myself on purpose.

I'm running through a pipe run. I've got a machine laid out. And I'm getting changes from engineering. I'm getting changes from the customer. And sometimes these changes are so complex that I have no choice but to break my pipe run apart and start putting it back together in a different configuration. So rather than trying to talk about, what are all the different reasons that you might find yourself with a hole in your pipe run, I've got, basically, one solution for all of them. So I'm going to just go right into the video.

[VIDEO PLAYBACK]

- I'm going to demonstrate a technique that I used for removing unwanted gaps in a pipeline--

**CHRIS BENNER:**

This one's quiet.

- --that occurred due to a design change.

**CHRIS BENNER:**

Everybody hear OK?

- These are usually unintended circumstances. You thought everything was going well. A design change was made. And suddenly, you're left with a hole in your pipeline. For the purposes of this demonstration, I'm going to use this PVC line that we are looking at here. The bottom half of this was

created using a different pipe spec-- so a different Tube & Pipe style.

And since it was impossible to join the two specs, I used this elbow-- I placed this elbow-- using standard assembly constraints. And then I ran this route to the elbow, and this route from the elbow. And everything worked out just fine. My route is exactly the way I want it to appear.

But then the--

**CHRIS BENNER:**

There's reasons behind why--

- --engineer came along and said--

**CHRIS BENNER:**

I did it that way that I can get into because they're proprietary.

- --we don't need that valve in there anymore. So we were going to delete that valve. And watch what happens when I delete this valve. Because of the way this pipeline was constructed, I'm left with a hole. And now, what do I do? Well, this is the technique that I'm going to demonstrate here.

Basically, I find the route that this gap is associated with, and I edit that route. OK, first thing I'm going to do is change the dimension of this segment just to shorten it up a little bit, get it out of my way.

**CHRIS BENNER:**

Be aware of your--

- Pinch that down to 6 inches.

**CHRIS BENNER:**

--minimum segment lines when you're doing this.

- And I'm going to simply create another segment--

**CHRIS BENNER:**

Whoa. That was a screencast [? error. ?]

--from up above. Apologize for the gap in my recording there. OK. So now I'm going to remove the dimensions from both pieces of this new route. OK, I still have a gap there. Now I'm going to use a coincident constraint on the endpoints. And you'll see they've come together to form one point.

Now that that is joined, I can simply come in here, and highlight the point, and delete it. I now have one single segment that's going to completely fill the gap. You'll notice it only puts a reference dimension on there. Since there is no way you can modify this dimension, the points on either end are fixed. Finish in route, and it should repair itself. And you're ready to move on.

Very simple, very easy to use-- there are a number of different reasons you might run into this situation. And this is usually the best fix for it. So that's it. Thanks.

[END PLAYBACK]

**CHRIS BENNER:**

Yeah, the number of times that you might run into that and the reasons you might run into that are more than I can even imagine. Because I, myself, have come across, probably, hundreds of different reasons within the way I'm designing. You can't always foresee what's going to happen. You can't see what's coming, so you make your best plan. Like Mark was saying, have a plan. And sometimes the best laid plans always fall apart, and you end up with a situation. So at least there is a fix for it if you run into it.

Now, here's one of my absolute favorites.

**AUDIENCE:**

Chris.

**CHRIS BENNER:**

Yes?

**AUDIENCE:**

How do you feel about autoroute?

**CHRIS BENNER:**

Autoroute?

**AUDIENCE:**

Yeah.

**CHRIS BENNER:**

Sorry, inventor guys-- kill them. Get rid of them. Don't use them. You're going to get them. You're going to get them as you're routing. Convert to sketch. Always convert to sketch. You have complete control at that point. Put your own dimensions, your own constraints. Don't use the autoroutes. You just cannot predict what the results are going to be as you change your design, which, you're going to change your design.

So that's my advice. It's my opinion. Make your own decision, whatever works best for you. But my advice is convert to sketch.

This is something I love-- quick place and quick replace of pipe fittings. Mark was talking earlier about how, sometimes, you may not need the content center. Here's why. You can place a new instance of any fitting that is already in your design just by using Place Fitting instead of the Place command. Because if you use the Place command, that takes you to the content center. And you have to navigate through however many folders you may have in the content center, find that fitting, select the size, put it into your route. And then, the next time, you go right back to the content center again.

