9 September, 2020

“U” = User, “A” = Ares

U: “Okay Ares, let’s print something.”

A: “Sure, are we going to print more White Alex Plus Latex Caulk?”

U: “No.”

A: “Okay, what material do you want to print?”

U: “Honey.”

A: “Okay, honey. What kind of honey do you want to print?”

U: “Happy Belly Wildflower Honey.”

A: “Okay, Happy Belly Wildflower Honey. I have three formulations available in my database. Which formulation do you want to use? You can also say ‘list’ to hear formulations stored in my database or ‘new’ to create a new formulation entry.”

U: “List.”

A: “Sure. Formulation one is ‘Unmodified’. Would you like to use this one or hear the next entry?”

U: “Next.”

A: “Formulation two is ‘Happy Belly Wildflower Honey Plus 15 mL Food Coloring’. Would you like to use this one or hear the next entry?”

U: “Use this one.”

A: “Okay, we’ll use ‘Happy Belly Wildflower Honey Plus 15 mL Food Coloring’. Do you already have a syringe loaded with this material?”

U: “No.”

A: “Okay. Would you like step-by-step instructions for loading the syringe with this material?”

U: “No.”

A: “Okay. Please let me know when you have the syringe loaded.”

[time passes]

U: “Okay Ares, I have the syringe loaded.”

A: “Great. Just to be clear, is this syringe loaded with ‘Happy Belly Wildflower Honey Plus 15 mL Food Coloring’?”

U: “Yes.”

A: “Great. Can you tell me how much material is in the syringe?”

U: “It looks like there’s about 8.9 mL”

A: “You said 8.9 mL; is this right?”

U: “Yes.”

A: “Great. Would you like me to adjust the syringe extruder carriage for you?”

U: “Sure.”

A: “Okay. Is there currently a syringe loaded in the syringe extruder?”

U: “Yes.”

A: “I need you to remove the old syringe before I can adjust the carriage for you. Do you want me to wait or do you want to cancel syringe extruder carriage adjustment?”

U: “Just wait.”

A: “Sure. Please let me know when you are ready to continue.”

[time passes]

U: “Okay Ares, I’m ready.”

A: “You’ve removed the old syringe from the extruder, is this right?”

U: “Yes.”

A: “Great. Is there a substrate or anything else on the build plate?”

U: “There’s a piece of glass.”

A: “Okay, you indicated that there’s a glass substrate on the build plate. Does it have a color or is it clear?”

U: “It’s black.”

A: “Okay, this sounds like the nine by six black glass substrate. Does it look like this?”

[image of 9” x 6” black glass substrate on build plate is shown]

U: “Yes.”

A: “Great. Okay, now I have all the information I need to adjust the carriage for you. Shall I proceed?”

U: “Yes.”

[Ares adjusts e-axis and z-axis accordingly]

A: “Okay, the carriage should be in a good position for you to load the new syringe. Have you installed a dispensing tip yet?”

U: “No.”

A: “No problem. Would you like to install one now or after loading the syringe?”

U: “Okay, I put one on.”

A: “Do you mean you installed a dispensing tip?”

U: “Yes.”

A: “Great. Can you please tell me what size dispensing tip is installed?”

U: “I’m not sure.”

A: “Can you describe it to me? What color is it?”

U: “It’s blue.”

A: “Blue. Got it. Does it have any metal parts or is it all plastic?”

U: “It has metal.”

A: “Okay. Here are pictures of blue dispensing tips with metal nozzles. You can click on the dispensing tip you are using, or tell me which one you chose.”

U: “It looks like B.”

A: “Great. This nozzle is 416 micron. Would you like to continue with this setting?”

U: “Yes.”

A: “Please install the plunger of the syringe into the syringe extruder carriage. Do not install the barrel clamp yet. Let me know when you are ready to continue.”

[pop-up image of plunger installation]

U: “Okay Ares, I’m ready.”

A: “You’ve installed the plunger of the syringe into the syringe extruder carriage, is that right?”

U: “Yes.”

A: “Okay, I’m going to lower the carriage until the barrel is tight.”

[Ares lowers syringe]

A: “Do the shoulders of the syringe barrel look like they’re tight against the extruder frame as shown?”

[Ares shows image of barrel shoulders tight against frame]

U: “Yes.”

