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(54) **INTEGRATED THRUST REVERSER ASSEMBLY**

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Description

[0001] The present invention relates generally to a thrust reverser assembly and more particularly to a thrust reverser subassembly being at least partially integrated with a pylon or other mounting structure.

[0002] Bypass engines typically employ thrust reversers for ground deceleration. Thrust reversers may be located in the fan bypass duct (the area radially between the outer nacelle and the engine core cowl and axially between the fan and the fan nozzle. Known designs include cascade and door type thrust reversers. These designs employ blocker doors with robust actuation systems to block the flow of bypass air from exiting the fan nozzle. However, known designs incorporate complex thrust reverser assemblies including drag links, latches, hinges, and supporting structure that add weight to the engine, thereby reducing efficiency.

[0003] A lighter turbofan engine subassembly to provide ground deceleration during aircraft landings and to back the aircraft away from the departure gate is desired to improve engine efficiency. Accordingly, it would be desirable to provide an integrated structure with fewer and lighter parts able to perform the desired deceleration function.

[0004] US 2010/0040466 A1 discloses a nacelle for a bypass turbojet engine, with the nacelle having a cowl able to translate along a pylon which connects the engine to an aircraft. This document also discloses the presence of two removable structures (doors) which are pivotally mounted well away from the pylon to allow access to the engine. US 2010/0040466 A1 discloses features generally corresponding to the preamble of claim 1 herein.

BRIEF DESCRIPTION OF THE INVENTION

[0005] The above-mentioned need or needs may be met by exemplary embodiments which provide an integrated thrust reverser/pylon assembly.

[0006] The present invention provides a thrust reverser/pylon assembly in accordance with claim 1 herein.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The subject matter which is regarded as the invention is particularly pointed out and distinctly claimed in the concluding part of the specification. The invention, however, may be best understood by reference to the following description taken in conjunction with the accompanying drawing figures in which:

FIG. 1 is a schematic side view of an exemplary gas turbine engine assembly illustrating a translatable cowl.

FIG. 2 is a schematic side view similar to FIG. 1 illustrating a translatable cowl and an openable cascade structure.

FIG. 3 is a schematic cut away view of an exemplary gas turbine engine assembly similar to FIG. 1.

FIG. 4 is an isometric view of an embodiment of a support member.

FIG. 5 is a schematic aft-looking-forward view of an exemplary gas turbine engine assembly.

FIG. 6 is a schematic side view similar to FIG. 2 also illustrating an openable core cowl.

DETAILED DESCRIPTION OF THE INVENTION

[0008] Referring to the drawings wherein identical reference numerals denote the same elements throughout the various views, FIG. 1 shows an exemplary gas turbine engine assembly 10 for mounting on an associated aircraft. The engine assembly includes a gas turbine engine 12, a support member or pylon 14, and a nacelle 16 generally circumscribing portions of the gas turbine engine 12 about a longitudinal axis "A".

[0009] An exemplary engine assembly 10 includes a translatable cowl 22 operable to translate generally axially at least between a forward, closed position and a rearward, open position. A cascade structure 24 is thereby selectively covered and exposed by movement of the translatable cowl 22. Those with skill in the art will appreciate that for thrust-reversing operations, the translatable cowl 22 is rearwardly translated a distance sufficient to uncover flow directing vents, schematically represented by vents 26, in the cascade structure 24.

[0010] In an exemplary embodiment, in the forward, closed position, the translatable cowl engages a fan housing 18 to form a portion of nacelle 16. An axial v-blade/v-groove arrangement may be utilized at the junction of translatable cowl 22 and fan housing 18. For example, a v-groove element 21 a may be carried at the forward end of the translatable cowl 22 while a mating v-blade element 21b is carried on the rearward end of fan housing 18. Of course this arrangement of elements may be reversed as those with skill in the art will appreciate. Fan housing 18 may be an integrated structure with inlet 20, or may comprise a separate component. In other exemplary embodiments, fan housing 18 may be formed as an openable clamshell arrangement of arcuate segments. In an exemplary embodiment, substantially all of the body structure of the translatable cowl is formed of a laminate composite material.

[0011] In an exemplary embodiment falling within the scope of the claims, the support member 14, translatable cowl 22 and cascade structure 24 comprise what is termed herein as an integrated pylon/thrust reverser assembly 30. During the operation of the thrust reverser, fan air from the engine fan is re-directed forward through the cascade structure to aid in decelerating the aircraft. In some embodiments, movement of the translatable cowl 22 may be coupled with movement of one or more

blocker doors to direct the flow of the fan air. Other embodiments may utilize so-called blockerless arrangements to direct movement of the fan air for thrust reversal operation.

