



6. Robotic Welding Operator Manual

General Overview:

Standing experience.

- In robotic welding operator, the user will operate different programs used in setting up and programming robot welding arms to work on wind turbine engines.
- They will first select the right types of robot arms based off of a work order.
- Then they will have to select the correct parameters for each type of robot arm.
- They will also need to determine where the robot arms will weld either through pattern selection or location selection.
- There is a lot of problem solving in this simulation, as the user must follow a very precise work order and I'm sure that deadlines are met.

Macros / Shortcut keys:

T = turn teleportation on or off

Wrist Watch: The wrist watch is always on the user's left wrist. When a call is coming in for the user, the icon on the watch will be an orange vibrating phone (Image 1 below). They must place their right hand on top of the watch and a blue circular progress bar will fill up (Image 2 below). Once it is filled, the call will be answered and the watch icon will become a green chat bubble (Image 3 below). When the call is finished, the watch icon will become a yellow question mark (Image 4 below). When the yellow question mark is visible, the user can place their right hand on top of the watch and the narrator will repeat the last set of instructions.



Image 1



Image 2

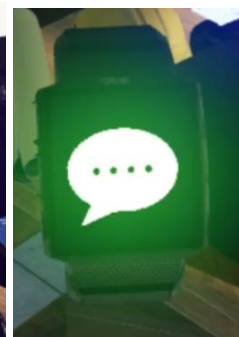


Image 3

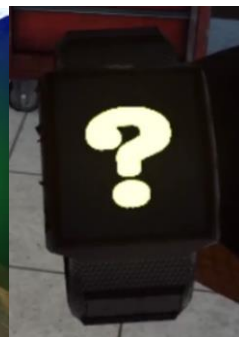
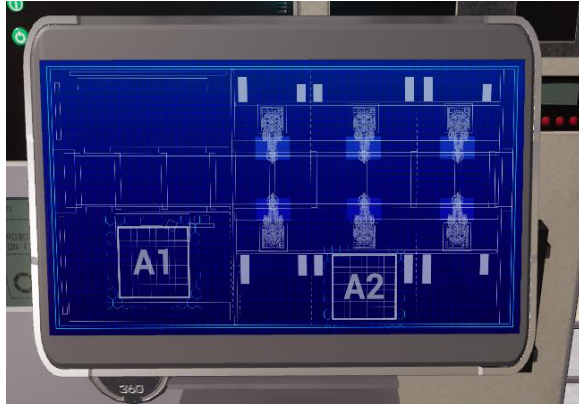


Image 4

Teleportation Map: A map tablet is at every location in the simulation though it is not always activated. The user can move around the world using the map tablet when it is activated. When your hand is near the tablet, it will automatically point with your index finger which you use to tap the screen. You can tap on the large boxes with numbers inside of them to move to that location. Each location is detailed on the map.



Facilitator Panel: The facilitator panel is an options menu that allows a simulation facilitator to adjust gameplay and accessibility options while a user is inside the experience. To access the facilitator panel during the simulation, press the TAB key.



There are five core options from this menu:

Hint Task: When pressed, the in-game narrator will repeat their most recent instruction, which is helpful if the user misses something or is distracted while in the simulation.

Print Screen: This button will save a screenshot of the current view that the user sees.

Settings: This will bring the facilitator into a separate menu screen where they have multiple options to change the experience. This is detailed below.

Restart: This will restart the simulation from the very beginning.

Quit: This will exit the experience.

Greyed out buttons: Finish Task & Restart Task - These functions are not currently working but will be implemented in the near future.

Settings: The gameplay settings have an additional set of toggles and sliders the facilitator can adjust during the simulation.



Force Grab: If someone is unable to reach something or is running the experience while seated, this option allows the user to grab objects without being directly next to them. The user can point their hands at objects that are far away and pulling the trigger will bring the object into their hand, grabbing it

Teleportation: This will turn on the granular teleportation around the game world. To use teleportation 1) hold down the center thumbpad button (Vive Pro) or push forward on the thumb joystick (Oculus Rift S) to create a blue teleportation arc 2) select a location to go by moving the controller until the blue circle at the end of the arc is in the desired location (A red line means that locations is not valid or blocked) and 3) release the center thumbpad button (Vive and Vive Pro) or thumb joystick (Oculus Rift S) which will cause the screen will quickly fade to black and when it fades back in, the user will be in a new location.

Seated Experience: When turned on, this option will move the user's location in the game world to be higher up, so that if they are sitting down, their view will be similar to a standing position.

Language: This drop-down menu will allow the facilitator to change the language of the experience. When changing language, the simulation will need to restart.

Volume: This slider will adjust the master volume of the game. If the sliding bar is on the right side, the volume will be at 100% and on the left side, the volume will be set to 0%.

