WHAT IS CLAIMED IS:

1. A method (200) for controlling a robotic arm assembly (100) through an environment (148), the robotic arm assembly (100) comprising a robotic arm (104), a base (102), and a utility member (122), the robotic arm (104) extending between a root end (110) attached to the base (102) and a distal end (112) including the utility member (122), the method (200) comprising:

determining (202) a position of the base (102), the root end (110), or both relative to the environment (148);

determining (204) a task position and orientation (152) for the utility member (122) within the environment (148);

determining (206) a three-dimensional constraint of the environment (148); and

determining (214) a path (150) for the robotic arm (104) through the environment (148) based on each of the position of the base (102), the root end (110), or both relative to the environment (148), the task position and orientation (152) for the utility member (122) within the environment (148), and the three-dimensional constraint of the environment (148).

2. The method (200) of claim 1, further comprising:

directing (216) the robotic arm (104) through the environment (148) along the path (150) determined for the robotic arm (104) through the environment (148).

3. The method (200) of claim 2, wherein directing (216) the robotic arm (104) through the environment (148) along the path (150) determined for the robotic arm (104) comprises directing (218) the robotic arm (104) through the environment (148) along the path (150) using a tip following sequence.

4. The method (200) of claim 1, wherein the environment (148) is a gas turbine engine, and wherein determining (206) the three-dimensional constraint of the environment (148) comprises determining (208) the three-dimensional constraint of

the environment (148) using a three-dimensional electronic representation or model of the gas turbine engine.

5. The method (200) of claim 1, further comprising:

determining (210) a set of operability limitations of the robotic arm (104), and wherein determining (214) the path (150) for the robotic arm (104) through the environment (148) comprises determining (215) the path (150) for the robotic arm (104) through the environment (148) further based on the set of operability limitations of the robotic arm (104).

6. The method (200) of claim 5, wherein determining (210) the set of operability limitations of the robotic arm (104) comprises determining (212) a set of joint limitations of the robotic arm (104), a set of geometric limitations for a plurality of segments (108) of the robotic arm (104), or both.

7. The method (200) of claim 1, wherein the determined task position and orientation (152) for the utility member (122) is a first task position and orientation (152) for the utility member (122), wherein the path (150) for the robotic arm (104) through the environment (148) is a first path (150) for the robotic arm (104) through the environment (148), and wherein the method (200) further comprises:

determining (220) a second task position and orientation (152) for the utility member (122) within the environment (148); and

determining (222) a second path (150) for the robotic arm (104) through the environment (148) based on each of the position of the base (102), the root end (110), or both relative to the environment (148), the second task position and orientation (152) for the utility member (122) within the environment (148), and the three-dimensional constraint of the environment (148).

8. The method (200) of claim 7, further comprising:

determining (224) a transitional movement of the robotic arm (104) from the first path (150) to the second path (150).

9. The method (200) of claim 8, wherein determining (224) the transitional movement of the robotic arm (104) from the first path (150) to the second path (150) comprises interpolating (226) one or more transitional paths (150) between the first path (150) and the second path (150).

10. The method (200) of claim 7, wherein the first task position and orientation (152) for utility member (122) within the environment (148) is a starting point of a task, and wherein the second task position and orientation (152) for the utility member (122) within the environment (148) is an ending point of the task.

11. The method (200) of claim 1, wherein the path (150) for the robotic arm (104) through the environment (148) comprises a plurality of sequential vectors for the robotic arm (104) to follow.

12. A robotic arm (104) assembly comprising:

a base (102);

a utility member (122);

a robotic arm (104) extending between a root end (110) and a distal end (112), the root end (110) of the robotic arm (104) coupled to the base (102) and the distal end (112) including the utility member (122); and

a controller (124) operable with the base (102), the robotic arm (104), or both and comprising one or more processors (130) and memory (132), the memory (132) storing data (134), the data (134) including instructions that when executed by the one or more processors (130) cause the robotic arm (104) assembly to perform functions, the functions including:

determining a position of the base (102), the root end (110), or both relative to an environment (148);

determining a task position and orientation (152) for the utility member (122) within the environment (148);

determining a three-dimensional constraint of the environment (148); and

~~determining a path (150) for the robotic arm (104) through the environment (148) based on each of the position of the base (102), the root end (110), or both relative to the environment (148), the task position and orientation (152) for the utility member (122) within the environment (148), and the three-dimensional constraint of the environment (148).~~

~~13. The robotic arm (104) assembly of claim 12, wherein the instructions further comprise directing the robotic arm (104) through the environment (148) along the path (150) determined for the robotic arm (104) through the environment (148).~~

1. A method for controlling a robotic arm assembly through an environment, the robotic arm assembly comprising a robotic arm, a base, and a utility member, the robotic arm extending between a root end attached to the base and a distal end including the utility member, the method comprising:

determining a position of the base, the root end, or both relative to the environment;

determining a task position and orientation for the utility member within the environment;

determining a three-dimensional constraint of the environment; and

determining a path for the robotic arm through the environment based on each of the position of the base, the root end, or both relative to the environment, the task position and orientation for the utility member within the environment, and the three-dimensional constraint of the environment,

wherein the task position and orientation for utility member within the environment is a starting point or an ending point of a task, and

wherein the task is a cutting task, a welding task, or a drilling task.

2. The method of claim 1, further comprising:

directing the robotic arm through the environment along the path determined for the robotic arm through the environment.

3. The method of claim 2, wherein directing the robotic arm through the environment along the path determined for the robotic arm comprises directing the robotic arm through the environment along the path using a tip following sequence.

