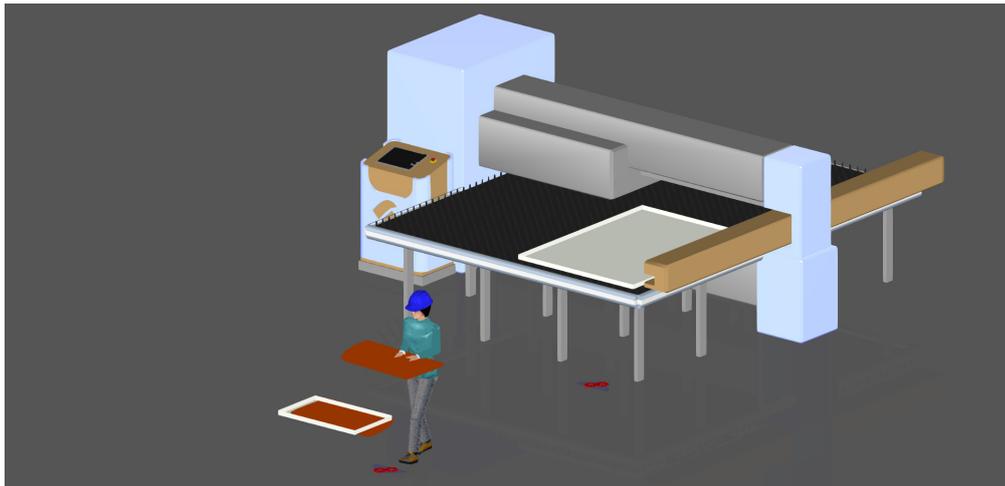


Works Library - Human and Machine Processes

Visual Components 4.0 | Version: February 14, 2017



The Works library can be used to simulate human and machine processes during a simulation. A machine process can include welding, cutting and other machine tending operations. A human process can be a time-consuming event, for example component assembly, load carrying and packaging.

In this tutorial you will learn the basics of defining tasks for human and machine processes with components in the Works library.

This will involve:

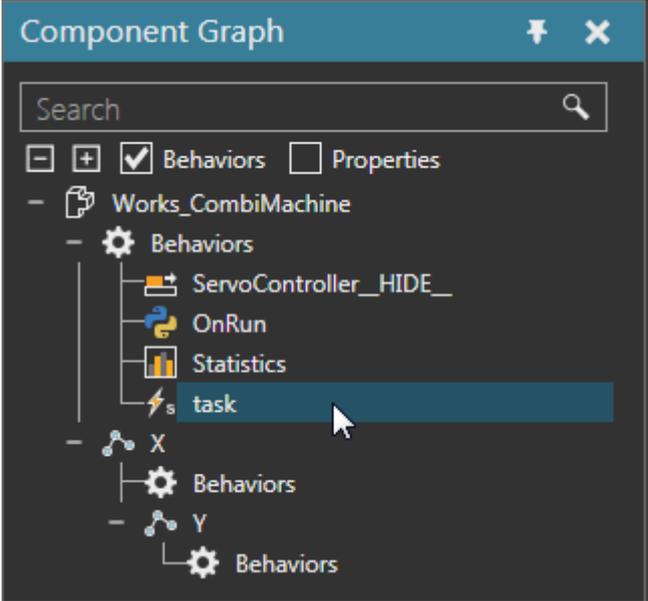
- Part creation, waste removal and changing product ids
- Editing resource locations
- Assigning pick, place and process task locations and animations for human workers
- Using humans to pick and place parts