But if that fitting is already in your design anywhere,

you can simply use Place Fitting without going to the content center. It doesn't even have to be in the active pipe run. If you use part priority, if you can find that part on your screen or in your browser, you can use Place Fitting to just drop one on to the pipe route that you are editing.

Never use copy and paste. I've done this myself. I see a fitting I want to reuse, so I just copy, paste. Guess what? You can't get rid of it. If you decide, later, you don't need it, you're stuck with it. It's stuck in your-- there is a workaround for that I don't think I put into this demonstration because I discovered it afterward, but I'll talk about that a little while. So never, ever, ever copy and paste if you can avoid it. Use Place Fitting.

And we're going to do quick video on this.

[VIDEO PLAYBACK]

- So this is a demo of quick place and quick replace of fittings. Now, if you have a fitting on your screen or in your model tree, you can quickly place another copy of it without having to return to the content center to scroll through all your various menus and find it. For example, I'm going to place another copy of this valve. Simply select it on your screen. And then, from your top menu, or from your context menu, choose Place Fitting. It's going to bring in another copy of that same fitting. And you can just drop it into your line. And that saves a lot of time when you have to go to the content center for every single fitting, especially as you have larger and larger libraries.

Now, the fitting does not have to be in your currently active model. If it is somewhere in another pipeline--

for example, this valve down here that is not currently active-- I can still place a copy of that without having to switch pipelines or go to the content center by simply right-clicking and choosing shift part priority. Now I can select this component and, again, go to my Place Fitting. And we'll use this one up here this time. And we'll just drop another copy of that right into this line. And there we go-- ready to go.

Now, to quick replace a fitting, again, you can always do a replace from content center and go search through all of your menus for the fitting that you want to replace. But you can use this same Place Fitting quick technique to do a replace. For example, if I wanted to replace this elbow with a branch to start a new route going off in a different direction, I can do that very easily. And I just so happen to have a conveniently placed T right here on my screen.

Conveniently sitting right there where I want it.

**CHRIS BENNER:**

- So I'm going to select that--

**CHRIS BENNER:**

It's amazing how that worked out.

- --and use Place Fitting.

**CHRIS BENNER:**

It's not like I planned it or anything.

- And watch what happens when I set this down over the top of the elbow. You do need to be back in component priority-

-

**CHRIS BENNER:**

Yeah, I forgot that step.

- --my apologies. So I'm going to select the tee--

**CHRIS BENNER:**

You do need to be in component priority for this.

--Place Fitting, and just hover over the elbow. You notice that it kind of snapped into place? And it's going to replace that elbow with that tee. Now that is ready, now, for me to create a new route and begin starting a new pipeline [INAUDIBLE].

**CHRIS BENNER:**

While you're doing that, especially--

- So that is a very quick, down and dirty technique--

**CHRIS BENNER:**

--the branch fitting like that. You can change the orientation of it by toggling--

- --for reusing fittings that are already on your--

**CHRIS BENNER:**

--your space bar until it's pointing in the way you want it.

- --screen or somewhere in your assembly so that you do not have to continually open and close the content center and scroll through all your different menus. So that's quick place and quick replace.

And as a side note, I should mention-- I never mentioned this enough-- do not ever copy and paste a fitting inside Tube & Pipe.

**CHRIS BENNER:**

That's my mantra. Never copy and paste.

- [INAUDIBLE] than it is worth. You just never do it. Thanks.

[END PLAYBACK]

**CHRIS BENNER:**

I can't say it enough. I use this all the time. Because in a large assembly, chances are I'm going to be using a lot of the same pipe specs. So those fittings are probably going to be somewhere in my assembly. Why keep going to the content center if you don't need to? So that's all I got to say about that. Any

questions on this one? Yes.

**AUDIENCE:**

Can you drag and drop [INAUDIBLE]?

**CHRIS BENNER:**

I believe you can. I haven't done that myself, but I believe that it's possible. It would be nice to try it and see if that works.

**AUDIENCE:**

Do you name your runs?

**CHRIS BENNER:**

Do I name my pipe runs? I did not in this class, for the demos. But at work, I do. I give them a name, a descriptive name, so I know what fluid is in it, what service it is. It might be cooling water. It might be bleach in.

**AUDIENCE:**

Well, with that, do you rename the file name or just the browser node when you [INAUDIBLE]?