A: “Great. Please install the barrel clamp assembly and let me know when you are ready to continue.”

[Ares shows barrel clamp assembly diagram]

U: “Okay Ares, I’m ready.”

A: “Were you able to install the barrel clamp assembly?”

U: “Yes.”

A: “Great. Since we’ve just installed a new syringe, we should purge the dispensing tip. Would you like to proceed or skip?”

U: “Let’s proceed.”

A: “Great. Is the substrate clean?”

U: “Yep.”

A: “Great. Please wait while I run the homing routine.”

[home routine runs]

A: “We need to calibrate the substrate origin. Please jog the build plate until the dispensing tip is over the front-left corner of the substrate. Let me know when you are ready to proceed.”

[Image showing dispensing tip over front-left corner of black glass substrate]

U: “Okay Ares. I’m ready.”

A: “Great. The dispensing tip is positioned over the front-left corner of the substrate. Is this right?”

U: “Yes.”

A: “Great. Please jog the z-axis until the tip is just making contact with the substrate. Let me know when you are ready to proceed.”

[Image showing dispensing tip touching substrate]

U: “Okay Ares. I’m ready.”

A: “Great. The dispensing tip is making contact with the substrate. Is this right?”

U: “Yes.”

A: “Great. Thanks. I’m now going to run the purge routine. This will take approximately 10 minutes. Shall I proceed?”

U: “Yes.”

A: “Great. Running purge routine. I’ll let you know when I’m finished.”

[pop-up with status; 10 minutes go by]

A: “Finished running purge routine. Ready when you are.”

[pop-up indicating purge routine is complete]

U: “Okay Ares.”

A: “I’ve just finished running the purge routine. Would you like to continue to set up your print task?”

U: “Yes.”

A: “It looks like you should have 78% of the substrate area available for printing. Would you like to clean the substrate or continue?”

U: “Continue.”

A: “Sure. My records indicate that we haven’t updated the nozzle-to-alignment camera offset values for this syringe. Would you like to do that now?”

U: “Yes.”

A: “Sure. I’ll need to print a fiducial mark. Shall I proceed?”

U: “Yes.”

A: “Great.”

[prints fiducial, switches to alignment camera]

A: “Did the fiducial mark print adequately?”

[Imagesof adequately and inadequately printed fiducial mark is shown]

U: “Yes.”

A: “Fantastic. Please jog the X, Y, and Z axes until the fiducial is aligned with the red crosshairs and is in focus. When you are finished, please let me know.”

[before and after images of misaligned and aligned fiducial/crosshair is displayed]

U: “Okay Ares. They’re aligned.”

A: “Great. The fiducial mark is in focus and aligned with the red crosshair. Is this right?”

U: “Yes.”

A: “Great. New offset values have been updated and saved.”

A: “It looks like you should have 73% of the substrate area available for printing. Would you like to clean the substrate or continue?”

U: “Continue.”

A: “Okay. Do you want to use an existing toolpath or create a new one?”

U: “Let’s create a new one.”

A: “Sure. Do you want to me to help you with that or would you like to create it yourself?”

U: “I want your help.”

A: “You indicated that you want me to help you create a toolpath. Is this right?”

U: “Yes.”

A: “Great. First, are we going to print a pattern or a 3D object?”

U: “Pattern.”

A: “Pattern. Got it. Can you describe what kind of pattern you want to print? You can say things like ‘square’ or ‘line’ or ‘text’. You can also say ‘list’ for a complete list of options.”

U: “Rectangle.”

A: “Rectangle. Got it. How long is the rectangle?”

U: “Thirteen.”

A: “You said thirteen. Did you mean thirteen millimeters?”

U: “Yes.”

A: “Great. Now, how wide is the rectangle?”

U: “Five millimeters.”

A: “You want to print a rectangle that is thirteen millimeters long and five millimeters wide. Is that right?”

U: “Yes.”

A: “Perfect. Do you want to print just the outline of the rectangle or do you want it filled?”

U: “Filled.”

A: “Got it. Would you like to add a lead-in to this toolpath?”

U: “Yes.”

A: “Sure. I can create a serpentine lead-in or use multiple straight lines. Which would you prefer?”

U: “Lines.”