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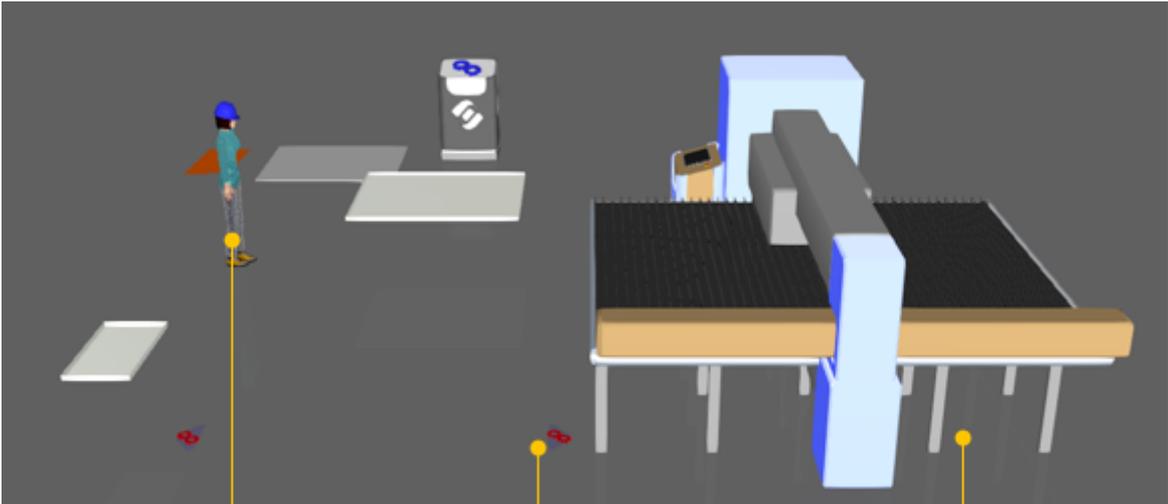
Getting Started

A machine can work directly with a Works Process component if the machine has a String Signal behavior named "task." Generally, this signal is used to trigger actions in a Python script as well as signal the start and end of a machine process.



A Works Human component can be used as a resource for performing tasks, for example picking and placing parts. You can assign tasks to a Works Human by using its Default properties group.

A Works Location component can be used to define locations and animations for tasks performed by a Works Human component. Otherwise, a Works Human will define its own animations and refer to a ResourceLocation frame in a Works Process component.



Works Human

Works Location

Works Combi Machine

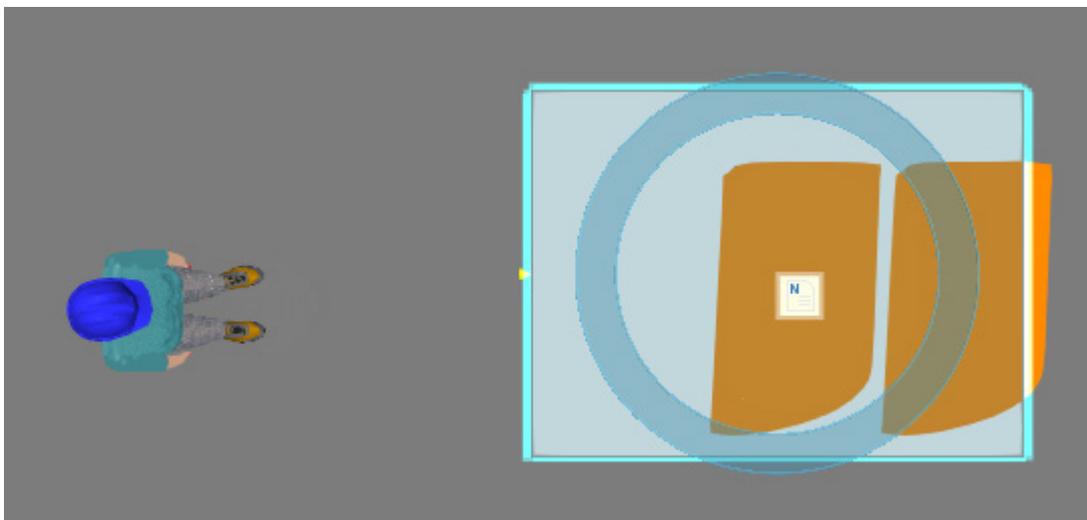
Task - Dummy Process

A Dummy Process task allows you to run a time-consuming event, thereby delaying the execution of a process. This is helpful if you need to create and modify products or remove them and create new ones after a certain amount of time.

1. Press CTRL+N to clear the 3D world.
2. Open the **Human and Machine Processes - Start** layout for this tutorial.
3. In the Cell Graph panel, under the Works category, click **WorksProcess** to select that component in the 3D world.
4. In the Component Properties panel, Default tab, set Task to **Create**, ListOfCompNames to **ParametricPallet**, and then click **CreateTask**.
5. Set Task to **DummyProcess**, and then click **CreateTask**.
6. Set Task to **CreatePattern**, SingleCompName to **VCCar_DoorSheet**, AmountY to **1**, StepX to **700**, and then click **CreateTask**.
7. Set Task to **Remove**, ListOfProdID to **ParametricPallet**, clear the **All** check box, and then click **CreateTask**. The Works Process component should now have the following sequence of tasks.

```
Create:ParametricPallet:  
DummyProcess:5.0  
CreatePattern:VCCar_DoorSheet:2:1:700.0:100.0:100.0:1:999999  
Remove:ParametricPallet:False
```