Full written walkthrough:

Quest	Task	Description
1	call	Answer your watch by holding your right hand above the watch icon on your left wrist
1	introInfo	Listen to the narrator describe the career

1	workOrder	Grab the work order from the table
1	info1	Listen to the narrator describe the work order
1	activate	Turn on operator tablet by pressing the "Activate" button on the tablet
1	info2	Listen to the narrator describe the operator's tablet
1	select1	Select the correct robots based on the work order for the first row. Row 1 will be arc welding robots
1	select2	Select the correct robots based on the work order for the second and third row. Row 2 will be spot and row 3 will be arc
1	info3	Listen to outro information about robot arms and watch as they move into the factory
1	teleport2	Move to the second location by pressing 2 on the map tablet
2	introInfo	Listen to introduction information about the area
2	consoleOn	Turn on console by flipping the switch
2	infoComps	Listen to information about the tools at this workstation
2	tabletGrab	Grab the programmers tablet
2	plug	Plug the tablet's USB into the console panel row A
2	infoArc	Listen to information about arc welding robots
2	paramWindow	Select the parameters window on the programmers tablet
2	infoArc2	Listen to information about arc welding robots
2	paramSet	Set the parameters of this robot arm. The power will be 8750 Amps and the speed to be 7 cycles
2	patternWindow	Select the pattern window
2	cardInfo	Listen to information about card patterns.
2	cardSelect	Select the correct card from the table on the right of the console
2	confirm1	Click the confirm button for the pattern
2	confirm2	Click the confirm button for the whole robot arm
2	outroInfo	Listen to some final notes about the arc welding robots
3	plug	Plug the programmers tablet into the console panel into row B
3	param1	Set the parameters of this robot arm. The will be randomized so check the table on the left of the work order to get the correct values
3	infoSpot	Listen to information about spot welding robots
3	patternSelect	Select pattern button from homepage
3	patternComp	Select the pattern for robot 2 and then test it

3	confirm1	Click the confirm button for the pattern
3	confirm2	Click the confirm button for the whole robot arm
4	plug	Plug the tablet into the console panel into row C
4	patternComp	Set the parameters of the robot arm and then set the pattern using the correct cards from the table on the right
4	outroInfo	Listen to outro about next steps
4	teleport1	Teleport back to location 1
5	introInfo	Listen to intro information about final section
5	beltGo	Select the start conveyor belt button
5	outroOut	Listen to outro information about first work order and watch as the cars get welded
5	secondOrder	Complete another full work order without any assistance and trigger to complete this section is when they successfully start the conveyor belt for a second time.
5	part2	Listen to outro information about the career.

Map

The user will work inside a wind turbine manufacturing facility where they will program the robot arms that weld the unfinished engines.



Location 1 - Operators Area: The Operators area is where the user will begin the experience. They will need to use the operators tablet located on the workbench in front of them. There is also a work order on a clipboard located next to the operator's tablet. Using the information on the work order, the user must select the correct type of robot arms for the task on the operator tablet. This is also where the user will come at the end of The Experience where they can begin the process of welding the engines.



Location 2 - Programming Area: The user will come to the programming area once the correct robot arms are on the production floor. The user will have access to a programmers tablet, their work order, an information chart that displays how they will set their parameters for the robot arms, and a series of different patterns that the arc welding robots will weld. There is a

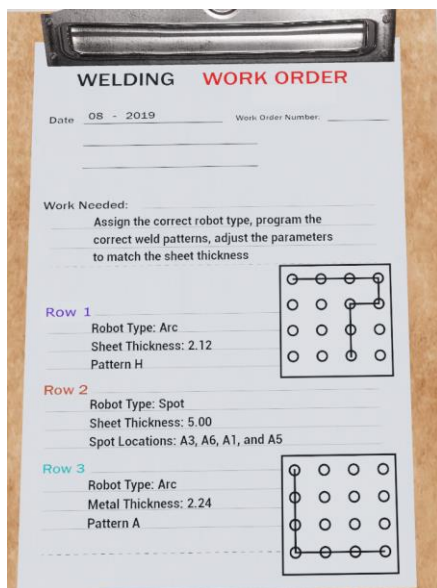
main console in front of the user at this location that they can plug the programmers tablet into in order to program the different types of robots.



Key Objects

Note: Some objects will not be visible at the beginning of the tutorial and will only appear when they are required.

Work order: The work order is located at the operators area and programmers area. The work order contains all of the information the user will need for setting up the robot arms in programming mode. There are three rows of robots that will need to be set up, and the work order shows the type of welding robot, the metal thickness that they will be welding, and the pattern that will need to be set. the first set of robots that will be welded will always be the same, but the second and third rows are randomized each time the user runs through the simulation.



Operators Tablet: The operators tablet is located at the operators area. To begin using the operators tablet, the user must tap on the touch screen and press the activate button.



