CLAIMS

1. A gas turbine engine comprising:

a shaft;

a turbine configured to drive the shaft, the turbine including at least one stage comprising a plurality of turbine vanes adjacent a plurality of turbine blades; and

wherein the plurality of vanes includes at least one variable vane movable between a closed position to reduce gaspath flow and an open position to increase gaspath flow, and wherein movement of the at least one variable vane is controlled based on an engine limiting condition.

2. The gas turbine engine according to claim 1, wherein the engine limiting condition comprises a temperature at a predetermined engine operational condition.

3. The gas turbine engine according to claim 2, wherein the predetermined engine operational condition comprises a takeoff condition, and wherein the variable vane is configured to be in the open position during the take-off condition when the temperature exceeds a predetermined temperature level.

4. The gas turbine engine according to claim 2, wherein the variable vane is configured to be in a more closed position during a cruise condition than in a takeoff position.

5. The gas turbine engine according to claim 1, wherein the engine limiting condition comprises a takeoff condition, and wherein the variable vane is configured to be in a more open position during takeoff conditions, and wherein the variable vane is configured to be in a more closed position during cruise conditions.

6. The gas turbine engine according to claim 5, wherein the variable vane is initiated to immediately move to a more open position in response to an increase in throttle for a take-off event or to move to a more open position as engine power is moved from part power to claim power.

7. The gas turbine engine according to claim 1, wherein the variable vane is controlled as a function of corrected fan rotor speed.

8. The gas turbine engine according to claim 1, wherein the at least one stage comprises at least a first stage and a second stage spaced aft of the first stage, and wherein the at least one variable vane is associated with the first stage.

9. The gas turbine engine according to claim 8, wherein the second stage includes at least one variable vane.

10. The gas turbine engine according to claim 8, wherein the at least one variable vane comprises a plurality of variable vanes.

11. The gas turbine engine according to claim 8, wherein the first and second stages comprise the only stages of the turbine.

12. The gas turbine engine according to claim 1, wherein the turbine comprises a high pressure turbine positioned upstream of a lower pressure turbine, and wherein the shaft comprises a first shaft driven by the high pressure turbine and including a second shaft driven by the lower pressure turbine.

13. The gas turbine engine according to claim 8, including a fan driven by the second shaft via a geared architecture.

14. A gas turbine engine comprising:

a first shaft;

a first turbine that drives the first shaft;

a fan driven by the first shaft via a speed change mechanism;

a second shaft rotatable relative to the first shaft; and

a second turbine configured to drive the second shaft, the second turbine including at least one stage comprising a plurality of turbine vanes adjacent a plurality of turbine blades, and wherein the plurality of vanes includes at least one variable vane movable between an open position during a take-off condition and is selectively closed as the air craft progress to a cruise condition.

15. The gas turbine engine according to claim 14, wherein movement of the at least one variable vane is controlled based on a temperature at a predetermined engine operational condition.

16. The gas turbine engine according to claim 14, wherein the variable vane is controlled as a function of corrected fan rotor speed.

17. The gas turbine engine according to claim 15, wherein the predetermined engine operational condition comprises a takeoff condition, and wherein the variable vane is configured to be in the open position during take-off conditions when the temperature exceeds a predetermined temperature level, and wherein the variable vane is configured to be in the closed position during cruise conditions.

18. The gas turbine engine according to claim 14, wherein the at least one variable vane comprises a plurality of variable vanes.

19. The gas turbine engine according to claim 14, wherein the at least one stage comprises at least a first stage and a second stage spaced aft of the first stage, and wherein the at least one variable vane is associated with the first stage.

20. The gas turbine engine according to claim 19, wherein the second stage includes at least one variable vane.

21. The gas turbine engine according to claim 19, wherein the first and second stages comprise the only stages of the turbine with the first stage including the variable vane and the second stage being comprised of non-variable vanes.