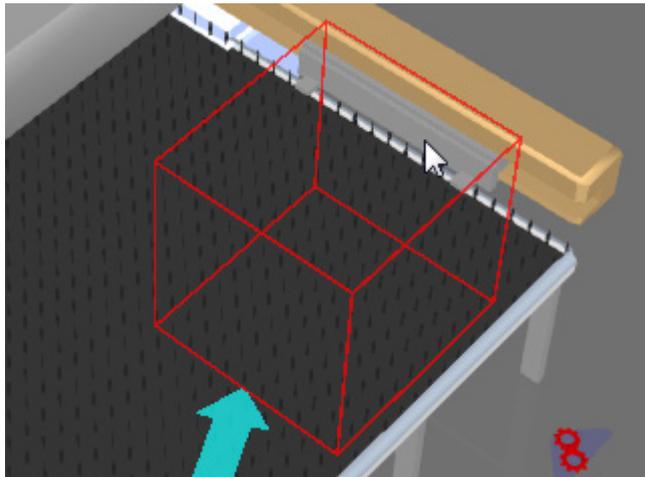
8. Click the **Task** tab, and then set RunTaskTimes to **1**.
9. Run the simulation, verify two doors are created from a sheet, and then reset the simulation.



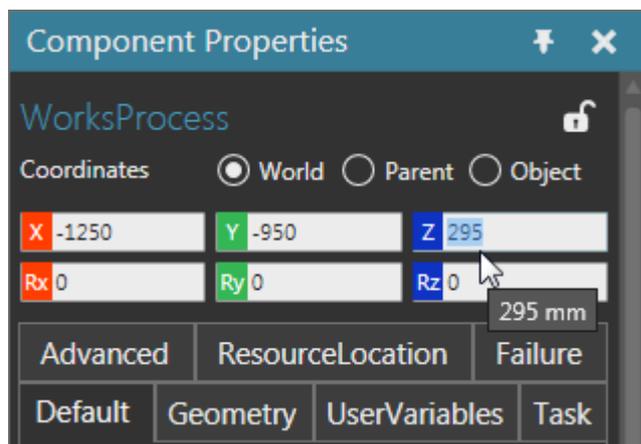
Task - Machine Process

A Machine Process task allows you to signal a machine to execute a process. The machine should be modeled to execute a process defined in a Python script. The script is triggered by a "task" signal, which is used to signal the start and end of the process and task.

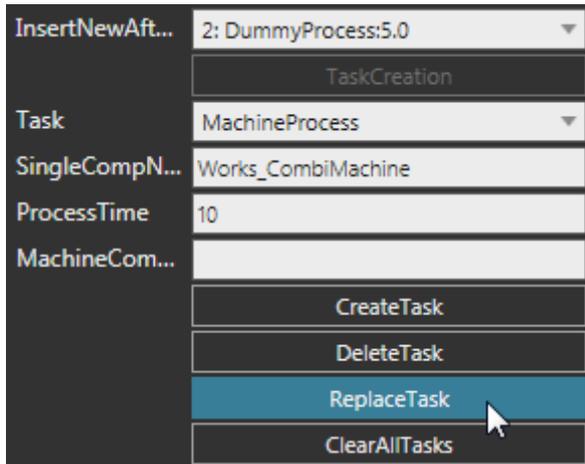
1. On the Home tab, in the Hierarchy group, click **Attach**.
2. In the 3D world, click the node containing the clasps of the machine to attach the WorksProcess component. This allows the components contained by WorksProcess to move with the clasps during a machine process.