[0012] FIG. 1 illustrates the translatable cowl 22 in a more rearward position than would be utilized for thrust reversing operations. As illustrated in FIG. 2, the rearward position of the translatable cowl 22 offers access to the core engine, as described in greater detail below.

[0013] With continued reference to FIG. 2, in an exemplary embodiment, the cascade structure 24 is "openable" to provide access to certain portions of the gas turbine engine 12. By "openable" it is meant that at least some portion of the cascade structure 24 is operable to move away from an operational position to a serviceable position to allow at least partial access to certain engine components that may otherwise be obstructed thereby. In an exemplary embodiment falling within the scope of the claims, the cascade structure 24 includes mirror-image arcuate segments 24a that are split vertically in a clamshell arrangement and movable in hinged relationship relative to the support member 14. The arcuate segments may be latched or otherwise joined at opposite ends thereof to form a ring-like member when the cascade structure is in an operational position. Rods, hooks or other structures may be utilized to retain the cascade segments in the opened, serviceable position. Movement of translatable cowl 22 is independent of the cascade structure 24. Additionally and as per the scope of the claimed invention, movement of each arcuate segment 24a of the cascade structure 24 is independent of movement of another segment.

[0014] In an exemplary embodiment, cascade structure 24 includes an element of a radial v-blade/v-groove attachment 28a at a forward end. In an exemplary embodiment, a fan structure such as fan case 32 (FIG. 3) carries a complementary v-blade/v-groove element 28b. In an exemplary embodiment, the cascade structure provides a v-blade element and the fan case provides a v-groove element, although these elements could be reversed.

[0015] In an exemplary embodiment falling within the scope of the claims, the translatable cowl 22 is adapted for translational movement along slider tracks 78, described in greater detail below. Further, in an exemplary embodiment, the translatable cowl 22 is selectively mountable relative to the support member 14. Therefore, for greater access to engine components, the translatable cowl 22 is moved to a more rearward position or may be disconnected from actuating mechanism(s), such as exemplary actuating mechanism 36, or other supporting connections, such that the translatable cowl 22 may be removed away from the support member 14, as illustrated by arrow B.

[0016] In an exemplary embodiment, a cascade support structure 40 may be included at a position diametrically opposed to the support member 14.

[0017] With reference to FIG. 3, in an exemplary embodiment falling within the scope of the claims, translatable cowl 22 includes a radially outer panel 42 and a radially inner panel 44 coupled at a rearward end 46 thereof. The outer and inner panels 42, 44 are arranged to define an interior space 48 sized for reception of the cascade structure 24 (not shown in this view) when the translatable cowl 22 is in the closed position. In an exemplary embodiment, the inner panel 44 includes a surface 50 that cooperates with a core cowl 52 adapted to form at least a portion of an annular by-pass duct 54 for the gas turbine engine assembly 10 when the translatable cowl 22 is in the closed position.

[0018] In an exemplary embodiment, the cascade support structure 40 may provide a track or rail 58 (FIG. 2) to support and direct movement of the translatable cowl 22, without extending into the annular by-pass duct 54 (see also FIG. 5). Thus, in an exemplary embodiment, there is no lower bifurcation in the by-pass duct.

[0019] With reference to FIGS. 3-4, an exemplary support member 14 is adapted for supported connection with an associated aircraft (not shown) at one or more mount sites 62, 64. Additionally, support member 14 includes attachment sites 66 (forward site), 68 (aft site), 70 (casing site) for supported connection with an engine 12. A plurality of force-transferring links 72, 74 are operable to transfer forces through the support member 14 to the associated aircraft.

[0020] With particular reference to FIGS. 4 and 5, an exemplary support member 14 includes opposed sidewalls 76. In an exemplary embodiment falling within the scope of the claims, integral slider tracks 78 for supporting and guiding translational movement of translatable cowl 22 are carried on each of the sidewalls 76. As used herein, "integral" means that certain structures are directly joined or attached, or unitarily formed with the support structure. In an exemplary embodiment, the inner panel 44 is slidably engageable with the slider tracks. In an exemplary embodiment falling within the scope of the claims, integral hinge mounts 80 are carried on sidewalls 76. In an exemplary embodiment, the hinge mounts 80 are disposed generally above the slider tracks 78. In an exemplary embodiment falling within the scope of the claims, the hinge mounts 80 operate to support the cascade structure 24 in hinged relationship to the support member 14. In an exemplary embodiment, an additional guide member or shoe 84 may be utilized to slidably engage the outer panel 42 to guide and support translational movement of the translatable cowl 22. In an exemplary embodiment, the integral slider tracks 78 extend a greater longitudinal distance than the guide member 84.