**CHRIS BENNER:**

Well, I give them a name when I'm creating a new pipe run. When you create a new pipe run, it comes up with a dialog box. And you can give it a name, or you can accept run 1, run 2, run 3. I gave it a descriptive name there, which then shows up in the browser. I don't necessarily do it with my routes. Sometimes I do, sometimes I don't. Sometimes I'll just accept route 1 route 2 route 3. So that's entirely up to you though. Yes.

**AUDIENCE:**

[INAUDIBLE] never, never use the constraints when placing fittings inside the run.

**CHRIS BENNER:**

Right.

**AUDIENCE:**

[INAUDIBLE] then you fall back to the old way of using your standard [INAUDIBLE].

**CHRIS BENNER:**

That is something I try to avoid. I did it in that last

example because I was caught between a rock and a hard place. And like I said, I can't really tell you why I did it that way, because there's proprietary information that goes into that machine. I hid everything that I didn't want you to see. So rarely do I ever use standard assembly constraints. But when I do, there's usually a good reason for it.

What I did-- I want to mention this now that we're on this topic is, if you do have an instance where you've copied and pasted and you cannot delete extra fittings that you did that with, what I found just earlier this year is you can highlight all of those-- any extra fittings that you're stuck with, and demote them into a new subassembly, and then just delete the subassembly. Which, it takes care of the problem. So after years of struggling with it, I finally found a workaround for that. Mark.

**MARK LANCASTER:**

One of the things you'll realize if you've worked with Routed System, even if it's been a couple months, is, how do you interact between two separate pipe runs. So in this example here, I need to run a tee from this larger pipe run to a tee in the upper pipe run. They are two separate pipe runs.

You've got to remember, when I talk about those level, level 3 are your individual pipe runs. So this pipe run on the bottom is a separate assembly, and the one on top is a separate assembly. And you know, when you're working in normal Inventor assembly, if I go edit, in place, a part, I'm only working on that information. Granted, you can project geometry, create adaptivity, and those type of things.

When you get into the Inventor Routed System

aspect, when I'm in a given pipe run, I have limited capability of interacting with other pipe runs. So in this demo, I'm going to demonstrate how you can create and align those pipe runs together. So if the tee moves in one pipe run, the connecting pipe run is moving. And also, the tee in the other pipe run is moving.

[VIDEO PLAYBACK]

**CHRIS BENNER:**

And this is only because Inventor Tube & Pipe cannot create branches-- [CLEARING THROAT] hint, hint.

[MUSIC PLAYING]

**MARK LANCASTER:**

Should've used quick place.

[END PLAYBACK]

So at the end, there's a question-- did anybody catch my mistake? And the person who brought up about autoroutes-- it's because I went from that lower pipe run, and I went to the upper tee. It automatically created an autoroute. And that's the key.

Years ago, there was some really unique pipe runs. If you left it as an autoroute, you get some regeneration, you got some pipe runs running out in space. So that's why a lot of us who are really into the Tube & Pipe section always tell new users, it's going to create autoroutes sometimes. When you're done with them, right mouse click on that and say convert to sketch. So that's why I put that in there, because I forgot to do it when I was doing the video.

**CHRIS BENNER:**

When I was doing the demos for my first class two years ago, I had an example where I had the same

tank and pumps that I'm using in the examples in this class. And I had a run going from the pump to the heat exchanger that had three elbows in it. And I did not change the autoroute. I used it as an example of why you need to change to sketch.

And when I changed one dimension, that route went from four elbows to three and put a 30-degree angle slope on the pipe. I did not want that. So again, that's just my advice. Always convert them to sketch.

All right, Dan, you and I were talking about earlier-- pipe runs with no routes. You can have a situation where you have a standalone pipe route in your assembly that you're not even going to create a route. It's doable. There are some challenges associated with it that I have created-- we've created a couple of workarounds to help with that, but there are still some issues.

So basically, it's a fitting to fitting pipe run generally found in very tight space constraints where you're just taking a bunch of fittings and bolting them together, or welding them together, or threading them together. You can do this with standard assembly constraints and make it not a Tube & Pipe. But I offer-- I say that you should use the Tube & Pipe, because it offers more flexibility. But it does come with some limitations.