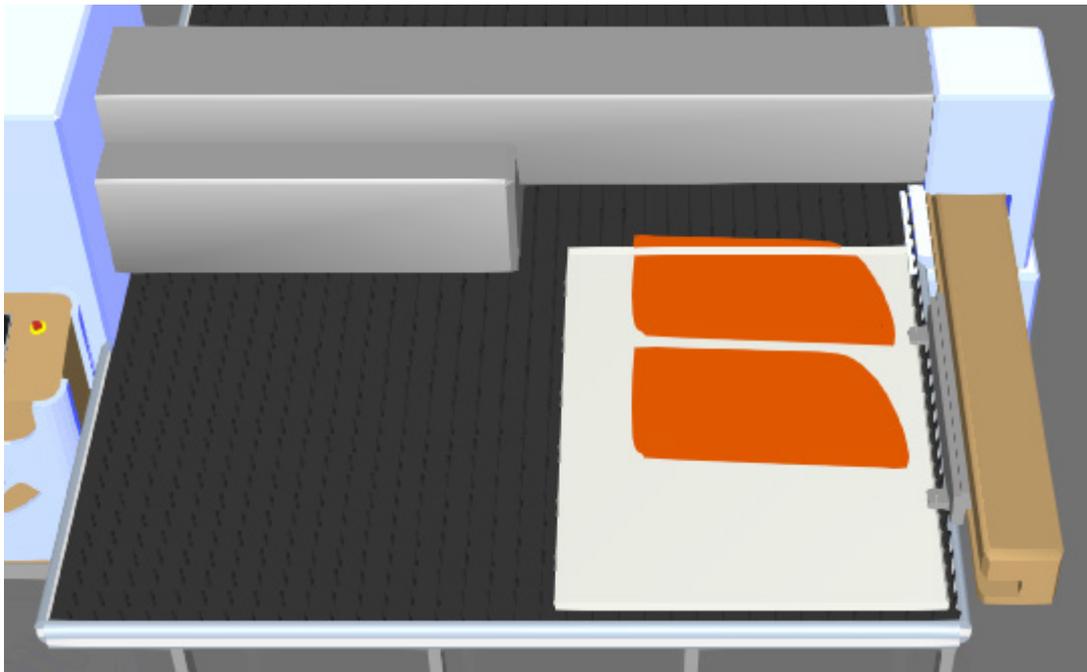
3. In the Component Properties panel, set the World XYZ coordinates to **{-1250, -950, 295}**.



- In the Default tab, set InsertNewAfterLine to the second task, and then set Task to **MachineProcess**, SingleCompName to **Works_CombiMachine**, and then click **ReplaceTask**.



- Run the simulation, verify the machine executes a process that creates two doors, and then reset the simulation.

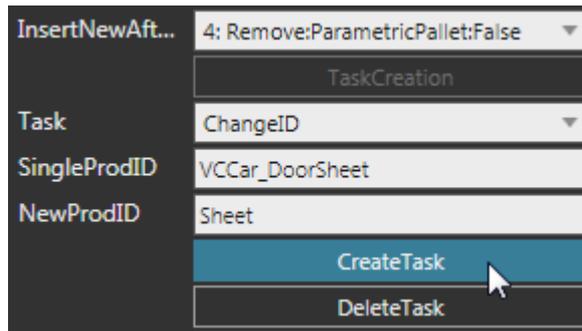


NOTE! You can teach a location for the doors to make it easier for a human worker to reach them. You can also use dummy processes to simulate machine warmup and cool down states.

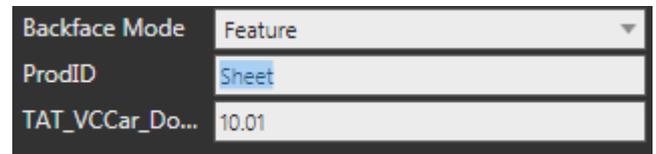
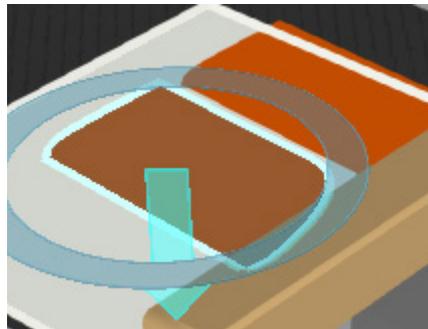
Task - Change ID

A Change ID task allows you to change the ProdID property of a component contained by a Works Process component. This is helpful if you need to filter products and identify the stage of a product in a process.

1. In the Component Properties panel, Default tab, set InsertNewAfterLine to the last task, and then set Task to **ChangeID**, SingleProdID to **VCCar_DoorSheet**, NewProdID to **Sheet**, and then click **CreateTask**.



