

Customer Need	Technical Need	Technical Requirement	Target Value	Current Performance
<u>Mobility Demonstration</u>				
Move fast	The robot's average velocity is greater than Harris Corporation's stated minimum velocity.	Measure the distance the robot moves every 60 seconds. This distance should be at least 18 feet. (Average velocity is > 0.3 feet/second)	The measured distance the robot moves after one minute intervals should be at least 36 feet. (Average velocity is > 0.6 feet/second)	Our robot moves 14.28 feet in one minute (an average velocity of 0.238 feet/second).
Move straight	The amount of deviation from the desired path of the robot should be a small distance.	The deviation of the robot perpendicular to the desired path (distance between the center of the robot and the center of the desired path) should be less than 2.4 inches for every foot the robot travels.	The deviation of the robot perpendicular to the desired path (distance between the center of the robot and the center of the desired path) should be less than 1.2 inches for every foot the robot travels.	The deviation of the robot from the center of the path, after moving 1 foot, was 1 foot.
<u>Line Follow</u>				
Follow a line	The amount of deviation between the center of the line and the center of the robot should be a small distance.	The deviation of the robot perpendicular to the desired path (distance between the center of the robot and the center of the desired path) should be less than 2.4 inches for every foot the robot travels.	The deviation of the robot perpendicular to the desired path (distance between the center of the robot and the center of the desired path) should be less than 1.2 inches for every foot the robot travels.	TBD
Follow a curved line	The robot should be able to follow a curve in the line as closely as possible.	The robot should be able to follow a circular path of radius 6 inches with a deviation of less than 1 inch for every cycle around the circle.	The robot should be able to follow a circular path of radius 4 inches with a deviation of less than 1 inch for every cycle around the circle.	TBD
Find a line	The robot must be able to detect a black solid, dotted,	Time to find line (if robot has deviated or line is broken) < 5	TBD	N/A

	and/or dashed line within a small amount of time.	seconds while robot is following the line		
<u>Obstacle Traversal</u>				
Overcome obstacles	The robot must be able to overcome small obstacles in its path.	The robot can overcome obstacles 0.5 inches tall or shorter.	The robot can overcome obstacles 1 inch tall or shorter.	N/A
Move quickly over irregular terrain	Robot must move over irregular terrain (squishy, slippery, rough, uphill, downhill, uneven, etc.) without slowing its pace.	Measure the distance the robot moves every 60 seconds. This distance should be at least 18 feet. (Average velocity is > 0.3 feet/second)	The measured distance the robot moves after one minute intervals should be at least 30 feet. (Average velocity is > 0.5 feet/second)	N/A
<u>Bin Drop-Off Location</u>				
Locate bin drop-off points	Robot must stop at bin drop-off points.	Distance between the center of the robot at its stop and the center of the bin drop off circle < 6 inches.	Distance between the center of the robot at its stop and the center of the bin drop off circle < 3 inches.	N/A
Make known that a bin drop-off point has been identified.	The robot must beep three times once the bin drop-off location has been identified.	The time between the robot's stop at the drop-off point and first identification beep must be less than 3 seconds.	The time between the robot's stop at the drop-off point and first identification beep must be less than 1 second.	N/A
<u>Lift, Transport, and Drop Bin</u>				
Lift a bin	Robot must be able to pick up the bins.	Weight able to lift > 125 grams	Weight able to lift > 250 grams	N/A
Transport quickly	Robot must be able to move with weight of bin without slowing pace.	Measure the distance the robot moves every 60 seconds. This distance should be at least 18 feet.	The measured distance the robot moves after one minute intervals should be at least 36	N/A

		(Average velocity is > 0.3 feet/second)	feet. (Average velocity is > 0.6 feet/second)	
Transport a bin	Robot must be able to move a minimum distance while carrying bin.	Distance moved with bin > 15 feet (estimated distance to drop off point from the original bin position)	Distance moved with bin > 30 feet (twice the estimated distance to drop off point from the original bin position)	N/A
Prevent dropping of the bin.	Robot must be able to transport the bins without dropping the bins at unwanted locations.	The robot can successfully carry the bins to their respective drop-off points 70% of the time.	The robot can successfully carry the bins to their respective drop-off points 100% of the time.	N/A
Drop a bin.	Robot must be able to accurately set down bins.	Distance between center of bin in its final location and center of bin drop-off circle < 6 inches	Distance between center of bin in its final location and center of bin drop-off circle < 3 inches	N/A
Orient a bin correctly upon drop-off.	Robot must be able to set down bins in the orientation in which they were picked up (with the handle on the top).	The robot places the bin so that the handle is on the top of the bin and the surface area of the base below the forklift slots touching the ground within the drop-off circle is 2500 square millimeters.	The robot places the bin so that the handle is on the top of the bin and the surface area of the base below the forklift slots touching the ground within the drop-off circle is 2500 square millimeters.	N/A
Disengage from the bin and continue its tasks.	Robot must quickly lose contact with bin once it has been properly placed and continue around the path.	Ten seconds after arriving at the drop- off point the robot should have no point of contact with the bin. The distance between the bottom of the bin and the ground should be 0 inches and the distance between any point on the outside	Five seconds after arriving at the drop- off point the robot should have no point of contact with the bin. The distance between the bottom of the bin and the ground should be 0 inches and the distance between any point on the outside	N/A

		of the bin and the robot should be greater than 0 inches.	of the bin and the robot should be greater than 5 inches.	
Bin Identification				
Identify the organic materials.	Robot must be able to identify the bin containing the organic materials, knowing that the bin will have a mass of 55-75 grams.	The robot will measure the bin mass twice (once when it has been picked up, and a second time when it reaches the drop-off circle). The difference between these two measurements should be < 5 grams.	The robot will measure the bin mass twice (once when it has been picked up, and a second time when it reaches the drop-off circle). There should be no difference between these two measurements.	N/A
Identify the ceramic materials.	Robot must be able to identify the bin containing the ceramic materials, knowing that the bin will have a mass of 85-105 grams.	The robot will measure the bin mass twice (once when it has been picked up, and a second time when it reaches the drop-off circle). The difference between these two measurements should be < 5 grams.	The robot will measure the bin mass twice (once when it has been picked up, and a second time when it reaches the drop-off circle). There should be no difference between these two measurements.	N/A
Identify the metallic materials.	Robot must be able to identify the bin containing the metallic materials, knowing that the bin will have a mass of 115-135 grams.	The robot will measure the bin mass twice (once when it has been picked up, and a second time when it reaches the drop-off circle). The difference between these two measurements should be < 5 grams.	The robot will measure the bin mass twice (once when it has been picked up, and a second time when it reaches the drop-off circle). There should be no difference between these two measurements.	N/A
Identify bins quickly	Robot must be able to determine the contents of the bins in a small amount of time.	Time to determine bin < 5 seconds	Time < 1 second	N/A

Display the identified material: organic materials	Robot must display that it has identified organic materials on the screen.	When the robot outputs 'organic materials', the weight output is between 50 and 80 grams.	When the robot outputs 'organic materials', the weight output is between 55 and 75 grams.	N/A
Display the identified material: ceramic materials	Robot must display that it has identified ceramic materials on the screen.	When the robot outputs 'ceramic materials', the weight output is between 80 and 110 grams.	When the robot outputs 'ceramic materials', the weight output is between 85 and 105 grams.	N/A
Display the identified material: metallic materials	Robot must display that it has identified metallic materials on the screen.	When the robot outputs 'metallic materials', the weight output is between 110 and 140 grams.	When the robot outputs 'metallic materials', the weight output is between 115 and 135 grams.	N/A