4. The method of claim 1, wherein the environment is a gas turbine engine, and wherein determining the three-dimensional constraint of the environment comprises determining the three-dimensional constraint the environment using a three-dimensional electronic representation or model of the gas turbine engine.

5. The method of claim 1, further comprising:

determining a set of operability limitations of the robotic arm, and wherein determining the path for the robotic arm through the environment comprises determining the path for the robotic arm through the environment further based on the set of operability limitations of the robotic arm.

6. The method of claim 5, wherein determining the set of operability limitations of the robotic arm comprises determining a set of joint limitations of the robotic arm, a set of geometric limitations for a plurality of segments of the robotic arm, or both.

7. The method of claim 1, wherein the determined task position and orientation for the utility member is a first task position and orientation for the utility member,

wherein the path for the robotic arm through the environment is a first path for the robotic arm through the environment, and wherein the method further comprises:

determining a second task position and orientation for the utility member within the environment; and

determining a second path for the robotic arm through the environment based on each of the position of the base, the root end, or both relative to the environment, the second task position and orientation for the utility member within the environment, and the three-dimensional constraint of the environment,

wherein determining the three-dimensional constraint of the environment comprises obtaining data indicative of position and orientation of cooling holes, and

wherein the task is drilling a hole or drilling through a clogged cooling hole.

8. The method of claim 7, further comprising:

determining a transitional movement of the robotic arm from the first path to the second path.

9. The method of claim 8, wherein determining the transitional movement of the robotic arm from the first path to the second path comprises interpolating one or more transitional paths between the first path and the second path.

10. The method of claim 7, wherein the first task position and orientation for utility member within the environment is the starting point of the task, and wherein the second task position and orientation for the utility member within the environment is the ending point of the task.

11. The method of claim 1, wherein the path for the robotic arm through the environment comprises a plurality of sequential vectors for the robotic arm to follow.

12. A computer implemented method for controlling a robotic arm assembly through a gas turbine engine, the robotic arm assembly comprising a robotic arm, a base, and a utility member, the robotic arm extending between a root end attached to the base and a distal end including the utility member, the method comprising:

determining, by one or more computing devices, a position of the base, the root end, or both relative to the gas turbine engine;

determining, by the one or more computing devices, a task position and orientation for the utility member within the gas turbine engine;

determining, by the one or more computing devices, a three-dimensional constraint of the gas turbine engine; and

determining, by the one or more computing devices, a path for the robotic arm through the gas turbine engine based on each of the position of the base, the root end, or both relative to the gas turbine engine, the task position and orientation for the utility member within the gas turbine engine, and the three-dimensional constraint of the gas turbine engine,

wherein the task position and orientation for utility member within the environment is a starting point or an ending point of a task, and

wherein the task is a cutting task, a welding task, or a drilling task.

13. The computer-implemented method of claim 12, further comprising:

directing, by the one or more computing devices, the robotic arm through the gas turbine engine along the path determined for the robotic arm through the gas turbine engine.

14. The computer-implemented method of claim 12, wherein determining, by the one or more computing devices, the three-dimensional constraint of the gas turbine engine comprises determining, by the one or more computing devices, the three-dimensional constraint the gas turbine engine using a CAD file of the gas turbine engine.

15. The computer-implemented method of claim 12, further comprising:

determining, by the one or more computing devices, a set of operability limitations of the robotic arm, and wherein determining, by the one or more computing devices, the path for the robotic arm through the gas turbine engine comprises determining, by the one or more computing devices, the path for the robotic arm through the gas turbine engine further based on the set of operability limitations of the robotic arm.

16. The computer-implemented method of claim 15, wherein determining, by the one or more computing devices, the set of operability limitations of the robotic arm comprises determining, by the one or more computing devices, a set of joint limitations of the robotic arm, a set of geometric limitations for a plurality of segments of the robotic arm, or both.

17. The computer-implemented method of claim 12, wherein the determined task position and orientation for the utility member is a first task position and orientation for the utility member, wherein the path for the robotic arm through the environment is a first path for the robotic arm through the gas turbine engine, and wherein the method further comprises:

determining, by the one or more computing devices, a second task position and orientation for the utility member within the gas turbine engine; and

determining, by the one or more computing devices, a second path for the robotic arm through the gas turbine engine based on each of the position of the base, the root end, or both relative to the gas turbine engine, the second task position and orientation for the utility member within the gas turbine engine, and the three-dimensional constraint of the gas turbine engine,

wherein determining the three-dimensional constraint of the environment comprises obtaining data indicative of position and orientation of cooling holes, and

wherein the task is drilling a hole or drilling through a clogged cooling hole.

18. The computer-implemented method of claim 17, further comprising:

determining, by the one or more computing devices, a transitional movement of the robotic arm from the first path to the second path.

19. A robotic arm assembly comprising:

a base;

a utility member;

a robotic arm extending between a root end and a distal end, the root end of the robotic arm coupled to the base and the distal end including the utility member; and

a controller operable with the base, the robotic arm, or both and comprising one or more processors and memory, the memory storing data, the data including instructions that when executed by the one or more processors cause the robotic arm assembly to perform functions, the functions including:

determining a position of the base, the root end, or both relative to an environment;

determining a task position and orientation for the utility member within the environment;

determining a three-dimensional constraint of the environment; and

determining a path for the robotic arm through the environment based on each of the position of the base, the root end, or both relative to the environment, the task position and orientation for the utility member within the environment, and the three-dimensional constraint of the environment,

wherein the task position and orientation for utility member within the environment is a starting point or an ending point of a task, and

wherein the task is a cutting task, a welding task, or a drilling task.

20. The robotic arm assembly of claim 19, wherein the instructions further comprise directing the robotic arm through the environment along the path determined for the robotic arm through the environment.