[0021] With particular reference to FIGS. 1 and 5, in an exemplary embodiment, the gas turbine engine assembly includes fairings or aerodynamic surfaces to direct movement of air past the support member 14. For example, an exemplary embodiment includes a forward fairing 90 and an aft fairing 92. In an exemplary embodiment an exemplary aft fairing 92 is shorter and more compact than other fairings known in the art. Exemplary

fairings may be structurally supported by the support member, or formed with or supported by other nacelle or other components.

[0022] The pylon/thrust reverser assembly disclosed herein may be mounted in various configurations to an associated aircraft. For example, the assembly may be mounted in supported connection to a wing structure, or a tail structure or other aircraft structure.

[0023] With reference to FIG. 5, in certain exemplary embodiments translatable cowl 22 defines an arcuate structure that circumferentially extends between sidewalls 76 of support structure 14 and defining a body of rotation of about 330°. In other exemplary embodiments, the body of rotation extends about 340°.

[0024] With reference to FIG. 6, certain integrated pylon/thrust reverser assemblies disclosed herein may be utilized with an exemplary gas turbine engines 12 including core cowls 52 having one or more doors or panels 96. The doors or panels 96 may be operable to close and open one or more openings 98 in the core cowl in order to provide service access to internal components. The core cowl doors may be hinged or otherwise movable with internal components. The core cowl doors may be hinged or otherwise movable with respect to the core cowl body. The openings may be sized, configured, and positioned to provide the desired access. In an exemplary embodiment, when the translatable cowl 22 is rearwardly displaced, the cascade structure 24 may be opened and door(s) or panel(s) 96 may be opened or moved to permit access through opening 98.

[0025] As can be appreciated from the exemplary embodiments disclosed herein, there is disclosed a thrust reverser/pylon assembly wherein certain structural elements are integral with the sidewalls of a support structure. The sidewalls are thus capable of providing a streamlined upper bifurcation in the by-pass duct of a gas turbine engine assembly. Further, the various mount sites and load-transferring linkages are operable to minimize backbone bending in the engine.

[0026] Although a combination of features is shown in the illustrated example, not all of these features are required to realize the benefits of various embodiments disclosed herein. Assemblies designed according to an embodiment of this disclosure will not necessarily include all of the features shown in any one of the Figures. Moreover, selected features of certain embodiments may be combined with certain other features of other exemplary embodiments. All such combinations are intended to be within the scope of this disclosure. Claim 1 herein defines those technical features which correspond to the invention in its broadest form.

[0027] This written description uses exemplary embodiments to disclose the invention, including the best mode, and also to enable any person skilled in the art to make and use the invention. The patentable scope of the invention is defined by the claims, and may include other examples that occur to those skilled in the art. Such other examples are intended to be within the scope of the claims if they have structural elements that do not differ from the literal language of the claims, or if they include equivalent structural elements with insubstantial differences from the literal languages of the claims.

Claims

1. A thrust reverser/pylon assembly (30) for mounting an aircraft engine (12) to an aircraft, comprising:

   a pylon (14) including opposed sidewalls (76), at least one mounting site (62,64) for mounting the pylon (14) to an aircraft and at least forward and aft mounting sites (66,68) for connecting the pylon (14) to an aircraft engine (12);
   a translatable cowl (22) comprising an arcuate body, the arcuate body including radially inner and outer panels (44,42) arranged to define an internal cavity (48) therebetween, wherein the translatable cowl (22) is translatable between at least a forward, closed position and a rearward, deployed position; and
   an openable cascade structure (24) comprising first and second arcuate cascade segments (24a), wherein the cascade structure is at least partially disposed within the internal cavity (48) when the translatable cowl (22) is in the closed position and exposed when the translatable cowl (22) is in the deployed position;
   characterized in that the thrust reverser/pylon assembly (30) further comprises:

      i) integral slider tracks (78) disposed on the opposed sidewalls (76), wherein the translatable cowl (22) is translatable along the slider tracks (78) between the at least a forward, closed position and rearward, deployed position;
      ii) integral hinge mounts (80) carried on the opposed sidewalls (76), the hinge mounts operable to support the first and second arcuate cascade segments (24a) in independent hinged relationship to the pylon (14).

2. The thrust reverser/pylon assembly (30) according to claim 1, wherein the pylon (14) further includes integral guide tracks disposed on the sidewalls (76).

3. The thrust reverser/pylon assembly (30) according to claim 1, wherein the translatable cowl (22) includes the radially outer panel (42) and the radially inner panel (44) coupled at a rearward end (46), and wherein the radially inner panel (44) is slidably engageable with the slider tracks.

4. The thrust reverser/pylon assembly (30) according to claim 3, wherein the radially inner panel (44) in-