WHAT IS CLAIMED IS:

1. A gas turbine engine, comprising:

a low pressure spool including:

a low pressure compressor configured for a rearward air flow; and

a low pressure turbine disposed aft of the low pressure compressor and configured for a forward air flow;

a high pressure spool disposed aft of the low pressure spool and including:

a high pressure turbine disposed aft of the low pressure turbine and configured for a forward air flow;

a combustor disposed aft of the high pressure turbine; and

a high pressure compressor disposed aft of the combustor and configured for a forward air flow, the high pressure compressor including a primary stage, including a set of primary rotors, and a secondary stage, including a set of secondary rotors, wherein the primary stage is disposed aft of the secondary stage; and

a clutch configured to selectively engage the primary and secondary stages, the clutch disposed aft of the high pressure compressor.

2. The gas turbine engine of claim 1, in which the high pressure spool includes a primary shaft coupled to the high pressure turbine and the primary rotors of the high pressure compressor, and a secondary shaft coupled to the secondary rotors of the high pressure compressor.

3. The gas turbine engine of claim 2, in which the clutch selectively engages the secondary shaft to the primary shaft, thereby to selectively engage the secondary stage to the primary stage.

4. The gas turbine engine of claim 3, in which the primary shaft includes an aft end, the secondary shaft includes an aft end, and the clutch is disposed adjacent the aft ends of the primary and secondary shafts.

5. The gas turbine engine of claim 1, further comprising a compressor diffuser configured to fluidly communicate from the high pressure compressor primary

stage to the combustor, thereby producing a bypass flow around the high pressure compressor secondary stage.

6. The gas turbine engine of claim 1, in which the set of secondary rotors comprises at least two secondary rotors.

7. The gas turbine engine of claim 1, further comprising a generator directly coupled to the high pressure spool.

8. The gas turbine engine of claim 7, in which the generator is disposed aft of the clutch.

9. The gas turbine engine of claim 1, further comprising a controller operatively coupled to the clutch, the controller having a loiter mode in which the clutch is engaged and a takeoff mode in which the clutch is disengaged.

10. The gas turbine engine of claim 1, further comprising a fan coupled to the low pressure spool by a fan drive gear system.

11. The gas turbine engine of claim 1, further comprising an intermediate pressure spool disposed forward of the high pressure spool, the intermediate pressure spool including an intermediate pressure compressor configured for a rearward air flow, and an intermediate pressure turbine disposed aft of the intermediate pressure compressor and configured for a forward air flow.

12. A gas turbine engine, comprising:

a low pressure spool including a first fan configured for a rearward air flow, an intermediate pressure turbine disposed aft of the first fan and configured for a forward air flow, and a first shaft coupled to the first fan and the intermediate pressure turbine;

an intermediate pressure spool including a second fan disposed aft of the first fan and configured for a rearward air flow, an intermediate pressure compressor disposed aft of the second fan and configured for a rearward air flow, a low pressure turbine disposed aft of the intermediate pressure compressor and forward of the intermediate pressure

turbine, the low pressure turbine configured for a forward air flow, and a second shaft coupled to the second fan, the intermediate pressure compressor, and the low pressure turbine;

a high pressure spool disposed aft of the low pressure spool and the intermediate pressure spool, and including:

a high pressure turbine disposed aft of the intermediate pressure turbine and configured for a forward air flow;

a combustor disposed aft of the high pressure turbine;

a high pressure compressor disposed aft of the combustor and configured for a forward air flow, the high pressure compressor including a primary stage, including a set of primary rotors, and a secondary stage, including a set of secondary rotors, wherein the primary stage is disposed aft of the secondary stage;

a primary shaft coupled to the high pressure turbine and the primary stage of the high pressure compressor; and

a secondary shaft coupled to the secondary stage of the high pressure compressor; and

a clutch configured to selectively engage the primary and secondary stages, the clutch disposed aft of the high pressure compressor.

13. The gas turbine engine of claim 12, in which the clutch selectively engages the secondary shaft to the primary shaft, thereby to selectively engage the secondary stage to the primary stage.

14. The gas turbine engine of claim 13, in which the primary shaft includes an aft end, the secondary shaft includes an aft end, and the clutch is disposed adjacent the aft ends of the primary and secondary shafts.

15. The gas turbine engine of claim 12, further comprising a high pressure compressor diffuser configured to fluidly communicate from the high pressure compressor primary stage to the combustor, thereby producing a bypass flow around the high pressure compressor secondary stage.