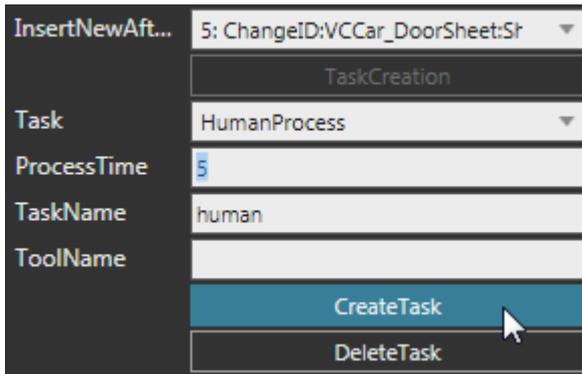
2. Run the simulation, wait for the process to finish, and then stop the simulation.
3. In the 3D world, select one of the created doors, and then in the Component Properties panel, verify its ProdID is Sheet.



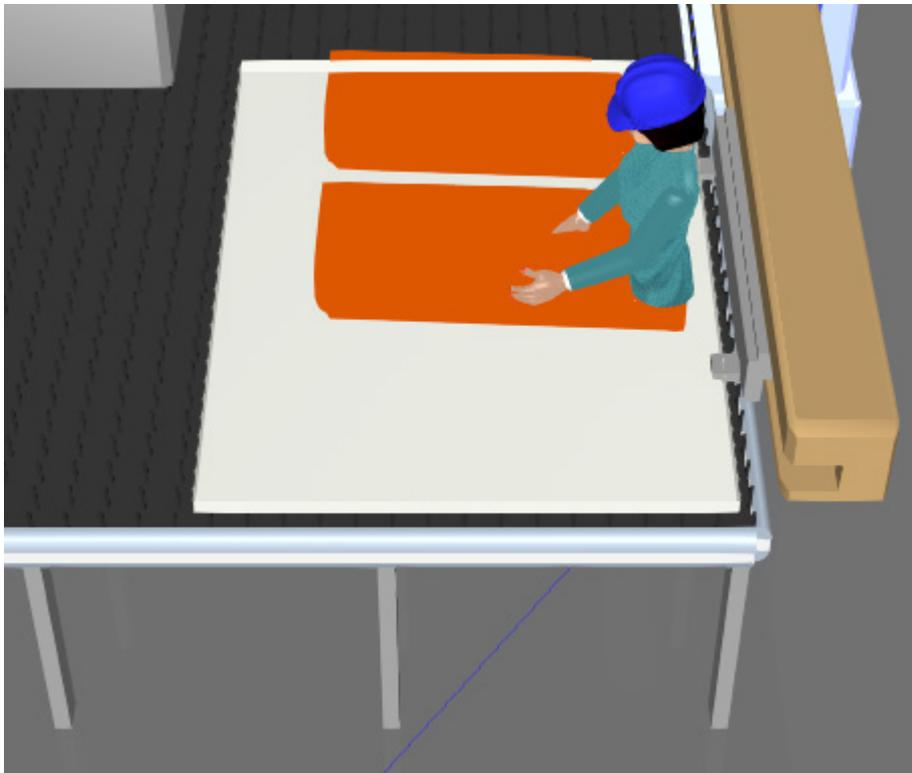
Task - Human Process

A Human Process task allows you to assign a time-consuming task to a human resource.

1. In the 3D world, select **WorksProcess**.
2. In the Component Properties panel, Default tab, set Task to **HumanProcess**, ProcessTime to **5**, and then click **CreateTask**. In this case, you are using a default TaskName of "human" which, by default, is already assigned to a Works Human component.



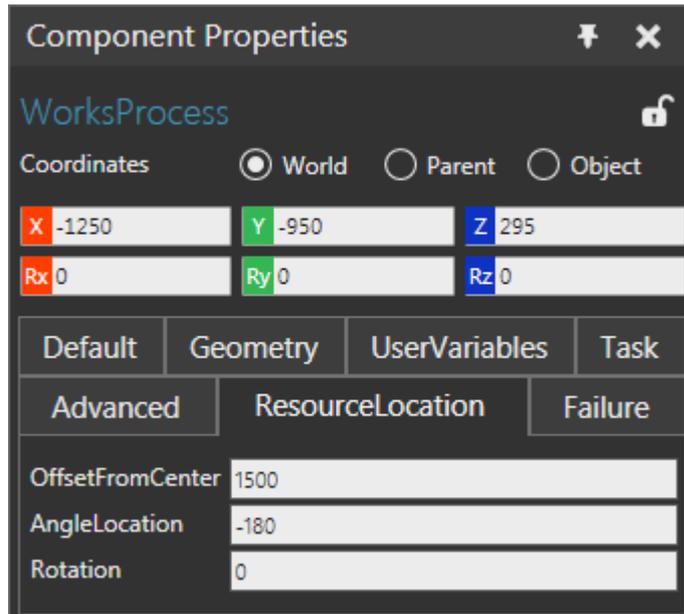
3. Run the simulation, verify the human walks to the doors and executes a process, and then reset the simulation. Notice the location of the human is inside the machine.