What happens is, changing the orientation of fittings is sometimes not very easy. If you have an instrument in one of these face to face lines, it's facing this way, and you want to flip it, you have to break all of the connections on that fitting, turn it around, and then reconnect all of the connections. So I say, again, that

there's still some room for improvement on this. Because I think it's something that, maybe, they didn't foresee. I don't know.

[VIDEO PLAYBACK]

So I did a real quick video. I didn't put any voiceover on this one, so I'm just going to talk to it. I threw some fittings on my screen, because I wanted to once again show the quick place, just because I love it so much. So I'm setting it to part priority. And I am in a pipe run. I'm just going to start dropping some fittings in.

This is a typical example, at where I work, of what would be an instrument air header. I'm going to use connect. This goes pretty quick. I'm just going to start dropping fittings on the screen and connecting them. And you'll notice that at no point do I enter the route tool.

But the reason I suggest doing this using Tube & Pipe is because you get the rotational axis tool. You can still do that. And now that everything's on the screen, I can just start dropping as many of those as I want on there and use the connect fittings to just start slapping them together.

Notice I'm not using copy and paste.

Or constraints.

Or constraints, yep. Then there's that handy tool in here called connect fittings. And once you've got as many of them as you think you need, you can just start backing them up face to face-- quick and easy, down and dirty.

Now, I don't remember if I mention this later in the

**MARK LANCASTER:**

**CHRIS BENNER:**

video, so I'll say it now. But last year-- I think it was a first in 2017-- they added a function in the Tube & Pipe runs where you can right-click on a fitting, and the one of the choices is delete all connections. So you don't have to individually pick each connection of the fitting. You can just say delete all, and anything that's connected to the fitting that you've selected will break. It makes the-- you still have to break the connections to flip things around, but at least it makes it a little bit quicker.

What I'd like to see in this functionality is, even though you don't have any pipe routes, it would still be nice to be able to just toggle the space bar and flip things back and forth. That's not currently available. I probably did more even than I needed to do. Yeah, yeah, yeah.

So I'm just basically trying to show you that you can do this without using any kind of a route. Just be aware of the limitations that go along with it. A lot of times, you may end up reconnecting this thing four or five times until you finally get it exactly the way you want it.

**AUDIENCE:**

[INAUDIBLE] ?

**CHRIS BENNER:**

That is one of your selection priorities in Inventor. You have component priority, part priority, sketch priority. There's a number of different ones.

**AUDIENCE:**

[INAUDIBLE] ?

**CHRIS BENNER:**

I'm sorry? No, that's available throughout Inventor. So at any level of any assembly, you can choose what priority you want. Component priority will select

components in the currently active assembly or subassembly. Part priority will select any part at any level of the assembly that's on your screen.

**AUDIENCE:**

Oh, OK, [INAUDIBLE].

**CHRIS BENNER:**

Yeah, and then, the sketch priority will select only sketch entities. Mark.

**MARK LANCASTER:**

All right, in this section, I'm going to take a whole bunch of methods applying fittings. Some of this stuff that Chris has already shown is kind of duplicate in here. And I am sorry about that. It's just that we were working on different things. And then, when we got the videos done and we were watching it, we realized we had some duplicate. But it's a great reinforcement of those factors. So this session-- or this demo-- just takes all the different ways that you can apply fittings to your-- whether it's a pipe run that has a route or doesn't have a route.

[VIDEO PLAYBACK]

[MUSIC PLAYING]

Now, keep in mind, this is a tank that I brought in from GrabCAD. So it's not even something I modelled. It doesn't even have any tube or pipe [INAUDIBLE]. So I can start a pipe run right from it.

**CHRIS BENNER:**

He's showing the insert here. This is just something that I prefer is do is I usually put my view cube straight on to the view. It tends to make the insert a little less jumpy and clicky. I don't know if you've ever had that problem, but that's something that I do-- just the way I like to do it.

**MARK LANCASTER:**

So in that case there, the first one was on the back side of the flange. When I moved it to the top part of the flange, because the flange has two points, it dropped down to match the pipe end to the flange face.

**CHRIS BENNER:**

Here's a little drag and drop.

When we were deciding which piping program we wanted to use at Powell, that feature right there was one of the deciding factors. Most of Autodesk's competitors could not replace an elbow with a tee

[END PLAYBACK]

without crashing the program. So Inventor, you were the first ones to get it right. So we went with Inventor.

