CLAIMS

WHAT IS CLAIMED IS:

1. A tool for performing an operation in a workspace, the tool comprising:

a camera configured to generate an image of a field of view of the camera;

a second optical device located adjacent to the camera, the second optical device configured to project a second viewing plane in the image;

a processor coupled to the tool and configured to communicate with the camera and the second optical device;

a spray nozzle at an end of the tool; and

a paddle configured to be removably coupled to the end of the tool via the spray nozzle and disposed in the field of view of the camera;

wherein the processor is configured to define a first viewing plane as a centerline of the field of view,

wherein the processor is configured to rotate the paddle perpendicular to the second viewing plane and define the second viewing plane using two alignment features on the paddle,

wherein the first viewing plane and the second viewing plane intersect to define an intersection point on the image.

2. The tool of claim 1, wherein the second optical device projects a visible line corresponding to the second viewing plane.

3. The tool of claim 2, wherein the second optical device is a laser that projects the visible line into the field of view of the camera.

4. The tool of claim 1, wherein the second viewing plane is defined by the second optical device and the second viewing plane is superimposed over the image of field of view.

5. The tool of claim 1, wherein the first viewing plane and the second viewing plane intersect to define an axis and the intersection point is on the axis.

6. The tool of claim 1, wherein the processor is configured to detect the intersection point in the image.

7. The tool of claim 6, further comprising a control device that controls the orientation of the tool to align the intersection point with a desired location.

8. The tool of claim 1, wherein the paddle is configured to be received in the spray nozzle.

9. The tool of claim 8, wherein the paddle includes markings that define at least two points in the field of view of the camera.

10. The tool of claim 1, wherein the tool includes a proximal body, a distal body, and a wrist connecting proximal body and distal body.

11. The tool of claim 10, wherein the wrist includes at least two rotating actuators and the tool is configured to determine the angles of the at least two rotating actuators.

12. The tool of claim 11, wherein the at least two rotating actuators are configured to align the distal body with known points on a component while the proximal body remains stationary.

13. The tool of claim 12, wherein the tool is configured to determine a current position of the tool based on angles of the at least two rotating actuators and a plurality of known locations on a component, where the angles of the at least two rotating actuators are determined each when the distal body is aligned with each of the plurality of known locations.

14. The tool of claim 13, wherein the tool is configured to move to a desired position after determining the current position.

15. An alignment system comprising:

a control device communicatively coupled to a tool;

the tool comprising:

at least one processor communicatively coupled to the control device;

a first optical device having a field of view and a first viewing plane, wherein the at least one processor is configured to define a first viewing plane as a centerline of the field of view;

a second optical device located adjacent to the first optical device, the second optical device having a second viewing plane; and

a paddle coupled to the end of the tool and usable as a surface for projection of the first viewing plane and the second viewing plane;

wherein the at least one processor is configured to rotate the paddle perpendicular to the second viewing plane and define the second viewing plane using at least two alignment features on the paddle,

wherein the alignment system determines a location of an intersection of the first viewing plane and the second viewing plane within a workspace,

wherein the at least one processor communicates the location of the intersection in an image proximate to a known point on a component to the control device over a communication network, and

wherein the control device adjusts a position of the tool such that the intersection aligns with a desired location.

16. The alignment system of claim 15, wherein the control device and the at least one processor communicate wirelessly over the communication network.

17. The alignment system of claim 15, further comprising a display to display the field of view and at least one of the first viewing plane and the second viewing plane.

18. The alignment system of claim 15, wherein the paddle includes alignment features disposed on the surface.