CLAIMS

1. A gas turbine engine comprising:

a fan rotatable about an axis;

a compressor section having a low pressure compressor section and a high pressure compressor section;

a combustor in fluid communication with the compressor section;

a turbine section in fluid communication with the combustor, said turbine section having a low pressure turbine section and a high pressure turbine section; and

a speed change system driven by the turbine section,

wherein said fan is driven in a first direction by the turbine section through the speed change system,

wherein said low pressure compressor section and said low pressure turbine section rotate about said axis in the first direction, and

wherein said high pressure compressor section and said high pressure turbine section rotate about said axis in a second direction opposite said first direction.

2. The gas turbine engine of claim 1, including a power density of greater than about 1.5 lbf/in^3 and less than or equal to about 5.5 lbf/in^3.

3. The turbine engine of claim 1, wherein said speed change system comprises a geared architecture.

4. The turbine engine of claim 3, wherein said geared architecture is a planetary geared architecture.

5. The turbine engine of claim 4, wherein said planetary geared architecture includes a sun gear driven by the turbine section, a plurality of planetary gears driven by the sun gear, a carrier supporting each of the plurality of planetary gears and a ring gear, and wherein the fan is attached to the carrier for rotation in the first direction.

6. The turbine engine of claim 5, wherein the low pressure turbine section drives a first shaft, which drives the sun gear.

7. The turbine engine of claim 1, including a mid-turbine frame between said low pressure turbine section and said high pressure turbine section, wherein said mid-turbine frame comprises a fixed vane.

8. The turbine engine of claim 7, wherein said fixed vane of said mid-turbine frame comprises a plurality of airfoils operable to direct airflow entering said low pressure turbine section.

9. The turbine engine of claim 8, wherein the mid-turbine frame includes a strut for supporting a bearing supporting rotation of a portion of the turbine section.

10. The turbine engine of claim 7, wherein said fixed vane comprises an inlet vane for the low pressure turbine section.

11. The turbine engine of claim 1, wherein said high pressure turbine section includes two stages.

12. The turbine engine of claim 1, wherein said high pressure turbine section includes a single stage.

13. The turbine engine of claim 1, wherein said low pressure turbine section includes at least one powdered metal disc.

14. The turbine engine of claim 1, wherein said low pressure turbine section includes at least one stage comprising single crystal turbine blades.

15. The turbine engine of claim 1, wherein said low pressure turbine section includes at least one stage comprising directionally solidified turbine blades.

16. The turbine engine of claim 1, wherein said low pressure turbine section is at least partially constructed of an aluminum lithium material.

17. A method for increasing a power density of a gas turbine engine comprising the step of:

rotating a low pressure turbine section and a low pressure compressor section in a first direction;

rotating a high pressure turbine section and a high pressure compressor section in a second direction opposite the first direction; and

driving a fan through a speed change system in the first direction such that the low pressure turbine section and low pressure compressor section rotate at a speed greater than the fan.

18. The method of claim 17, further comprising the step of reducing a volume of the low pressure turbine section by directing high speed gas flow entering said low pressure turbine section with a mid-turbine frame vane.

19. The method of claim 18, including housing a mid-turbine frame strut within said mid-turbine frame vane.

20. The method of claim 17, including generating a power density that is greater than or equal to about 1.5 lbf/in^3 and less than or equal to about 5.5 lbf/in^3.

CLAIMS:

1. A gas turbine engine comprising:

a fan rotatable about an axis;

a compressor section having a low pressure compressor section and a high pressure compressor section;

a combustor in fluid communication with the compressor section;

a turbine section in fluid communication with the combustor, said turbine section having a low pressure turbine section and a high pressure turbine section; and

a speed change system driven by the turbine section through a shaft rotatable about the axis,

wherein said fan is driven in a first direction by the turbine section through the speed change system at a speed different than the low pressure compressor section and the turbine section,

wherein said low pressure compressor section is coupled to the low pressure turbine by the shaft such that both the low pressure turbine section and the low pressure compressor rotate about said axis in the first direction at the same speed, and

wherein said high pressure compressor section and said high pressure turbine section rotate about said axis in a second direction opposite said first direction.

2. The gas turbine engine of claim 1, including a power density of greater than about 1.5 lbf/in^3 and less than or equal to about 5.5 lbf/in^3.

3. The turbine engine of claim 1, wherein said speed change system comprises a geared architecture.

4. The turbine engine of claim 3, wherein said geared architecture is a planetary geared architecture.

5. The turbine engine of claim 4, wherein said planetary geared architecture includes a sun gear driven by the turbine section, a plurality of planetary gears driven by the sun gear,

a carrier supporting each of the plurality of planetary gears and a ring gear, and wherein the fan is attached to the carrier for rotation in the first direction.

6. The turbine engine of claim 5, wherein the low pressure turbine section drives the shaft, which drives the sun gear.

7. The turbine engine of claim 1, including a mid-turbine frame between said low pressure turbine section and said high pressure turbine section, wherein said mid-turbine frame comprises a fixed vane.

8. The turbine engine of claim 7, wherein said fixed vane of said mid-turbine frame comprises a plurality of airfoils operable to direct airflow entering said low pressure turbine section.

9. The turbine engine of claim 8, wherein the mid-turbine frame includes a strut for supporting a bearing supporting rotation of a portion of the turbine section.

10. The turbine engine of claim 7, wherein said fixed vane comprises an inlet vane for the low pressure turbine section.

11. The turbine engine of claim 1, wherein said high pressure turbine section includes two stages.

12. The turbine engine of claim 1, wherein said high pressure turbine section includes a single stage.

13. The turbine engine of claim 1, wherein said low pressure turbine section includes at least one powdered metal disc.

14. The turbine engine of claim 1, wherein said low pressure turbine section includes at least one stage comprising single crystal turbine blades.

15. The turbine engine of claim 1, wherein said low pressure turbine section includes at least one stage comprising directionally solidified turbine blades.

16. The turbine engine of claim 1, wherein said low pressure turbine section is at least partially constructed of an aluminum lithium material.

17. A method for increasing a power density of a gas turbine engine comprising the step of:

rotating a low pressure turbine section coupled through a shaft to a low pressure compressor section in a first direction such that both the low pressure turbine and the low pressure compressor rotated at a common speed;

rotating a high pressure turbine section and a high pressure compressor section in a second direction opposite the first direction; and

driving a fan through a speed change system in the first direction such that the low pressure turbine section and the low pressure compressor section rotate at a speed greater than the fan.

18. The method of claim 17, further comprising the step of reducing a volume of the low pressure turbine section by directing high speed gas flow entering said low pressure turbine section with a mid-turbine frame vane.

19. The method of claim 18, including housing a mid-turbine frame strut within said mid-turbine frame vane.

20. The method of claim 17, including generating a power density that is greater than or equal to about 1.5 lbf/in^3 and less than or equal to about 5.5 lbf/in^3.