A: “You chose multiple straight lines. Would you like them to be oriented horizontally or vertically?”

U: “Go back.”

A: “Sure. I can create a serpentine lead-in or use multiple straight lines. Which would you prefer?”

U: “Serpentine.”

A: “You chose serpentine. Would you like the serpentine to be oriented horizontally or vertically?”

U: “Horizontally.”

A: “You chose horizontally. Relative to your specimen, where would you like to print the lead-in?”

U: “In front.”

A: “You chose to print the lead-in horizontally, in front of the specimen.”

A: “What is the total target length of the serpentine?”

U: “60 mm”

A: “Okay, 60 mm. What is the target pitch of the serpentine?”

U: “2 mm”

A: “Got it. The serpentine will consist of 4 lengths at 13.5 mm. Is this okay?”

U: “No.”

A: “Would you like to change the total target length or the pitch of the serpentine?”

U: “Set the target length to 58 mm.”

A: “Got it. Total target length set to 58 mm. The serpentine will consist of 4 lengths at 13 mm. Is this okay?”

U: “Yes.”

A: “Great. Do you want to set fixed parameters for the lead-in or do you want to use the toolpath parameters?”

U: “Fixed.”

A: “You chose to set fixed parameters for the lead-in. Which parameter would you like to set first? Say ‘list’ for a list of parameters.”

U: “Speed.”

A: “You chose to set a fixed value for print speed. What print speed would you like to use for the lead-in?”

U: “Five millimeters per second.”

A: “You specified five millimeters per second for the lead-in print speed. Is this right?”

U: “Yes.”

A: “Got it. Would you like to set other fixed parameter values for the lead-in? Say ‘list’ for a list of parameters or ‘done’ if you are finished.”

U: “Done.”

A: “Okay. Let’s save this toolpath. Do you want to give it a name?”

U: “Yes.”

A: “Okay. What do you want to call this toolpath?”

U: “Let’s call it ’13 mm rectangle’”

A: “Okay, we’re going to save this toolpath as thirteen millimeter rectangle. Is that right?”

U: “Yes.”

A: “Great. Toolpath saved.”

A: “Would you like to begin printing using current fixed parameter values, set new fixed parameter values, or hear a listing of current fixed parameter values?

U: “Listing.”

A: “Okay, would you like to hear all values or a specific value?”

U: “Tip height.”

A: “The working distance is set to 0.3 mm. Would you like to hear more values?”

U: “Set tip height to 0.2 mm.”

A: “Okay. You want to set the working distance to 0.2 mm. Is this right?”

U: “Yes.”

A: “Got it. Would you like to change any other values?”

U: “What is the value for prime distance?”

A: “The value for prime distance is 0.05 mm. Would you like to hear more fixed parameter values?”

U: “What is the fill value?”

A: “The fill type is diagonal at 45 degrees and the fill pitch is 416 microns. Would you like to hear more fixed parameter values?”

U: “Change fill type.”

A: “Okay. What type of fill? You can say things like ‘horizontal’ or ‘diagonal’ or ‘concentric’. You can also say ‘list’ for a complete list of options.”

U: “Diagonal.”

A: “You chose ‘diagonal’. The default angle is 45 degrees. Say ‘keep’ to keep this angle or ‘specify’ to specify a new angle.”

U: “Keep.”

A: “Got it. The fill angle is 45 degrees. Would you like to change any other values?”

U: “Change fill pitch.”

A: “Okay. The default pitch for filling is set to the dispensing tip diameter which is currently 416 microns. Say ‘keep’ to use this value or ‘specify’ to specify a new pitch.”

U: “Specify.”

A: “Sure. What would you like to set the pitch as?”

U: “Seventy-five percent.”

A: “Did you mean seventy-five percent of the dispensing tip diameter?”

U: “Yes.”

A: “Great. Got it. The pitch will be set to seventy-five percent of the tip diameter.”

A: “The current pitch is 312 microns.”

A: “Would you like to change any other values?”

U: “What’s the current print speed?”

A: “The print speed is set to 5.0 mm/s. Would you like to hear more fixed parameter values?”

U: “No.”

A: “Would you like to begin printing using current fixed parameter values, set new fixed parameter values, or hear a listing of current fixed parameter values?

U: “Begin printing.”