16. The gas turbine engine of claim 12, in which the set of secondary rotors comprises at least two secondary rotors.

17. The gas turbine engine of claim 12, further comprising a generator directly coupled to the primary shaft.

18. The gas turbine engine of claim 17, in which the generator is disposed aft of the clutch.

19. The gas turbine engine of claim 12, further comprising a controller operatively coupled to the clutch, the controller having a loiter mode in which the clutch is engaged and a takeoff mode in which the clutch is disengaged.

20. The gas turbine engine of claim 12, further comprising a fan coupled to the low pressure spool by a fan drive gear system.

21. A method of operating a gas turbine engine for an aircraft having a takeoff mode and a loiter mode, the method comprising:

providing a low pressure spool having a low pressure compressor and a low pressure turbine disposed aft of the low pressure compressor;

providing a high pressure spool disposed aft of the low pressure spool and including a high pressure turbine disposed aft of the low pressure turbine, a combustor disposed aft of the high pressure turbine, and a high pressure compressor disposed aft of the combustor, the high pressure compressor including a primary stage, including a set of primary rotors, and a secondary stage, including a set of secondary rotors, wherein the primary stage is disposed aft of the secondary stage;

providing a clutch configured to selectively engage the primary and secondary stages, the clutch disposed aft of the high pressure compressor;

generating an axially rearward flow of fan air with a fan drive gear system;

splitting the fan air into a low pressure fan air flow directed rearward and into an exhaust duct, and a core air flow directed rearward into the low pressure compressor;

redirecting the core air flow from the low pressure compressor to a reverse flow

duct to produce an axially forward flow of core air;

directing the forward flow of core air sequentially through the high pressure compressor, the combustor, the high pressure turbine, and the low pressure turbine to produce exhaust gas;

venting the exhaust gas into the exhaust duct;

disengaging the clutch when the aircraft is in the takeoff mode; and

engaging the clutch when the aircraft is in the loiter mode.

22. The method of claim 21, further comprising providing a compressor diffuser configured to fluidly communicate from the high pressure compressor primary stage to the combustor, thereby producing a bypass flow around the high pressure compressor secondary stage when the clutch is disengaged and the aircraft is in the takeoff mode.

23. The method of claim 21, further comprising, subsequent to splitting the fan air into the low pressure fan air flow and the core air flow, separating a high pressure fan air flow from the core air flow, wherein the high pressure fan air flow is directed rearward.

What is claimed is:

1. A gas turbine engine, comprising:

a low pressure spool including:

a low pressure compressor configured for a rearward air flow; and

a low pressure turbine disposed aft of the low pressure compressor and configured for a forward air flow;

a high pressure spool disposed aft of the low pressure spool and including:

a high pressure turbine disposed aft of the low pressure turbine and configured for a forward air flow;

a combustor disposed aft of the high pressure turbine; and

a high pressure compressor disposed aft of the combustor and configured for a forward air flow, the high pressure compressor including a primary stage, including a set of primary rotors, and a secondary stage, including a set of secondary rotors, wherein the primary stage is disposed aft of the secondary stage; and

a clutch configured to selectively engage the primary and secondary stages, the clutch disposed aft of the high pressure compressor.

2. The gas turbine engine of claim **1**, in which the high pressure spool includes a primary shaft coupled to the high pressure turbine and the primary rotors of the high pressure compressor, and a secondary shaft coupled to the secondary rotors of the high pressure compressor.

3. The gas turbine engine of claim **2**, in which the clutch selectively engages the secondary shaft to the primary shaft, thereby to selectively engage the secondary stage to the primary stage.

4. The gas turbine engine of claim **3**, in which the primary shaft includes an aft end, the secondary shaft includes an aft end, and the clutch is disposed adjacent the aft ends of the primary and secondary shafts.

5. The gas turbine engine of claim **1**, further comprising a compressor diffuser configured to fluidly communicate from the high pressure compressor primary stage to the combustor, thereby producing a bypass flow around the high pressure compressor secondary stage.

6. The gas turbine engine of claim **1**, in which the set of secondary rotors comprises at least two secondary rotors.

7. The gas turbine engine of claim **1**, further comprising a generator directly coupled to the high pressure spool.

8. The gas turbine engine of claim **7**, in which the generator is disposed aft of the clutch.

9. The gas turbine engine of claim **1**, further comprising a controller operatively coupled to the clutch, the controller having a loiter mode in which the clutch is engaged and a takeoff mode in which the clutch is disengaged.

10. The gas turbine engine of claim **1**, further comprising a fan coupled to the low pressure spool by a fan drive gear system.

