

AIRCRAFT CARGO DOOR SHIELD

BACKGROUND OF THE INVENTION

Field of the Invention

5 The present invention is directed generally to the protection of aircraft cargo doors from damage during the loading and unloading of cargo, and more particularly to an aircraft cargo door shield releasably attachable to cargo doors.

Description of the Related Art

10 Aircraft cargo doors are often configured to open inwardly with respect to the fuselage of the aircraft. This configuration exposes the external skin of the cargo door to contact by cargo during loading and unloading. Damage to the external skin of the cargo door may prevent the aircraft from operating normally and could present a safety hazard. Due to strict safety procedures governing the airline industry, the
15 severity of any damage caused to the aircraft must be investigated to ensure the safety of the aircraft and may result in repair or replacement processes. These inspections and/or maintenance events may lead to delays for passengers, disruption of flight schedules, and financial loss to the airline.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S)

20 Figure 1 is a front view of an aircraft cargo door shield releasably attached to a partially open cargo door of an aircraft in accordance with an exemplary embodiment of the present invention.

25 Figure 2A is an enlarged view of an upper attachment mechanism of the aircraft cargo door shield shown in Figure 1.

 Figure 2B depicts the attachment mechanism shown in Figure 2A positioned over an upper edge of the external skin of the cargo door.

 Figure 2C is another view of the attachment mechanism shown in Figure 2A.

30 Figures 3A and 3B illustrate a lower attachment mechanism of the aircraft cargo door shield of Figure 1.

 Figures 4A and 4B illustrate a lateral attachment mechanism of the aircraft cargo door shield of Figure 1.

Figure 5 illustrates a schematic diagram including dimensions of the aircraft cargo door shield of Figure 1 sized for a particular size cargo door.

DETAILED DESCRIPTION OF THE INVENTION

5 Embodiments of the present invention are directed to an aircraft cargo door shield configured for protecting an aircraft cargo door during loading and unloading of cargo. Referring to Figure 1, a cargo door shield is shown releasably attached to a partially open cargo door of an aircraft. The cargo door is configured to open inwardly with respect to the fuselage of the aircraft. As an example, the cargo door may be a cargo door of a Boeing 737. The cargo door shield comprises a panel configured for covering a portion of an external skin of the cargo door, and one of more fastening or attachment mechanisms configured for releasably holding the panel adjacent to the cargo door during use. In the embodiment shown, the panel is sized and shaped to cover and therefore protect a substantial portion of the exterior skin of the cargo door from being damaged by contact during the loading and unloading of cargo.

 The panel of the cargo door shield may be made from any suitable materials. In some embodiments, the panel is constructed from a lightweight material configured to enable, for example, a single user to removably attach the panel to the cargo door without assistance. The panel may be constructed from material that has a relatively high impact strength and thickness, which enables it to withstand impacts from cargo during loading and unloading thereof without damage occurring to the cargo door. Examples of suitable materials include, but are not limited to, composites or polymers, such as polypropylene or high-density polyethylene.

25 The dimensions of the panel are configured to complement the dimensions of a cargo door of an aircraft, as shown in Figure 1. It will be appreciated that the dimensions of the panel may be configured to complement the dimensions of various sizes of cargo doors for various types of aircrafts. The shape of the panel may also be configured to match the external shape of the cargo door. For example, the panel, having an outward side and an inward side, may be configured to follow the generally convex curvature of the external skin of the cargo door so that the inward side of the panel is held adjacent to the external skin of the cargo door during use.

 As shown in Figure 1, the cargo door of the aircraft is hingedly attached to the fuselage of the aircraft at the cargo door's upper end. The cargo door includes a

lower free end located substantially opposite the hinged end and two lateral edges extending between the hinged end and the free end. In this embodiment, the cargo door shield includes a plurality of attachment mechanisms located around the periphery of the panel, each configured for removable attachment to corresponding edges of the external skin of the cargo door. The attachment mechanisms that are attachable to the cargo door at its upper hinged end are shown in Figures 2A, 2B, and 2C. The attachment mechanisms that are attachable to the cargo door at its lower free end are shown in Figures 3A and 3B. The attachment mechanisms that are attachable to the cargo door at its lateral edges are shown in Figures 4A and 4B. It should be appreciated that in some embodiments, various combinations including some or all of the attachment mechanisms may be used. For example, in some embodiments, the cargo door shield may only include attachment mechanisms on its upper and lateral edges, or on its upper and lower edges, etc.