**MARK LANCASTER:**

For those who do process piping here, anybody requires self-draining lines? OK. Inventor Routed System does provide-- sorry to get in front of the projector-- does provide for self-draining pipelines. Keep in mind that I tell people that your definitions of self-draining may not what it means inside of Inventor. I'm not saying it's limited, but it does have limited capability. So this just demonstrates how to create a self-draining pipe run.

[VIDEO PLAYBACK]

It's always based on the gravity direction definition that you apply to the model.

[MUSIC PLAYING]

**CHRIS BENNER:**

Ah, I was going to say, where is the music?

**MARK LANCASTER:**

[INAUDIBLE] .

If you're not used to working with Tube & Pipe's style, watch the different methods that are shown here. It's save you some time setting up your styles.

**CHRIS BENNER:**

There' a good section of this in that handout that I did from two years ago, just to talk about Tube & Pipe styles.

**MARK LANCASTER:**

I don't know why that capability is there, because it does violate-- you're going to see, it's going to violate the rules. Because in self-draining, they're only going down in one direction. You can't go back up.

**CHRIS BENNER:**

Wouldn't drain very well if you did.

**MARK LANCASTER:**

There is a quiz coming up. So pay attention. See if you can answer the question.

[END PLAYBACK]

So this question is, will I violate the rules? It will violate the rules, because the first pipe route section, point A to point B, has to be perpendicular to the slope.

**CHRIS BENNER:**

To what you defined as gravity.

**MARK LANCASTER:**

Sorry, parallel-- good, sorry.

**CHRIS BENNER:**

Yeah, has to be parallel to gravity.

**MARK LANCASTER:**

Parallel to gravity. OK, I got the quiz wrong.

**CHRIS BENNER:**

That's not good.

**MARK LANCASTER:**

And for our last demo, how many have you who's been using Routed System have been in a design situation where you cannot use a 45-, or a 90-degree, or perhaps, a self-draining elbow in your design? In

your Tube & Pipe style, you are only permitted to define 45-degree elbows, 90-degree elbows, and the self-draining elbow.

In this workflow, I'm going to teach you how to create using cut-back elbows. I will tell you that this is not a perfect workflow, and there's other possible solutions. The reason I wanted-- I'm adding this to it, because I am incorporating-- how many have used the derived route into your Routed System models? This workflow, because new 3D sketching capabilities in Inventor 2017 release, allows you to do some sketching, 3D sketching, and deriving that into your pipe run. So then you can start creating custom pipe runs. And this is our last demo.

[VIDEO PLAYBACK]

So basically, what I'm doing, I was trying to connect that tank connection to that tank connection. But because they are so close to each other, I cannot really use a 45- or a 90-degree elbow.

[MUSIC PLAYING]

So basically, what I'm going to do is I'm going to bring in a part that I'm going to use inside of my assembly to do 3D sketchings on and then take those 3D sketches and derive them into my pipelines. Like I said, it's not a perfect solution, but I just wanted to show as a way of doing this. So now I'm just constraining that part, blank part, to my top assembly.

Now I'm going to edit in place, start my 3D sketch. And now I'm going to include geometry. [INAUDIBLE] starting point from, so I can pick a pipe route outside

what's there with my ortho on, which is new in 3D sketching [INAUDIBLE] from 2017. And then I'm going to turn it off and just draw my line. I'm going to dimension and constrain it.

Now what I'm going to do is, in that 3D sketch that I created, I'm going to create radius of the-- inner radius of the elbow.

So now I'm going to derive the route, which is the 3D sketch. But I'm not going to use the entire thing. I only want a single part of it, that single line that I've created between those two elbow radiuses. It's kind of hard to see, but there are two nodes there now, because it's created that from point A to point B.

In this segment, that 22-degree elbow is not in my content center. It's just sitting somewhere on my hard drive or network. It's my modified elbow.

So as that spins around, you can see, now, my modified elbow, it has been put in place. And it's heading in the direction that I need to go.

And then, as you can see, as I rotated that around, it's pointing in the wrong direction. So I need to rotate it back.

Now I'm going to create a route between that last cut-back elbow over to the flanged connection on the other pressure vessel. And what do you think I missed again in the demo?

**AUDIENCE:**

[INAUDIBLE] .

**MARK LANCASTER:**

But I do actually catch myself. And I go back in and convert it to the sketch. So like I said, you don't see it, but right on those autoroutes, right mouse click on it

and say convert to sketch.

