CLAIMS

What is claimed is:

1. A gas turbine engine comprising:

a shaft defining an axis of rotation;

a turbine section comprising:

an outer turbine rotor directly driving the shaft, the outer rotor including a first set of blades; and

an inner turbine rotor having a second set of blades interspersed with the first set of blades, the inner turbine rotor configured to rotate in an opposite direction about the axis of rotation from the outer turbine rotor; and

a gear system coupling the inner turbine rotor to the shaft and configured to rotate the second set of blades at a faster speed than the first set of blades, the gear system mounted to a mid-turbine frame.

2. The gas turbine engine according to claim 1, wherein the gear system is supported on the mid-turbine frame by a bearing.

3. The gas turbine engine according to claim 2, wherein the gear system includes a sun gear engaged to the inner turbine rotor, a plurality of star gears in meshing engagement with the sun gear, and a ring gear in meshing engagement the star gears.

4. The gas turbine engine according to claim 3, wherein the sun gear is fixed for rotation with an aft end of the inner turbine rotor.

5. The gas turbine engine according to claim 3, wherein the star gears are supported within a carrier that is fixed to the mid-turbine frame.

6. The gas turbine engine according to claim 3, wherein a fore end of the outer turbine rotor is coupled to the ring gear.

7. The gas turbine engine according to claim 2, including a first bearing supporting a fore end of the inner turbine rotor for rotation relative to the shaft and a second bearing supporting an aft end of the inner turbine rotor for rotation relative to the shaft.

8. The gas turbine engine according to claim 7, including a third bearing supporting the shaft for rotation relative to the mid-turbine frame.

9. The gas turbine engine according to claim 8, wherein the first, second, and third bearings are axially spaced apart from each other parallel to the axis of rotation with the third bearing being located forward of the first bearing.

10. The gas turbine engine according to claim 2, including a low pressure turbine static case having an aft end unsupported and a fore end connected to a mid-turbine frame first case.

11. The gas turbine engine according to claim 1, wherein a fore end of the shaft is associated with a counter-rotating low pressure compressor.

12. A gas turbine engine comprising:

a core air flowpath;

a shaft supporting a compressor section and a turbine section arranged within the core flowpath; and

wherein the turbine section includes a counter-rotating low pressure turbine comprising

an outer rotor directly driving the shaft, the outer rotor including a first set of blades,

an inner rotor having a second set of blades interspersed with the first set of blades, the inner rotor configured to rotate in an opposite direction about the axis of rotation from the outer rotor, and

a gear system coupling the inner rotor to the shaft and configured to rotate the second set of blades at a faster speed than the first set of blades, wherein the gear system is supported by a mid-turbine frame.

13. The gas turbine engine according to claim 12, wherein compressor section includes a high pressure compressor section that has a pressure ratio of approximately 23:1.

14. The gas turbine engine according to claim 12, wherein the compressor section includes a counter-rotating low pressure compressor driven by the shaft.

15. The gas turbine engine according to claim 14, wherein the gear system includes a sun gear engaged to the inner rotor, a plurality of star gears in meshing engagement with the sun gear, and a ring gear in meshing engagement with the star gears.

16. The gas turbine engine according to claim 15, wherein the sun gear is fixed for rotation with a fore end of the inner rotor, the star gears are supported within a carrier that is fixed to the mid-turbine frame, and a fore end of the outer rotor is coupled to the ring gear.

17. The gas turbine engine according to claim 12, including a first bearing supporting a fore end of the inner rotor for rotation relative to the shaft, a second bearing supporting an aft end of the inner rotor for rotation relative to the shaft, and a third bearing supporting the shaft for rotation relative to the mid-turbine frame.

18. The gas turbine engine according to claim 17, wherein the first, second, and third bearings are axially spaced apart from each other parallel to the axis of rotation with the third bearing being located upstream from the first bearing.

19. The gas turbine engine according to claim 17, wherein the first and third bearings are roller bearings and the second bearing is a ball bearing.

What is claimed is:

1. A gas turbine engine comprising:

a shaft defining an axis of rotation;

a turbine section including a high pressure turbine section and a low pressure turbine section, comprising:

an outer turbine rotor directly driving the shaft, the outer rotor including a first set of blades; and

an inner turbine rotor having a second set of blades interspersed with the first set of blades, the inner turbine rotor configured to rotate in an opposite direction about the axis of rotation from the outer turbine rotor;

a gear system coupling the inner turbine rotor to the shaft and configured to rotate the second set of blades at a faster speed than the first set of blades, the gear system mounted to a mid-turbine frame that is disposed between the high pressure turbine section and the low pressure turbine section;

a first bearing supporting a fore end of the inner turbine rotor for rotation relative to the shaft;

a second bearing supporting an aft end of the inner turbine rotor for rotation relative to the shaft; and

a third bearing supporting the shaft for rotation relative to the mid-turbine frame.

2. The gas turbine engine according to claim 1, wherein the first, second, and third bearings are axially spaced apart from each other parallel to the axis of rotation with the third bearing being located forward of the first bearing.

3. A gas turbine engine comprising:

a core air flowpath;

a shaft supporting a compressor section and a turbine section arranged within the core flowpath, the turbine section includes a high pressure turbine section and a low pressure turbine section; and

wherein the turbine section includes a counter-rotating low pressure turbine comprising

an outer rotor directly driving the shaft, the outer rotor including a first set of blades,

an inner rotor having a second set of blades interspersed with the first set of blades, the inner rotor configured to rotate in an opposite direction about the axis of rotation from the outer rotor.

a gear system coupling the inner rotor to the shaft and configured to rotate the second set of blades at a faster speed than the first set of blades, wherein the gear system is supported by a mid-turbine frame that is disposed between the high pressure turbine section and the low pressure turbine section; and

a first bearing supporting a fore end of the inner rotor for rotation relative to the shaft, a second bearing supporting an aft end of the inner rotor for rotation relative to the shaft, and a third bearing supporting the shaft for rotation relative to the mid-turbine frame.

4. The gas turbine engine according to claim **3**, wherein the first, second, and third bearings are axially spaced apart from each other parallel to the axis of rotation with the third bearing being located upstream from the first bearing.

5. The gas turbine engine according to claim **3**, wherein the first and third bearings are roller bearings and the second bearing is a ball bearing.