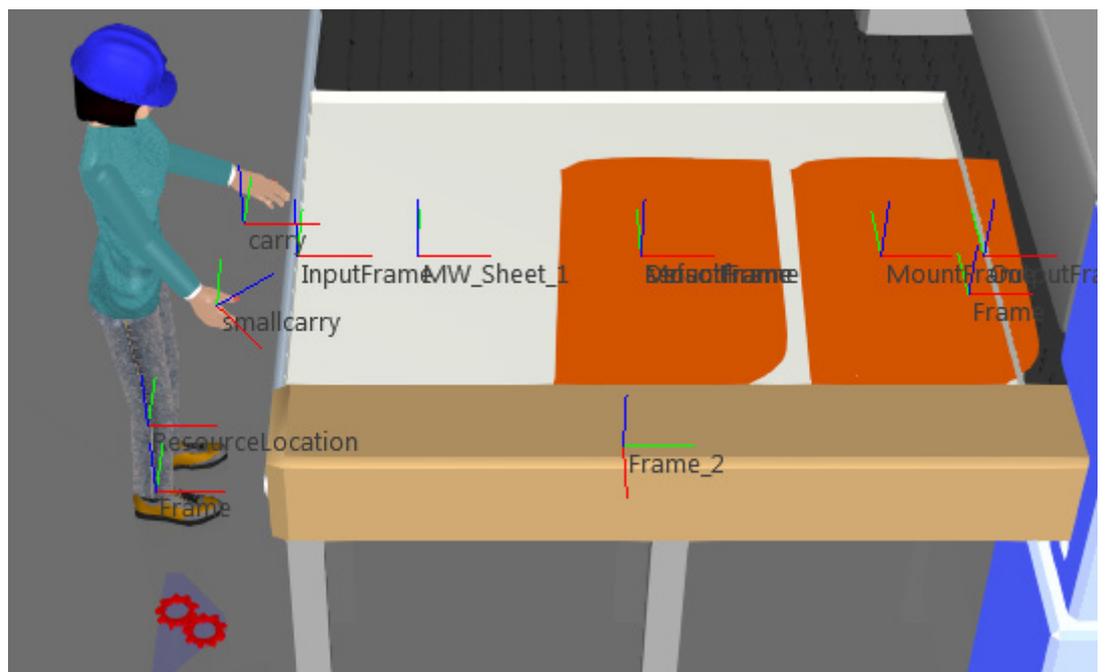
Resource Location

The default location of a human resource at a Works Process component is defined by a ResourceLocation frame.

1. On the 3D world toolbar, click the **Frame Types** arrow, and then select the **Frames** check box to turn on the visibility of frame features in the 3D world.
2. In the Component Properties panel, ResourceLocation tab, set OffsetFromCenter to **1500** and AngleLocation to **-180**.



