CLAIMS

What is claimed is:

1. A method of managing a gas turbine engine operating line comprising the steps of:

detecting an airspeed;

detecting a fan speed;

referencing a parameter relationship related to desired variable area fan nozzle position based upon at least airspeed and fan speed, and comparing the detected airspeed and detected fan speed to the parameter relationship to determine a target variable area fan nozzle position; and

adjusting an actual variable area fan nozzle position in response to the determination of the target area fan nozzle position.

2. The method according to claim 1, wherein the fan speed detecting step includes detecting a low speed spool rotational speed, and correcting the fan speed based upon an ambient temperature.

3. The method according to claim 2, wherein the fan speed detecting step includes calculating the fan speed based upon a gear reduction ratio.

4. The method according to claim 1, wherein the referencing and comparing steps include providing a target variable area fan nozzle position for a range of air speeds based upon the fan

speed, wherein the fan speed is not needed for air speeds outside of the range when determining the target variable area fan nozzle position.

5. The method according to claim 4, wherein the air speed range is 0.35-0.55 Mach, and the data table includes first and second thresholds corresponding to lower and upper fan speed limits, the target variable area fan nozzle position selected based upon the first and second thresholds.

6. The method according to claim 5, wherein the upper fan speed limit is 60% of the fan aerodynamic design speed, and the lower fan speed limit is 75% of the fan aerodynamic design speed.

7. The method according to claim 5, wherein the upper fan speed limit is 65% of the fan aerodynamic design speed.

8. The method according to claim 5, wherein the lower fan speed limit is 75% of the fan aerodynamic design speed.

9. The method according to claim 1, wherein the adjusting step includes adjusting a fan nacelle exit area to the target variable fan nozzle position.

10. The method according to claim 9, wherein the adjusting step includes adjusting a fan nacelle exit area approximately to the target variable fan nozzle position.

11. The method according to claim 9, wherein the adjusting step includes translating flaps to selectively block a vent in the fan nacelle.

12. The method according to claim 1, wherein the gas turbine engine comprises:

a fan arranged in a fan nacelle including a flap configured to be movable between first and second positions;

an actuator operatively coupled to the flap;

a compressor section fluidly connected to the fan, the compressor comprising a high pressure compressor and a low pressure compressor;

a combustor fluidly connected to the compressor section;

a turbine section fluidly connected to the combustor, the turbine section comprising:

a high pressure turbine coupled to the high pressure compressor via a shaft; and

a low pressure turbine.

13. The method according to claim 12, wherein the gas turbine engine is a high bypass geared aircraft engine having a bypass ratio of greater than about six (6).

14. The method according to claim 12, wherein the gas turbine engine includes a low Fan Pressure Ratio of less than about 1.45.

15. The method according to claim 12, wherein the low pressure turbine has a pressure ratio that is greater than about 5.

16. A gas turbine engine comprising:

a fan nacelle including a flap configured to be movable between first and second positions;

an actuator operatively coupled to the flap; and

a controller configured to reference a parameter relationship that related to a desired variable area fan nozzle position based upon at least airspeed and fan speed, the controller configured to compare a detected airspeed and a detected fan speed to the parameter relationship to determine a target variable area fan nozzle position, and the controller configured to provide a command to the actuator to adjust the flap from a first position to the second position in response to the determination of the target variable fan nozzle position.

17. The gas turbine engine according to claim 16, comprising:

a fan arranged in a fan nacelle;

a compressor section fluidly connected to the fan, the compressor comprising a high pressure compressor and a low pressure compressor;

a combustor fluidly connected to the compressor section;

a turbine section fluidly connected to the combustor, the turbine section comprising:

a high pressure turbine coupled to the high pressure compressor via a shaft; and

a low pressure turbine.

18. The gas turbine engine according to claim 17, wherein the gas turbine engine is a high bypass geared aircraft engine having a bypass ratio of greater than about six (6).

19. The gas turbine engine according to claim 17, wherein the gas turbine engine includes a low Fan Pressure Ratio of less than about 1.45.

20. The gas turbine engine according to claim 17, wherein the low pressure turbine has a pressure ratio that is greater than about 5.

21. The gas turbine engine according to claim 16, wherein the controller is configured to provide a target variable area fan nozzle position for a range of air speeds based upon the fan speed, the air speed range is 0.35-0.55 Mach, and the data table includes first and second thresholds corresponding to lower and upper fan speed limits, the target variable area fan nozzle position selected based upon the first and second thresholds.