A: “Okay. Let’s start printing. Do you want print specimens, or run an experimental campaign?”

U: “I want to print 10 specimens.”

A: “Sure. Would you like to analyze the specimens?”

U: “Yes.”

A: “Okay. Can you describe where the analysis image should be captured?”

U: “4 mm left of the right edge, and 2 mm back from the front edge.”

A: “Okay. The image will be centered at x = 9 mm and y = 12 mm. Does this sound right?”

U: “Yes.”

A: “Perfect. Which analyzer would you like to use? Say ‘list’ for a list of analyzers”

U: “The ‘white on black’ one.”

A: “I found two analyzers that match your description, ‘white on black line start analysis’ and ‘white on black line start flex analysis’. Did you mean one of these?”

U: “Yes, the first one.”

A: “You’d like to use ‘white on black line start analysis’. Is this right?

U: “Yes.”

A: “Great. Would you like to start printing now?”

U: “No.”

A: “Okay. Would you like to make changes to this task, cancel the operation, or would you like me to wait?”

U: “Just wait.”

A: “Okay, I’m happy to wait. Just let me know when you are ready to proceed.”

[time passes]

U: “Okay Ares, I’m ready to start printing.”

A: “Great. We’re printing 10 specimens using ‘Happy Belly Wildflower Honey Plus 15 mL Food Coloring’, 8.9 mL in a syringe fitted with a 416 micron dispensing tip using the toolpath ’13 mm rectangle’ created Wednesday, September 8th, 2020 and analyzing using ‘white on black line start analysis’ at x = 9 mm and y = 12 mm. Is this correct?”

U: “Yes.”

A: “Perfect. My records are showing that 73% of the substrate is available for printing. Would you like to clean the substrate or continue?”

U: “Continue.”

A: “Okay. I’ve divided the remaining area into ## cells. Shall I continue to move to the first cell?”

U: “Okay.”

[Ares positions tip over first cell]

A: Please jog the z-axis until the tip is just making contact with the substrate. Let me know when you are ready to proceed.”

[Image showing dispensing tip touching substrate]

U: “Okay Ares, I’m ready.”

A: “Great. I will start the print task in 10 seconds. You can ask me to cancel or pause anytime.”

[time passes]

A: “Print job complete. Data stored in folder two-thousand twenty dash zero nine dash zero nine dash ten twenty-six thirteen.”

U: “Okay Ares, how did the print go?”

A: “Would you like to see a summary of results from the most recent print job labeled wo-thousand twenty dash zero nine dash zero nine dash ten twenty-six thirteen or are you asking about a different print job?”

U: “I’m asking about the most recent one.”

A: “Okay. Here are the results from the most recent print job.”

[summary chart displayed]

U: “Okay Ares, let’s run a print campaign.”

A: “Sure. Are we going to print more ‘Happy Belly Wildflower Honey Plus 15 mL Food Coloring’?”

U: “Yes.”

A: “My records indicate that there is eight point three milliliters of this material in the installed syringe. Would you like to continue with this syringe?”

U: “Yes.”

A: “My records indicate that a zero point four one six millimeter dispensing tip is installed on the syringe. Would you like to continue with this dispensing tip?”

U: “Yes.”

A: “Okay. Would you like to use the toolpath ‘13 mm rectangle’ created earlier today?

U: “Yes.”

A: “Great. Are we going to use the analyzer ‘white on black line start analysis’?”

U: “Yes.”

A: “Good. Previously, we captured an analysis image at x = 9 mm and y = 12 mm. Would you like to keep this setting?”

U: “Yes.”

A: “Fantastic. Please provide the objective target value. This is a value between zero and one.”

U: “One.”

A: “Got it. One. Now, please tell me which parameters to optimize. You can say ‘list’ for a list of parameters.”

U: “Print speed and prime delay.”

A: “You want me to optimize ‘print speed’ and ‘prime delay’ is that right?”

U: “Also working distance.”

A: “You want me to optimize ‘print speed’, ‘prime delay’, and ‘working distance’. Is that right?

U: “Yes.”

A: “Okay. What are the campaign’s termination conditions? You can say number of experiments, threshold value, or combination.”

U: “Number of experiments.”

A: “Great. Do you want to set a minimum number of experiments or a maximum number of experiments?”