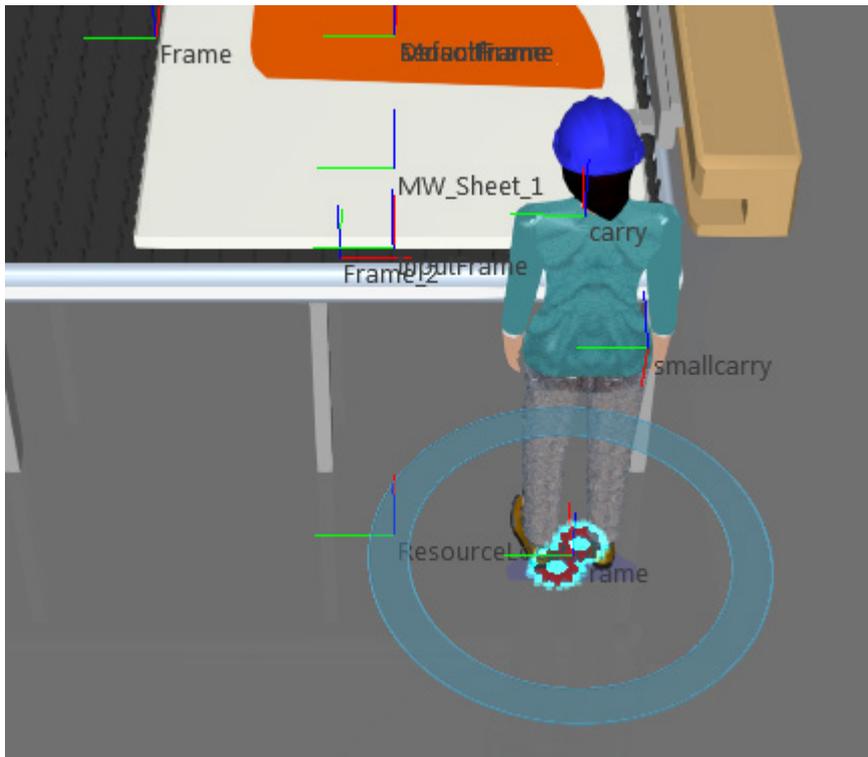
3. Run the simulation, verify the human worker walks to the updated resource location, and then reset the simulation.



Works Location

A Works Location component allows you to define the location and animation of a human resource assigned pick, place and process type tasks.

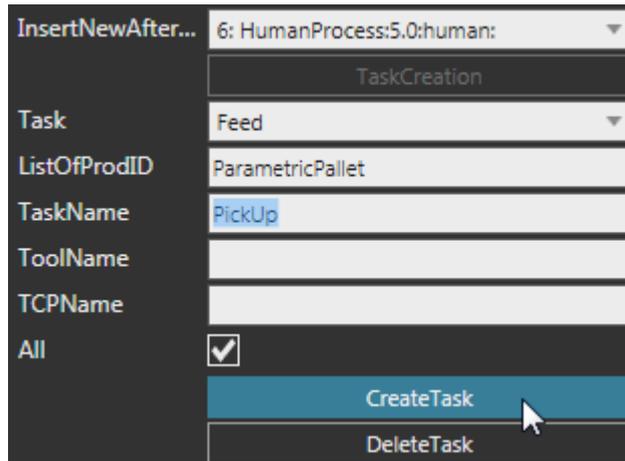
1. In the Cell Graph panel, under the Works category, select **Works_Location** to select that component in the 3D world.
2. In the Component Properties panel, set ProcessTasks to **human**.
3. Run the simulation, verify the human worker walks to the new process location, and then reset the simulation.



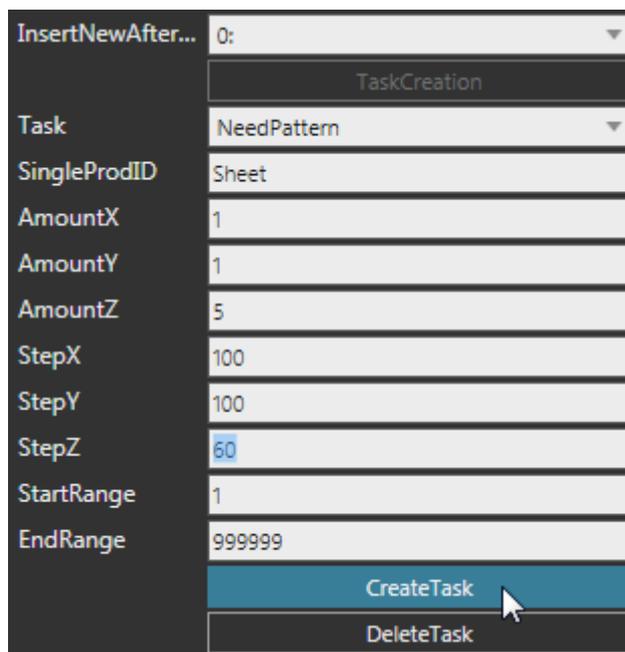
Human - Pick and Place

A human resource can be used to pick and place parts. For example, a Works Process component can feed parts needed at other Works Process components and use a human worker to deliver those parts.