CLAIMS

1. A method of managing a gas turbine engine operating line comprising the steps of:

detecting an airspeed;

detecting a fan speed;

referencing a parameter relationship related to desired variable area fan nozzle position based upon at least airspeed and fan speed, and comparing the detected airspeed and detected fan speed to the parameter relationship to determine a target variable area fan nozzle position; and

adjusting an actual variable area fan nozzle position in response to the determination of the target area fan nozzle position; and

wherein the referencing and comparing steps include providing a target variable area fan nozzle position for a range of air speeds based upon the fan speed, wherein the fan speed is not needed for air speeds outside of the range when determining the target variable area fan nozzle position.

2. The method according to claim 1, wherein the fan speed detecting step includes detecting a low speed spool rotational speed, and correcting the fan speed based upon an ambient temperature.

3. The method according to claim 2, wherein the fan speed detecting step includes calculating the fan speed based upon a gear reduction ratio.

4. The method according to claim 1, wherein the air speed range is 0.35-0.55 Mach, and the data table includes first and second thresholds corresponding to lower and upper fan

speed limits, the target variable area fan nozzle position selected based upon the first and second thresholds.

5. The method according to claim 4, wherein the upper fan speed limit is 60% of the fan aerodynamic design speed, and the lower fan speed limit is 75% of the fan aerodynamic design speed.

6. The method according to claim 4, wherein the upper fan speed limit is 65% of the fan aerodynamic design speed.

7. The method according to claim 4, wherein the lower fan speed limit is 75% of the fan aerodynamic design speed.

8. The method according to claim 1, wherein the adjusting step includes adjusting a fan nacelle exit area to the target variable fan nozzle position.

9. The method according to claim 8, wherein the adjusting step includes adjusting a fan nacelle exit area approximately to the target variable fan nozzle position.

10. The method according to claim 8, wherein the adjusting step includes translating flaps to selectively block a vent in the fan nacelle.

11. The method according to claim 1, wherein the gas turbine engine comprises:

a fan arranged in a fan nacelle including a flap configured to be movable between first and second positions;

an actuator operatively coupled to the flap;

a compressor section fluidly connected to the fan, the compressor comprising a high pressure compressor and a low pressure compressor;

a combustor fluidly connected to the compressor section;

a turbine section fluidly connected to the combustor, the turbine section comprising:

a high pressure turbine coupled to the high pressure compressor via a shaft; and a low pressure turbine.

12. The method according to claim 11, wherein the gas turbine engine is a high bypass geared aircraft engine having a bypass ratio of greater than about six (6).

13. The method according to claim 11, wherein the gas turbine engine includes a low Fan Pressure Ratio of less than about 1.45.

14. The method according to claim 11, wherein the low pressure turbine has a pressure ratio that is greater than about 5.

15. A gas turbine engine comprising:

a fan nacelle including a flap configured to be movable between first and second positions;

an actuator operatively coupled to the flap; and

a controller configured to reference a parameter relationship that related to a desired variable area fan nozzle position based upon at least airspeed and fan speed, the controller configured to compare a detected airspeed and a detected fan speed to the parameter relationship to determine a target variable area fan nozzle position, and the controller configured to provide a command to the actuator to adjust the flap from a first position to the second position in response to the determination of the target variable fan nozzle position; and

wherein the controller is configured to provide a target variable area fan nozzle position for a range of air speeds based upon the fan speed, the air speed range is 0.35-0.55 Mach, and the data table includes first and second thresholds corresponding to lower and upper fan speed limits, the target variable area fan nozzle position selected based upon the first and second thresholds.

16. The gas turbine engine according to claim 15, comprising:

a fan arranged in a fan nacelle;

a compressor section fluidly connected to the fan, the compressor comprising a high pressure compressor and a low pressure compressor;

a combustor fluidly connected to the compressor section;

a turbine section fluidly connected to the combustor, the turbine section comprising:

a high pressure turbine coupled to the high pressure compressor via a shaft; and a low pressure turbine.

17. The gas turbine engine according to claim 16, wherein the gas turbine engine is a high bypass geared aircraft engine having a bypass ratio of greater than about six (6).

18. The gas turbine engine according to claim 16, wherein the gas turbine engine includes a low Fan Pressure Ratio of less than about 1.45.

19. The gas turbine engine according to claim 16, wherein the low pressure turbine has a pressure ratio that is greater than about 5.