Once the operator's tablet has been turned on, it will display the six robot arms that can come out onto the production floor. Each of the six robots is in one of three rows labelled 1 2 and 3 in pairs of two.



The user will need to tap on one pair of robots and then an option menu will pop up which will display either arc welding or spot welding. Based on the work order, the user will need to set whether each pair of robot arms will be our core spot welding robots. Once the user has selected either arc or spot welding for all three pairs of robot arms, a confirm button will appear and when pressed, the robots will move out onto the production floor along the conveyor system. While the work order is randomized each time the user plays through the experience, row 1 and 3 will always be arc welding robots and row 2 will always be spot welding robots. If the user finds that the operator's tablet is too high or too low, they can grab the sides of the operator's tablet and adjust its location as the tablet is on an adjustable swivel arm.



Programmers Console: The programmers console is located in the center of the programmer area. There is a power switch on the bottom right of the console, that the user will need to switch in order to turn on the console. Once the console is on, the user can grab the USB key from the programmers tablet and it is inserted into one of the three USB slots along the bottom of the console. There is also an arc welding robot pattern scanning section on the top of the console, along with a small screen that will display which patterns have been selected. The user can pick up an arc welding pattern card from the table to the right and scan it here.



Programmers Tablet: The programmer's tablet is located in the programmer's area. To begin using the programmers tablet, the user must grab the heal USB key that is attached to the right side of the tablet.



Then they insert the USB key into one of the three USB slots on the console if the console has been turned on. Once the programmer's Tablet USB key has been inserted, it will automatically detect the type of robot arms in that row and bring the user to the home screen.



From this home screen, the user can select either the parameters or the pattern. In the tutorial mode, the user must always set the parameters first and then the pattern. See the sections Below on how to set the parameters and set the patterns for the different types of robot arms. For each row of robots, once the pattern and parameters have been set properly, a final confirm button will appear and the user can press it which will display a message that the robots have successfully been programmed. At this point, the user can unplug the USB key from the current row and move on to another set of robot arms in a different row. Similar to The Operators tablet, the user can adjust the programmers tablet location by grabbing the side of the tablet and adjusting it.

Programmers Tablet: Setting Parameters: To set the parameters of the robot arms, the user will have to set the speed and the power that will be used during the welding process. To adjust the speed and power for the robot arms, there are two arrows to the left into the right of the value on the programmers tablet. They can increase or decrease the power and speed by using these Arrow buttons.



To determine what the parameters will need to be set too, the user will first need to check the work order and see what the metal thickness that this row of robot arms will be welding. Then check the metal thickness chart to determine what the correct power and speed are for that thickness of metal. Once the values have been set, the user can press the confirm button and if both values were set correctly, they will appear green. If any of the values were set in correctly, they will appear a red in the user will need to check the metal thickness chart again to ensure they are sending me correct power and speed. This process is the same for both spot and arc welding robots.

Programmers Tablet: Setting Patterns of Arc Welding Robots: To set the patterns of the arc welding robots, the user must select the pattern button from the home screen when the programmers tablet is plugged into a row with arc welding robots. This will bring them to a menu screen, where they can click the scan arc welding pattern button.



From here, the user will need to check what pattern type this row of arc welding robots requires, the patterns are delineating with letters (A, B, C). the user will need to look for the correct pattern card on the table to the right of the console, and then grab it and tap it on to the scanning section of the console which will be indicated with an arrow. It is on the top right side of the console. When they tap the card on to the console scanning device it will appear both on the left of the scanner and on the programmers tablet.



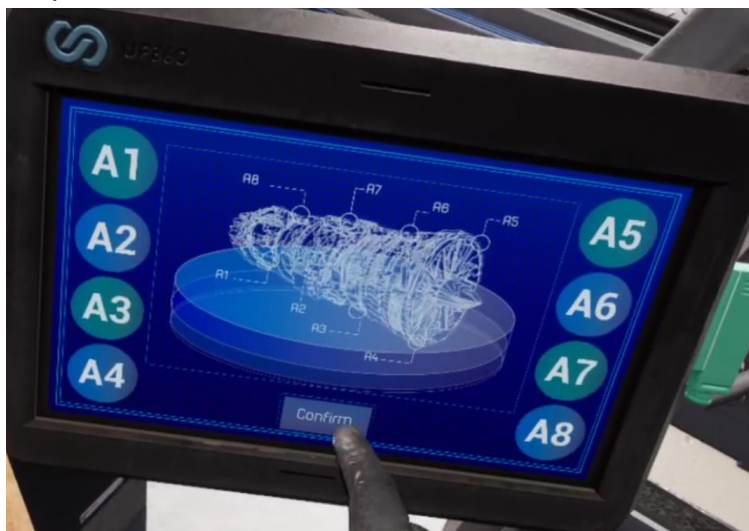
If the pattern is correct, the user can press the confirm button in this will cause the arc welding robots to test that welding pattern. If it is incorrect, a warning message will appear and the user must try again. Once the robot arms have finished testing that pattern, they can press the confirm button which will bring them back to the home screen.