As shown in Figures 2A, 2B, and 2C, the two upper attachment mechanisms each comprise an elongated hook with a shank portion coupled to the upper portion of the panel. Each hook is configured to have a relatively small depth hooked portion so that it may slide over the contour of the cargo door and into position to engage the upper edge of the cargo door without disturbing or damaging a gasket of the cargo door (see Figures 2B and 2C). The tip portion of the hooked portion of the hook has a thickness to fit in the space between the inside surface of the edge of the upper end of the cargo door and the gasket. As can be appreciated, this feature prevents damage to the gasket that may otherwise occur if a differently-sized attachment mechanism was used which engaged the gasket.

As shown in Figures 3A and 3B, the attachment mechanism coupled to the panel at its lower end comprises a planar, sector-shaped piece of material coupled to the lower portion of the panel by three straps that are threaded through holes in the panel and sewn to the piece of material. The attachment mechanism also comprises a hook, somewhat similar to the hooks shown in Figures 2A-2C, configured to have a relatively small depth hooked portion so that it can be engaged with the lower edge of the cargo door at its lower free end. Like the hooks described above, the hook shown in Figures 3A and 3B is shaped and sized with a tip portion of the hooked portion having thickness to fit in the space between the inside surface of the edge of the lower end of the cargo door and the gasket without contacting the gasket of the cargo door, thereby preventing potential damage to the gasket. The hook portion of the attachment

mechanism is coupled to the piece of material by a tension member (e.g., a shock cord or “bungee” cord). The attachment mechanism also includes a looped handle that is configured to aid a user in engaging the hooked portion over the lower edge by pulling downward on the handle so as to stretch the tension member to a length that enables the hooked portion to engage the lower edge at the lower free end of the cargo door. The tension member operates to retain the engagement of hooked portion with the lower edge of the cargo door.

Figures 4A and 4B illustrate enlarged views of the lateral attachment mechanisms that are releasably attachable to the lateral edges of the external skin of the cargo door. The attachment mechanisms each include a hook coupled proximate a lateral edge of the panel by a tension member (e.g., a shock cord) that is looped through a hole in the panel. Similar to the lower attachment mechanism shown in Figures 3A and 3B and described above, the lateral attachment mechanisms also include a looped handle configured to aid the user when stretching the tension member to engage a hooked portion with the lateral edge of the cargo door with a tip portion of the hooked portion having a thickness to fit in the space between the inside surface of the lateral edge of the cargo door and the gasket without contacting the gasket to prevent damage to the gasket.

During installation of the cargo door shield, a single user may first position the cargo door in an inwardly partially open position such as shown in Figure 1. Next, the user may position the upper hooks on the exterior skin of the cargo door near, but below, the upper hinged end. While holding the shield such that its upper end is substantially parallel with the upper edge of the cargo door, the user may simply raise the shield and slide the upper hooks in an upward direction along the exterior skin until the hooked portion of the hooks extend over the upper edge of the external skin and move inward at a position above the upper edge as a result of either or both of the inward force applied by the user to the shield or the resiliency of the shield panel. The shield may next be lowered to position the portions of the hooked portions of both hooks in the space between the upper edge of the cargo door and the gasket. The shield will then be “hanging” on the cargo door from the upper edge of the cargo door. Once the shield is hanging on the cargo door, the user does not need to continue lifting the shield, such that the user’s hands are free to releasably attach the lateral attachment mechanisms and/or the lower attachment mechanism to the external skin of the cargo door. Thus, the cargo door shield is easily installed by a single user and

does not damage the gasket that seals the cargo door. Further, by providing the upper hooks and the looped handles, the cargo door shield is easily installed by a user wearing gloves, which is often the case. In a reverse procedure, the shield may be easily removed from the cargo door by a single user.