And then, the last thing I do-- because remember, that first route, I went out in space. I don't know what length it is. I now have to go back and say the-- I need to take the measurement from that route to the first cut-back elbow. And then I can cut back my first route segment-- or that last route segment-- to the elbow.

And I always do that when I copy and paste. I forget about-- I'm thinking it's on the right mouse click. And I always forget about that when I'm doing measurement.

So as you can see, to get that, I have to create three separate pipe routes for this given pipe run. And then you're going to go back at the end, which I didn't do here, and turn off the visibility of the 3D sketch in my part.

[END PLAYBACK]

So in that case is I created a pipe run using non-45- or 90-degree elbows. And with that--

**CHRIS BENNER:**

That's all we really put together for you today. That's all, folks. I can't do the Porky Pig. So I'm sorry, I won't do that. But we do have some time left for questions. We've got about 12 minutes. So if anybody has any questions-- if you don't-- if we don't get to them, or if you have questions afterward, come on up and talk to us. Or you can always catch us in the forums, on Twitter.

We have business cards up here on the table that you can get our information from. And hit us up any

time, especially in the forums. We both spend a lot of time in the Autodesk forums, the Inventor forums, and we'd love to help you out.

**AUDIENCE:**

Yes, on the [INAUDIBLE]?

**CHRIS BENNER:**

That can be established when you're authoring the fittings. It's a part of the authoring dialog box. You can establish an offset based on whatever standard you're using, or you can say that you don't want one. That's entirely up to you.

**MARK LANCASTER:**

If you're using the stuff that comes with Inventor, you may have to adjust using that-- I said, that one demo, edit the fit it connection. You may have to go in and say user-defined and adjust that to what you need.

**CHRIS BENNER:**

Yeah. The content center comes with 750,000 parts out of the box. They're already pre-authored. Any offsets are already set on them. So what I was talking about is anything that you're going to create and author yourself. But like he was saying, with the ones that are pre-authored, you may have to just adjust those fitting connections to match whatever your specs are. Yes. Yes, go ahead.

**AUDIENCE:**

[INAUDIBLE] ?

**CHRIS BENNER:**

I'm sorry? Best practices for--

**MARK LANCASTER:**

Performance.

**CHRIS BENNER:**

Performance? Well, we have been working with the Inventor development team on this for several years. They are painfully aware of our concerns and our ideas. And we're really trying to push Tube & Pipe to the top of the wish list to get some performance

improvements. They have told me that there may be some improvements coming soon, but--

**AUDIENCE:**

Chris.

**CHRIS BENNER:**

Yes?

**AUDIENCE:**

[INAUDIBLE] is part of our team.

**CHRIS BENNER:**

Oh.

**AUDIENCE:**

I think what he's asking you is--

**CHRIS BENNER:**

I'm sorry.

**AUDIENCE:**

--do you have any best practices right now that you give to people to help out with the core performance [INAUDIBLE] we're going to try to make it better. But in the interim, do you guys have any suggestions for people?

**CHRIS BENNER:**

Nothing specific. Do you want to--

**MARK LANCASTER:**

In your handout-- I don't remember what section it is-- there is a discussion, I think, when I'm talking about pipe runs. There's three types of pipe runs, the pipelines that Chris showed you with no routes associated, there's the unpopulated pipe route, and a populated pipe route. You will get your best performance out of using unpopulated pipe routes-- or pipe runs, sorry.

The downfall is, because it's a single line-- think about if you're running a 10-inch pipeline or something in the metric-- is that you lose your design capabilities. Because you don't know-- visually, you could be running into other pipe runs that you have there. The more populated pipe runs that you have, the

performance goes down.

There was a workflow years ago-- and I don't even remember. I was trying to look for it for here. There was-- and I think it was an Autodesk article that took how, when you're done with the pipe run, you are sure, you've locked it in time, you can do something. And I couldn't find that anymore. That was supposed to increase performance.

But what I tell everybody now, you have to work. If you can design with unpopulated pipe routes-- pipe runs-- I keep confusing them-- please do that. That will be your best performance once you start populating them. And most of the commands-- there's only a couple-- you can do everything that we're showing you on unpopulated pipe runs.

So go down that route. That's the best performance. But you sacrifice the design capabilities. And I covered that in that handout.