U: “Minimum.”

A: “Okay. What is the minimum number of experiments you want run for this campaign?”

U: “One hundred.”

A: “Okay. You want to run at least one hundred experiments. What planner to you want to use? You can say ‘list planners’ for a list of available planners.”

U: “I want to use the BORAAS planner.”

A: “You want to use the BORAAS Web Planner. Is that right?”

U: “Yes.”

A: “Okay, we need to set three sets of seed values for the BORAAS Web Planner. Ready to proceed?”

U: “Sure.”

A: “Great. What is seed value number one for ‘print speed’?”

U: “One millimeter per second”

A: “Got it. What is seed value number two for ‘print speed’?”

U: “Three millimeters per second”

A: “Got it. What is seed value number three for ‘print speed’?”

U: “Five.”

A: “Did you mean five millimeters per second?”

U: “Yes.”

A: “Got it. One millimeter per second for seed one, three millimeters per second for seed two, and five millimeters per second for seed three, for ‘print speed’. Is this right?”

U: “Yes.”

A: “Great. What is seed value number one for ‘prime delay’?”

U: “Zero”

A: “Got it. What is seed value number two for ‘prime delay’?”

U: “Zero point five.”

A: “Did you mean zero point five seconds?”

U: “Yes.”

A: “Got it. What is seed value number three for ‘prime delay’?”

U: “Zero point two five seconds.”

A: “Got it. Zero point zero seconds for seed one, zero point five seconds for seed two, and zero point two five seconds for seed three for ‘prime delay’. Is this right?”

U: “Yes.”

A: “Great. What is seed value number one for ‘working distance’?”

U: “Zero point two millimeters.”

A: “Got it. What is seed value number two for ‘working distance’?”

U: “Zero point three millimeters.”

A: “Got it. What is seed value number three for ‘working distance’?”

U: “Zero point four millimeters.”

A: “Got it. Zero point two millimeters for seed one, zero point three millimeters for seed two, and zero point four millimeters for seed three for ‘working distance’. Is this right?”

U: “Yes.”

A: “Great. Do you want to change any of the static parameter values? You can say ‘list parameter values’ or ask me about any specific parameter.”

U: “What is the ‘prime distance’ set to?”

A: “The ‘prime distance’ value is zero point zero five millimeters. Anything else?”

U: “What is the ‘coast factor’?

A: “The ‘coast factor’ value is one. Anything else?”

U: “No.”

A: “Okay. I have all of the information I need to run this campaign. Are you ready to proceed?”

U: “I think so.”

A: “Great. My records indicate that there is not enough room remaining on the current substrate to run all one hundred experiments. Would you like to clean the substrate now?”

U: “Okay.”

A: “Thank you. I’ll move the build plate to the front of the system to facilitate cleaning.”

[build plate moves to front]

A: “Please let me know when you are finished cleaning the build plate.”

U: “Okay Ares. I’m ready.”

A: “Have you finished cleaning the build plate?”

U: “Yes.”

A: “Great. Please wait while I run the homing routine.”

[homing routine runs]

A: Would you like to calibrate the substrate origin?”

U: “Okay.”

A: “Fantastic. Please jog the build plate until the dispensing tip is over the front-left corner of the substrate. Let me know when you are ready to proceed.”

[Image showing dispensing tip over front-left corner of black glass substrate]

U: “Okay Ares. I’m ready.”

A: “Great. The dispensing tip is positioned over the front-left corner of the substrate. Is this right?”

U: “Yes.”

A: “Great. Please jog the z-axis until the tip is just making contact with the substrate. Let me know when you are ready to proceed.”

[Image showing dispensing tip touching substrate]

U: “Okay Ares. I’m ready.”

A: “Great. The dispensing tip is making contact with the substrate. Is this right?”

U: “Yes.”

A: “We are ready to begin the campaign. Shall I proceed?”

U: “Yes.”

A: “Great. I will start the print task in 10 seconds. You can ask me to cancel or pause anytime.”

[time passes]

A: “Print job complete. Data stored in folder two-thousand twenty dash zero nine dash zero nine dash thirteen ten thirteen.”

U: “Okay Ares. Shutdown system.”

A: “Confirm system shutdown.”

U: “Confirmed.”

A: “Goodbye.”