Programmers Tablet: Setting Patterns of Spot Welding Robots

To set the patterns for the spot welding robot, the user will need to select the pattern screen from the homepage of the programmers tablet. This will bring them to a screen with an image of an engine and a smaller button that says select pattern.



From here the user will need to select which locations the spot welding robots will weld. These are labelled a 1 through 1/8. To determine which of the four locations will need to be welded, they will need to check the work order.



Once they have selected the correct four locations, they can press the confirm button and the spot welding robots will run a test weld. Once they have finished testing the patterns, another confirm button will appear and the user can press that button to return to the home screen.

Metal Thickness Chart: The metal thickness chart is located to the left of the console in the programmers area. This chart displays different metal thicknesses, and the associated welding speed and welding power that will need to be used for that type of thickness. this chart will need to be checked when the user is trying to set the parameters for each row of robots. They will need to check their work order to see what thickness of metal the robots will be welding, then check this chart to get the power and speed they will need to set.

Table 8. Welding parameters for RobotArms.

Metal Thickness (mm)	Welding Power (A)	Welding Speed (Cycles)
2.00	8500	6
2.12	8750	7
2.24	9000	8
2.36	10300	9
2.80	10900	10
3.55	11500	12
4.00	12200	15
5.00	12350	16
6.15	12350	19

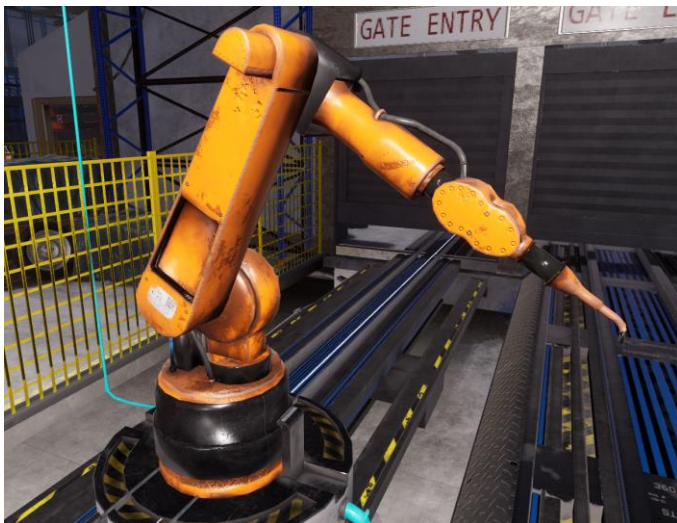
Arc welding pattern cards: The arc welding pattern cards are located to the right of the programmers console in the programming area. There are multiple different cards each labelled with a different letter, which will represent the type of pattern they contain. The user can pick up these different cards, and scan them at the main programmers console when inputting the type of patterns the arc welding robots will use. If the user loses the card, They will reappear after a brief period of time.



Spot Welding Robots: The Spot welding robots come out onto the production floor and are large yellow machines. The user will need to program these too well for different locations using the programmers tablet.



Arc Welding Robots: The arc welding robots come out onto the production floor and are a large orange machine. The user will need to program these to weld different patterns by using the pattern cards at the console.



Initialization button: The initialization button is on a stand to the right of the workbench at the operator's area. This button is used to start the production floor process once the user has programmed all three pairs of robot arms. Once it is pressed, the engine that will be welded will roll out onto the production floor from the launch and get welded by the three different pairs of robot arms on the right.



Freeplay vs. Tutorial:

In the tutorial, the narrator will walk the user through how to set up the robot arms using both the operator's tablet and the programmer's tablet. The user will begin in the operator's area and setup which types of robot arms will be used. They will then move to the programmer's area and will need to set the specific parameters and patterns that these different robot arms will use during the welding process. There are several constraints during the section to make sure that the user cannot get out of order when completing the linear tutorial. Once the tutorial has finished, the user will be tasked with setting up another whole work order all on their own without any guidance. This part will require a lot of problem solving and frequently checking both the work order and the metal thickness chart.

In freeplay, the user will begin the experience with the work order and will have to set up the operator's tablet all on their own. Once the operator's tablet has been set up, they can move to the programmer's area where they will need to program the three different pairs of robot arms using the programmer's tablet, work order, and metal thickness chart. Once that set of robot arms have been programmed, they can return to the operator's area and start the production cycle by pressing the initialization button to the right of the workbench. Once all those engines have been welded, another work order will be sent to them and they can continue to program the different robot arms indefinitely.