11. The gas turbine engine of claim **1**, further comprising an intermediate pressure spool disposed forward of the high pressure spool, the intermediate pressure spool including an intermediate pressure compressor configured for a rearward air flow, and an intermediate pressure turbine disposed aft of the intermediate pressure compressor and configured for a forward air flow.

12. A gas turbine engine, comprising:

a low pressure spool including a first fan configured for a rearward air flow, an intermediate pressure turbine disposed aft of the first fan and configured for a forward air flow, and a first shaft coupled to the first fan and the intermediate pressure turbine;

an intermediate pressure spool including a second fan disposed aft of the first fan and configured for a rearward air flow, an intermediate pressure compressor disposed aft of the second fan and configured for a rearward air flow, a low pressure turbine disposed aft of the intermediate pressure compressor and forward of the intermediate pressure turbine, the low pressure turbine configured for a forward air flow, and a second shaft coupled to the second fan, the intermediate pressure compressor, and the low pressure turbine;

a high pressure spool disposed aft of the low pressure spool and the intermediate pressure spool, and including:

a high pressure turbine disposed aft of the intermediate pressure turbine and configured for a forward air flow;

a combustor disposed aft of the high pressure turbine;

a high pressure compressor disposed aft of the combustor and configured for a forward air flow, the high pressure compressor including a primary stage, including a set of primary rotors, and a secondary stage, including a set of secondary rotors, wherein the primary stage is disposed aft of the secondary stage;

a primary shaft coupled to the high pressure turbine and the primary stage of the high pressure compressor; and

a secondary shaft coupled to the secondary stage of the high pressure compressor; and

a clutch configured to selectively engage the primary and secondary stages, the clutch disposed aft of the high pressure compressor.

13. The gas turbine engine of claim **12**, in which the clutch selectively engages the secondary shaft to the primary shaft, thereby to selectively engage the secondary stage to the primary stage.

14. The gas turbine engine of claim **13**, in which the primary shaft includes an aft end, the secondary shaft includes an aft end, and the clutch is disposed adjacent the aft ends of the primary and secondary shafts.

15. The gas turbine engine of claim **12**, further comprising a high pressure compressor diffuser configured to fluidly communicate from the high pressure compressor primary stage to the combustor, thereby producing a bypass flow around the high pressure compressor secondary stage.

16. The gas turbine engine of claim **12**, in which the set of secondary rotors comprises at least two secondary rotors.

17. The gas turbine engine of claim **12**, further comprising a generator directly coupled to the primary shaft.

18. The gas turbine engine of claim **17**, in which the generator is disposed aft of the clutch.

19. The gas turbine engine of claim **12**, further comprising a controller operatively coupled to the clutch, the controller having a loiter mode in which the clutch is engaged and a takeoff mode in which the clutch is disengaged.

20. The gas turbine engine of claim **12**, wherein the first fan is coupled to the low pressure spool by a fan drive gear system.

21. A method of operating a gas turbine engine for an aircraft having a takeoff mode and a loiter mode, the method comprising:

providing a low pressure spool having a low pressure compressor and a low pressure turbine disposed aft of the low pressure compressor;

providing a high pressure spool disposed aft of the low pressure spool and including a high pressure turbine disposed aft of the low pressure turbine, a combustor disposed aft of the high pressure turbine, and a high pressure compressor disposed aft of the combustor, the high pressure compressor including a primary stage, including a set of primary rotors, and a secondary stage, including a set of secondary rotors, wherein the primary stage is disposed aft of the secondary stage;

providing a clutch configured to selectively engage the primary and secondary stages, the clutch disposed aft of the high pressure compressor;

generating an axially rearward flow of fan air with a fan drive gear system;

splitting the fan air into a low pressure fan air flow directed rearward and into an exhaust duct, and a core air flow directed rearward into the low pressure compressor;

redirecting the core air flow from the low pressure compressor to a reverse flow duct to produce an axially forward flow of core air;

directing the forward flow of core air sequentially through the high pressure compressor, the combustor, the high pressure turbine, and the low pressure turbine to produce exhaust gas;

venting the exhaust gas into the exhaust duct;

disengaging the clutch when the aircraft is in the takeoff mode; and

engaging the clutch when the aircraft is in the loiter mode.

22. The method of claim **21**, further comprising providing a compressor diffuser configured to fluidly communicate from the high pressure compressor primary stage to the combustor, thereby producing a bypass flow around the high pressure compressor secondary stage when the clutch is disengaged and the aircraft is in the takeoff mode.

23. The method of claim **21**, further comprising, subsequent to splitting the fan air into the low pressure fan air flow and the core air flow, separating a high pressure fan air flow from the core air flow, wherein the high pressure fan air flow is directed rearward.