1. In the 3D world, select **WorksProcess**.
2. In the Component Properties panel, Default tab, set Task to **Feed**, TaskName to **PickUp**, select the **All** check box, and then click **CreateTask**.



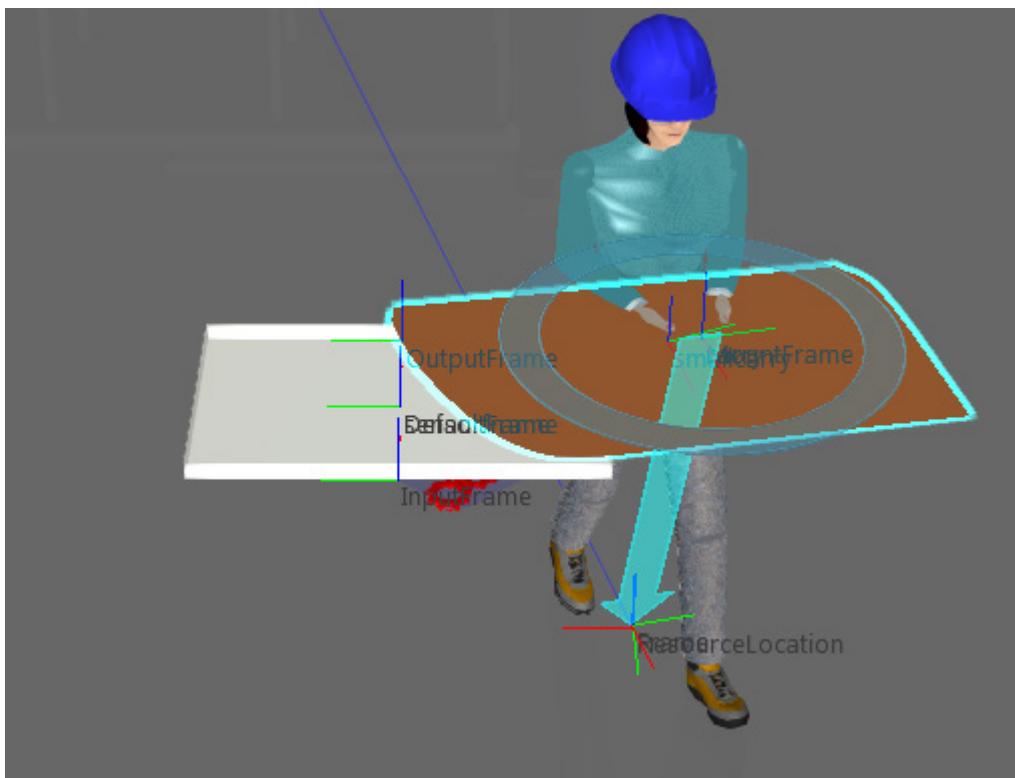
3. In the 3D world, select **WorksProcess #2**.
4. In the Component Properties panel, Default tab, set Task to **NeedPattern**, SingleProdID to **Sheet**, AmountX and Y to **1**, AmountZ to **5**, StepZ to **60**, and then click **CreateTask**.



- In the 3D world, select the **human worker**.
- In the Component Properties panel, Default tab, set PickAnimation and PlaceAnimation to **PickMid**, and Tasklist to **human,PickUp**.

ProcessAnimation	ManualWork
PickAnimation	PickMid
PlaceAnimation	PickMid
Tasklist	human,PickUp
reserver	

- Run the simulation, verify the human worker pick and places doors, and then reset the simulation. Notice the human worker used the default locations at each Works Process component for picking and placing the doors.



- In the 3D world, select **Works_Location**, and then in the Component Properties panel, set PickTasks to **PickUp**.
- In the 3D world, select **Works_Location #2**, and then in the Component Properties panel, set PlaceTasks to **PickUp**. Why? In this case, a Feed task is being used to pick and place parts, so the task itself would have pick and place locations.
- Run the simulation, verify the human worker uses the new pick and place locations, and then reset the simulation.

Review

In this tutorial you learned how to simulate human and machine processes using components in the Works library. For example, you created a process where a machine uses one product to create two new products, and then a human worker delivers those products to a different station. You understand how to edit the location and animation of human resources performing tasks. This will help you in completing other Works library tutorials that cover human resources in more detail. In addition, you may want to learn more about how to model machines to execute processes.