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WINGLET SYSTEMS AND METHODS FOR AIRCRAFT

Abstract

A winglet system is configured to be secured to a wing of an aircraft. The winglet system includes an upper blade, a lower blade, and a cover plate integrally formed with the upper blade and the lower blade. The cover plate covers an opening within a transition joint between the upper blade and the lower blade. The cover plate remains coupled to the upper blade if the lower blade is separated from the winglet system.

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Background/Summary

FIELD OF THE DISCLOSURE

[0001] Examples of the present disclosure generally relate to winglet systems and methods for

aircraft, such as are disposed at ends of wings.

BACKGROUND OF THE DISCLOSURE

[0002] Certain aircraft include winglets extending from distal ends of main wing structures.

Winglets are configured to reduce drag, such as by partially recovering tip vortex energy. Various winglets are configured to increase lift generated at the wingtip (by smoothing airflow across the upper wing near the tip) and reduce lift-induced drag caused by wingtip vortices, thereby improving lift-to-drag ratio.

[0003] Known winglets include an upper blade and a lower blade. The lower blade extends downwardly in relation to a tip of a wing, thereby reducing ground clearance relative to the tip of the wing. As such, the lower blade may be susceptible to accidental impacts, such as from ground service vehicles at airports. In such circumstances, the lower blade may be removed. The aircraft can be temporarily flown without the lower blade after a separate and distinct structure is separately installed over an opening caused by removal of the lower blade.

[0004] As can be appreciated, the process of obtaining and installing a separate and distinct structure over the opening is time and labor intensive, and can be costly.

SUMMARY OF THE DISCLOSURE

[0005] A need exists for an improved winglet. Further, a need exists for a system and a method for effectively and efficiently compensating for a removed lower blade of a winglet.

[0006] With those needs in mind, certain examples of the present disclosure provide a winglet system configured to be secured to a wing of an aircraft. The winglet system includes an upper blade, a lower blade, and a cover plate integrally formed with the upper blade and the lower blade. The cover plate covers an opening within a transition joint between the upper blade and the lower blade. The cover plate remains coupled to the upper blade if the lower blade is separated from the winglet system.

[0007] In at least one example, the cover plate includes a covering panel disposed within the opening, and one or more couplers extending from the covering panel. As an example, the one or more couplers include a first coupler (such as an aft or forward coupler), and a second coupler (such as a forward or aft coupler). In at least one example, the one or more couplers include legs separated by a gap.

[0008] In at least one example, the lower blade includes one or more attachment fittings secured to the one or more couplers. As a further example, the covering panel includes one or more channels. The one or more attachment fittings extend through the one or more channels. In at least one example, the one or more attachment fittings are secured to the one or more couplers through one or more frangible fasteners.

[0009] In at least one example, the upper blade includes one or more attachment fittings secured to the one or more couplers. As a further example, the one or more couplers secure to one or more first attachment fittings of the upper blade through one or more first fasteners. The one or more couplers secure to one or more second attachment fittings of the lower blade through one or more second fasteners. The one or more first fasteners are different than the one or more second fasteners. In at least one example, the one or more first attachment fittings do not extend to or contact the one or more second attachment fittings.

[0010] In at least one example, at least one fastener secures the one or more couplers to one or more first attachment fittings of the upper blade and one or more second attachment fittings of the lower blade. As a further example, one or more retaining fasteners secure the one or more couplers to the one or more first attachment fittings of the upper blade. The one or more retaining fasteners do not connect to the one or more second attachment fittings of the lower blade.

[0011] Certain examples of the present disclosure provide a method for a winglet system configured to be secured to a wing of an aircraft. The method includes integrally forming a cover plate with an upper blade and a lower blade.

[0012] Certain examples of the present disclosure provide an aircraft including a fuselage, wings extending from the fuselage, and a winglet system secured each of the wings, as described herein.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] FIG. **1** illustrates a perspective front view of an aircraft, according to an example of the present disclosure.