22. The gas turbine engine according to claim 14, wherein the second shaft is spaced radially outwardly relative to the first shaft, and wherein the first turbine comprises a low pressure turbine and the second turbine comprises a high pressure turbine.

23. The gas turbine engine according to claim 14, wherein the speed change mechanism that drives the fan comprises a geared architecture.

24. The gas turbine engine according to claim 14, wherein variable vane position is controlled based on inputs comprising at least fuel flow and ambient temperature to provide an output to control temperature at one or more desired engine locations.

25. A method for controlling a gas turbine engine comprising the steps of :

(a) identifying an engine limiting condition; and

(b) generating a control signal to move a variable turbine vane to a desired vane position to address the engine limiting condition.

26. The method according to claim 25, wherein the engine limiting condition comprises a takeoff condition, and generating a control signal to move the variable vane to be in a more open position during take-off conditions, and generating a control signal to move the variable vane to be in a more closed position during cruise conditions.

27. The method according to claim 26, including generating a control signal to immediately move the variable vane to a more open position in response to an increase in throttle for a take-off event, or to move to a more open position as engine power is moved from part power to claim power.

CLAIMS

1. A gas turbine engine comprising:

   a shaft;

   a turbine configured to drive the shaft, the turbine including at least one stage comprising a plurality of turbine vanes adjacent a plurality of turbine blades; and

   wherein the plurality of vanes includes at least one variable vane movable between a closed position to reduce gaspath flow and an open position to increase gaspath flow, and wherein movement of the at least one variable vane is controlled based on at least one engine limiting condition wherein the at least one engine limiting condition comprises at least a takeoff condition.

2. The gas turbine engine according to claim 1, wherein the engine limiting condition comprises a temperature at a predetermined engine operational condition.

3. The gas turbine engine according to claim 2, wherein the variable vane is configured to be in the open position during the take-off condition when the temperature exceeds a predetermined temperature level that is based on a maximum allowable temperature level at a rear stage of a high pressure compressor.

4. The gas turbine engine according to claim 2, wherein the variable vane is configured to be in a more closed position during a cruise condition than in a takeoff position.

5. The gas turbine engine according to claim 1, wherein the variable vane is configured to be in a more open position during take-off conditions, and wherein the variable vane is configured to be in a more closed position during cruise conditions.

6. The gas turbine engine according to claim 5, wherein the variable vane is initiated to immediately move to a more open position in response to an increase in throttle for a take-off event or to move to a more open position as engine power is moved from part power to claim power.

7. The gas turbine engine according to claim 1, wherein the variable vane is controlled as a function of corrected fan rotor speed that comprises actual fan rotor speed modified by a temperature correction factor.

8. The gas turbine engine according to claim 1, wherein the turbine comprises a high pressure turbine, and comprising at least a first stage and a second stage spaced aft of the first stage, and wherein the at least one variable vane is associated with the first stage.

9. The gas turbine engine according to claim 8, wherein the second stage includes at least one variable vane.

10. The gas turbine engine according to claim 8, wherein the at least one variable vane comprises a plurality of variable vanes.

11. The gas turbine engine according to claim 8, wherein the first and second stages comprise the only stages of the high pressure turbine, and including a low pressure turbine downstream of the high pressure turbine.

12. The gas turbine engine according to claim 1, wherein the turbine comprises a high pressure turbine positioned upstream of a lower pressure turbine, and wherein the shaft comprises a first shaft driven by the high pressure turbine and including a second shaft driven by the lower pressure turbine, and wherein the high pressure turbine includes first and second stages with the at least one variable vane being positioned in the second stage.

13. The gas turbine engine according to claim 8, including a low pressure turbine positioned downstream of the high pressure turbine, and wherein the shaft comprises a first shaft driven by the high pressure turbine and including a second shaft driven by the low pressure turbine, and including a fan driven by the second shaft via a geared architecture.