5 The foregoing described embodiments depict different components contained within, or connected with, different other components. It is to be understood that such depicted architectures are merely exemplary, and that in fact many other architectures can be implemented which achieve the same functionality. In a conceptual sense, any arrangement of components to achieve the same functionality is effectively "associated" such that the desired functionality is achieved. Hence, any two
10 components herein combined to achieve a particular functionality can be seen as "associated with" each other such that the desired functionality is achieved, irrespective of architectures or intermedial components. Likewise, any two components so associated can also be viewed as being "operably connected", or "operably coupled", to
15 each other to achieve the desired functionality.

 While particular embodiments of the present invention have been shown and described, it will be obvious to those skilled in the art that, based upon the teachings herein, changes and modifications may be made without departing from this invention and its broader aspects and, therefore, the appended claims are to
20 encompass within their scope all such changes and modifications as are within the true spirit and scope of this invention.

 Furthermore, it is to be understood that the invention is solely defined by the appended claims. It will be understood by those within the art that, in general, terms used herein, and especially in the appended claims (e.g., bodies of the appended
25 claims) are generally intended as "open" terms (e.g., the term "including" should be interpreted as "including but not limited to," the term "having" should be interpreted as "having at least," the term "includes" should be interpreted as "includes but is not limited to," etc.).

 It will be further understood by those within the art that if a specific
30 number of an introduced claim recitation is intended, such an intent will be explicitly recited in the claim, and in the absence of such recitation no such intent is present. For example, as an aid to understanding, the following appended claims may contain usage of the introductory phrases "at least one" and "one or more" to introduce claim recitations. However, the use of such phrases should not be construed to imply that the

introduction of a claim recitation by the indefinite articles "a" or "an" limits any particular claim containing such introduced claim recitation to inventions containing only one such recitation, even when the same claim includes the introductory phrases "one or more" or "at least one" and indefinite articles such as "a" or "an" (e.g., "a" and/or "an" should typically be interpreted to mean "at least one" or "one or more"); the same holds true for the use of definite articles used to introduce claim recitations. In addition, even if a specific number of an introduced claim recitation *is* explicitly recited, those skilled in the art will recognize that such recitation should typically be interpreted to mean *at least* the recited number (e.g., the bare recitation of "two recitations," without other modifiers, typically means *at least* two recitations, or *two or more* recitations).

CLAIMS

The invention claimed is:

- 5 1. A shield for protecting an aircraft cargo door, comprising:
a panel;
an upper hook coupled to the panel proximate an upper end configured
for engaging an upper edge of the cargo door at a hinged end of the cargo door; and
an attachment mechanism coupled to the panel proximate an end of the
panel other than the upper end that includes an elastic portion.
- 10 2. The shield of claim 1, wherein the attachment mechanism
comprises a lower hook configured for engaging a lower edge of the cargo door at a
free end of the cargo door opposite the hinged end.
- 15 3. The shield of claim 2, wherein the attachment mechanism also
comprises a lateral hook configured for engaging a lateral edge of the cargo door.
- 20 4. The shield of claim 1, wherein the attachment mechanism
comprises a lower hook configured for engaging an edge of the cargo door at a free
end of the cargo door opposite the hinged end, a first lateral hook configured for
engaging a first lateral edge of the cargo door, and a second lateral hook configured for
engaging a second lateral edge of the cargo door opposite the first lateral edge.
- 25 5. The shield of claim 1, wherein the hook has a hooked portion with
depth configured such that a tip portion of the hooked portion is sized and arranged to
fit between an inside surface of the upper edge of the cargo door and a gasket attached
to the cargo door at the hinged end and spaced inward from the inside surface of the
upper edge of the cargo door.
- 30 6. A shield for protecting an aircraft cargo door as described herein.