**AUDIENCE:**

[INAUDIBLE] 3D mouse for controlling, beware that you should have a video card. Engineers, myself as well [INAUDIBLE].

**CHRIS BENNER:**

That's a good point. Your graphics are key.

**AUDIENCE:**

And secondly, be aware that you have the correct drive. Don't think [INAUDIBLE].

**AUDIENCE:**

Along that same route, in terms of graphics performance manipulation, in 2018, we've improved some of the zooming and rotating upwards of 50% to 80%.

**CHRIS BENNER:**

That will be nice.

**AUDIENCE:** And that will get into [INAUDIBLE].

**CHRIS BENNER:** Right.

**AUDIENCE:** So if you've got it, if you want to test it up, download a beta [INAUDIBLE], download the alpha. Get some of your [? larger models. ?] And start manipulating them. [INAUDIBLE]. So how we draw things-- and we drop some things on the ground when you start doing-- set different things to the card. [INAUDIBLE] up to 50% faster.

**AUDIENCE:** Will that affect if you have your mouse over the model?

**AUDIENCE:** What's that?

**AUDIENCE:** Will that affect when your mouse is on the model?

**AUDIENCE:** We've also improved selection when you're rotating and zooming as well.

**AUDIENCE:** OK. If you move your mouse off, everything works fine.

**CHRIS BENNER:** If your mouse is in the middle of the screen, it locks up on you. Yeah, that's a good--

**AUDIENCE:** What we've done is-- you know, a little detail to what we've actually done is, when you go into these rotations and the zooms, we put you in animation mode. You don't select any of those.

**CHRIS BENNER:** Excellent.

**AUDIENCE:** There's a [INAUDIBLE].

**AUDIENCE:** Yeah, and I don't know if they're going to have machines set up in there or not. But you can actually

stop by [INAUDIBLE]. If you find me tomorrow, I'll have my laptop. And I can show you [INAUDIBLE].

**AUDIENCE:**

Or do the beta.

**AUDIENCE:**

Yeah, the beta's the easiest way.

**CHRIS BENNER:**

Yeah.

**AUDIENCE:**

[INAUDIBLE] .

**CHRIS BENNER:**

You can play with it on your own time.

**AUDIENCE:**

I don't want to see it too early. [INAUDIBLE].

**MARK LANCASTER:**

All right, we've got questions here when you--

**AUDIENCE:**

Do you have any best practices or anything when, basically, ending a pipe run in space? I've basically tried to route stuff. I'm doing a skid design.

**CHRIS BENNER:**

Yeah, which is what we do.

**AUDIENCE:**

[INAUDIBLE] flange to get them to a specific spot [INAUDIBLE]. Is there any easiest ways to do that so that the flange [INAUDIBLE]?

**CHRIS BENNER:**

What I do is I route out into space like you're talking about, past the end of my frame. And then while I'm in the route, I use include geometry and bring in a work plant off the end of that frame. And then, from the end node on the pipe route, I can place a dimension to the frame, taking into consideration the thickness of your flange so that your flange face will end up exactly where you want it.

So if I want my flange face to be 6 inches off the end of that frame, if my flange is an inch thick, I'll put that dimension at 5 inches. And then plus the inch of the

flange face will drop it right at the 6 inches.

**AUDIENCE:**

[INAUDIBLE] ?

**CHRIS BENNER:**

Yeah.

**MARK LANCASTER:**

The other way that you can do that, kind of like in a reverse, if you right mouse click when they're routing, there's a snap offset. And you can go and say, if I want my flange, or whatever, sitting there at the end of that face of, let's say, your frame, you can snap there and then offset either a positive or negative direction from that. Now, the thing is, it doesn't create a relationship there. So if you increase your frame, it's not going to move it. But that's another way that you can--

**CHRIS BENNER:**

The thing to bear in mind when doing this though is, if you place that dimension and you've got your flange tied to that dimension, if you start adding fittings or modifying your route behind that, those dimensions are going to change. Those constraints are going to change. You may need to go back in and replace them again. That's just kind of a fact of life in Tube & Pipe.

A route is not fully constraining and dimensioned until it's fully constrained and dimensioned. And it will change as you're making changes to the pipe run. Those dimensions may change on you without you even being aware of it. So you need to constantly keep an eye on those until you're ready to say, OK, this is done. And then those dimensions should stay there.

**MARK LANCASTER:**

Was there another question in the back?