CLAIMS

WHAT IS CLAIMED IS:

1. A method of detecting damage to a gas turbine engine, the method comprising:

observing a thermal response of the engine during a thermal transition occurring when the engine transitions between an elevated temperature and a lesser temperature;

determining potential damage to the gas turbine engine based on the observed thermal response of the gas turbine engine; and

generating an action in response to the determined potential damage to the gas turbine engine.

2. The method of claim 1, wherein determining the potential damage to the gas turbine engine comprises

determining one or more thermal gradients in the engine during the cooling duration;

comparing the one or more thermal gradients with one or more predetermined thermal gradient margins; and

determining when the one or more thermal gradients is outside of the one or more predetermined thermal gradient margins.

3. The method of claim 2, wherein determining the one or more thermal gradients is performed by one or more computing devices in electronic communication with a thermal imaging camera observing the thermal response of the engine.

4. The method of claim 2, wherein the one or more predetermined thermal gradient margins are determined at least in part in view of fleetwide workscopes and information associated therewith.

5. The method of claim 2, wherein the predetermined thermal gradient margin comprises an acceptable range of thermal gradients.

6. The method of claim 1, wherein the thermal transition occurs from a cooling condition between the engine at operating temperature and ambient temperature.

~~7. The method of claim 1, wherein observing the thermal response is performed by a thermal imaging device of an at least partially autonomous robotic assembly.~~

~~8. The method of claim 7, wherein the robotic assembly is configured to move relative to the engine during the step of observing the thermal response.~~

~~9. The method of claim 1, further comprising, in response to generating the action, inspecting an area of the engine corresponding to a location of the observed thermal response of the gas turbine engine.~~

~~10. The method of claim 1, wherein the thermal transition occurs at least in part in response to at least one of forced cooling and forced heating on the engine.~~

~~11.~~1. A robotic assembly for detecting damage to equipment, the robotic assembly comprising:

a platform;

a drive assembly;

a local computing device to control the drive assembly to move the platform and navigate the platform ~~configured to move~~ through an environment from a first location away from the equipment to a second location containing the equipment based on instructions received from a remote computing device and signals from an environmental capture device, ~~containing the equipment,~~ the platform being an autonomous ~~or semi-autonomous~~ platform;

~~an environmental capture device coupled to the platform~~ and configured to aid in autonomous navigation and to observe a thermal response of a gas turbine engine during a cooling transition occurring between an elevated temperature and a lesser temperature by moving the environmental capture device relative to the gas turbine engine, wherein the elevated temperature occurs based on a prior gas turbine engine operation, and wherein the cooling transition is caused by forced cooling on an exterior surface of the gas turbine engine; and ~~observe a thermal response of the equipment during a thermal transition occurring between an elevated temperature and a lesser temperature; and~~

one or more computing devices configured to:

from information generated by the environmental capture device, determine one or more thermal gradients in the equipment during the cooling transition;

compare the one or more thermal gradients with predetermined thermal gradient margins;

determine when the thermal gradients exceed the predetermined thermal gradient margins; and

generate an action when the thermal ~~gradient is~~ gradients are outside of the predetermined thermal gradient margin.

~~12.~~2. The ~~service equipment~~ robotic assembly of claim ~~11~~1, wherein the environmental capture device comprises a thermal imaging camera.

~~13.~~3. The robotic assembly ~~service equipment~~ of claim ~~11~~1, wherein, in response to the generated action, the one or more computing devices is further configured to cause the robotic assembly to further inspect an area of the equipment corresponding to a location where the thermal ~~gradient~~ gradients exceeded the predetermined thermal gradient margin.

~~14.~~4. The robotic assembly ~~service equipment~~ of claim ~~11~~1, wherein the robotic assembly is configured to move through the environment while the environmental capture device observes the thermal response.

~~15.~~5. The robotic assembly ~~service equipment~~ of claim ~~11~~1, ~~wherein the equipment comprises a gas turbine engine, and~~ wherein the elevated temperature is at least 300˚F.

~~16.~~6. The robotic assembly ~~service equipment~~ of claim ~~11~~1, wherein the predetermined thermal gradient margins are at least partially-autonomously adjusted by the one or more computing devices in response to aggregate data compiled by comparing thermal gradients with predetermined cooling gradient margins on a fleet of equipment.

~~17. A computer implemented method for detecting damage to equipment, the method comprising:~~

~~receiving, by one or more computing devices, information from an environmental capture device, the information capturing thermal conditions of the equipment~~

~~during a cooling transition occurring from an elevated temperature to a lesser temperature;~~

~~determining, by the one or more computing devices, cooling gradients in the equipment during the cooling transition;~~

~~determining, by the one or more computing devices, potential damage to the gas turbine engine based at least in part on the determined cooling gradients; and~~

~~causing to generate, by the one or more computing devices, an action in response to the determined potential damage to the gas turbine engine.~~

~~18. The method of claim 17, further comprising causing, in response to the generated action, a robotic assembly to further inspect an area of the equipment corresponding to a location where the cooling gradient was determined.~~

~~19. The method of claim 17, further comprising:~~

~~comparing, by the one or more computing devices, the cooling gradients with cooling gradient margins; and~~

~~wherein determining the potential damage to the gas turbine engine comprises determining the potential damage to the gas turbine engine in response to the cooling gradients being outside of the cooling gradient margins.~~

~~20. The method of claim 19, further comprising adjusting, by the one or more computing devices, the cooling gradient margin in response to aggregate data compiled by comparing cooling gradients with cooling gradient margins on a fleet of equipment.~~

7. The robotic assembly of claim 11, wherein the forced cooling occurs after landing.

8. The robotic assembly of claim 1, wherein the predetermined thermal gradient margins are based on a prior scan of the equipment.

9. The robotic assembly of claim 1, wherein the predetermined thermal gradient margins are based on a present scan of the equipment.

10. The robotic assembly of claim 1, wherein the predetermined thermal gradient margins are based on a theoretical predetermined thermal gradient of the equipment.

11. The robotic assembly of claim 1, wherein the local computing device is disposed locally on the robotic assembly.

12. The robotic assembly of claim 1, wherein the local computing device is contained within the environment.

13. The robotic assembly of claim 1, wherein the local computing device is contained near the second location.

14. The robotic assembly of claim 1, wherein the remote computing device is contained within the environment.

15. The robotic assembly of claim 1, wherein the remote computing device is contained near the second location.

16. The robotic assembly of claim 1, wherein the remote computing device is contained in an off-site location away from the environment.