14. A gas turbine engine comprising:

a first shaft;

a first turbine that drives the first shaft;

a fan driven by the first shaft via a speed change mechanism;

a second shaft rotatable relative to the first shaft; and

a second turbine configured to drive the second shaft, the second turbine including at least one stage comprising a plurality of turbine vanes adjacent a plurality of turbine blades, and wherein the plurality of vanes includes at least one variable vane movable between an open position during a take-off condition and is selectively closed as the air craft progress to a cruise condition.

15. The gas turbine engine according to claim 14, wherein movement of the at least one variable vane is controlled based on a temperature at a predetermined engine operational condition.

16. The gas turbine engine according to claim 14, wherein the variable vane is controlled as a function of corrected fan rotor speed that comprises actual fan rotor speed modified by a temperature correction factor.

17. The gas turbine engine according to claim 15, wherein the variable vane is configured to be in the open position during take-off conditions when the temperature exceeds a predetermined temperature level that is based on a maximum allowable temperature level at a rear stage of a high pressure compressor, and wherein the variable vane is configured to be in the closed position during cruise conditions.

18. The gas turbine engine according to claim 14, wherein the at least one variable vane comprises a plurality of variable vanes.

19. The gas turbine engine according to claim 14, wherein the at least one stage comprises at least a first stage and a second stage spaced aft of the first stage, and wherein the at least one variable vane is associated with the first stage.

20. The gas turbine engine according to claim 19, wherein the second stage includes at least one variable vane.

21. The gas turbine engine according to claim 19, wherein the first and second stages comprise the only stages of the turbine with the first stage including the variable vane and the second stage being comprised of non-variable vanes.

22. The gas turbine engine according to claim 14, wherein the second shaft is spaced radially outwardly relative to the first shaft, and wherein the first turbine comprises a low pressure turbine and the second turbine comprises a high pressure turbine, and comprising at least a first stage and a second stage spaced aft of the first stage, and wherein the at least one variable vane is associated with the second stage.

23. The gas turbine engine according to claim 14, wherein the speed change mechanism that drives the fan comprises a geared architecture.

24. The gas turbine engine according to claim 14, wherein variable vane position is controlled based on inputs comprising at least fuel flow and ambient temperature to provide an output to control temperature at one or more desired engine locations.

25. A method for controlling a gas turbine engine comprising the steps of:

(a) identifying at least one engine limiting condition that includes at least a takeoff condition; and

(b) generating a control signal to actuate a control to move a variable turbine vane to a desired vane position to address the engine limiting condition.

26. The method according to claim 25, including generating a control signal to move the variable vane to be in a more open position during take-off conditions, and generating a control signal to move the variable vane to be in a more closed position during cruise conditions.

27. The method according to claim 26, including generating a control signal to immediately move the variable vane to a more open position in response to an increase in throttle for a take-off event, or to move to a more open position as engine power is moved from part power to claim power.

28. The method according to claim 25, including controlling the variable vane as a function of corrected fan rotor speed that comprises actual fan rotor speed modified by a temperature correction factor.

29. The method according to claim 25, including moving the variable vane to be in an open position during the take-off condition when the temperature exceeds a predetermined temperature level that is based on a maximum allowable temperature level at a rear stage of a high pressure compressor.

30. The method according to claim 25, including positioning the variable turbine vane in a first stage of a high pressure turbine, and controlling the variable turbine vane based on a temperature measured at an inlet to the high pressure turbine.

31. The method according to claim 25, including positioning the variable turbine vane in a high pressure turbine that includes first and second stages, the variable turbine vane being positioned within the second stage which is downstream of the first stage.

32. The gas turbine engine according to claim 14, wherein the second turbine comprises a high pressure turbine, and wherein movement of the at least one variable vane is controlled based on a temperature measured at an inlet to the second turbine.

33. The gas turbine engine according to claim 1, including a temperature sensor positioned to measure a temperature at the variable vane, and wherein movement of the variable vane is controlled based on a temperature measured at the variable vane.