[0014] FIG. **2** illustrates a perspective side view of a winglet system, according to an example of the present disclosure.

[0015] FIG. **3** illustrates a perspective top view of the winglet system at a transition joint, according to an example of the present disclosure.

[0016] FIG. **4** illustrates a cross-sectional view of a coupler, according to an example of the present disclosure.

[0017] FIG. **5** illustrates a perspective side of the winglet system with a lower blade removed, according to an example of the present disclosure.

[0018] FIG. **6** illustrates a perspective top view of the winglet system at a transition joint, according to an example of the present disclosure.

[0019] FIG. **7** illustrates a top view of an aft coupler of a cover plate, according to an example of the present disclosure.

[0020] FIG. **8** illustrates a top view a forward coupler of the cover plate, according to an example of the present disclosure.

DETAILED DESCRIPTION OF THE DISCLOSURE

[0021] The foregoing summary, as well as the following detailed description of certain embodiments will be better understood when read in conjunction with the appended drawings. As used herein, an element or step recited in the singular and preceded by the word “a” or “an” should be understood as not necessarily excluding the plural of the elements or steps. Further, references to “one embodiment” are not intended to be interpreted as excluding the existence of additional embodiments that also incorporate the recited features. Moreover, unless explicitly stated to the contrary, embodiments “comprising” or “having” an element or a plurality of elements having a particular condition can include additional elements not having that condition.

[0022] As described herein, examples of the present disclosure provide a winglet system including an integrated cover plate disposed between an upper blade and a lower blade. The integrated cover plate is not separate and distinct from the winglet system. Instead, the cover plate is integrally formed with the winglet system. The winglet system allows for an aircraft to be flown without a lower blade, and without installation of a separate and distinct covering structure. The winglet system further includes frangible attach points for the lower blade while incorporating the cover plate.

[0023] FIG. **1** illustrates a perspective front view of an aircraft **100**, according to an example of the present disclosure. The aircraft **100** includes a propulsion system, such as can include two engines **112**, for example. Optionally, the propulsion system may include more engines **112** than shown. The engines **112** are carried by wings **116** of the aircraft **100**. In other examples, the engines **112** may be carried by a fuselage **118** and/or an empennage **120**. The empennage **120** may also support horizontal stabilizers **122** and a vertical stabilizer **124**.

[0024] A winglet system **130** is secured to a distal end **131** of each wing **116**. Each winglet system **130** includes an upper blade **134** and a lower blade **136**. The upper blade **134** extends upwardly above a plane of an upper surface of the wing **116**. The lower blade **136** extends downwardly below the plane of the upper surface of the wing **116**.

[0025] The aircraft **100** shown in FIG. **1** is merely an example. The aircraft **100** can be sized and

shaped differently than shown in FIG. 1.

[0026] FIG. 2 illustrates a perspective side view of a winglet system **130**, according to an example of the present disclosure. The winglet system **130** includes the upper blade **134** coupled to the lower blade **136** at a transition joint **138**, which can include an upper covering fairing **139**.

[0027] FIG. 3 illustrates a perspective top view of the winglet system **130** at the transition joint **138**, according to an example of the present disclosure. The upper covering fairing **139** (shown in FIG. 2) is not shown in FIG. 3.

[0028] The winglet system **130** includes a cover plate **140**, which is integrally formed with the winglet system **130**. That is, the cover plate **140** is an integral part of the winglet system **130**, and is not separately installed thereto, such as if the lower blade **136** is removed.

[0029] The cover plate **140** includes a covering panel **142** disposed within an opening **143** of the transition joint **138**. A first coupler **144** extends inwardly from an inboard surface **145** of the covering panel **142**. The first coupler **144** can be an aft coupler. A second coupler **146** also extends inwardly from the inboard surface **145** of the covering panel **142**. The second coupler **146** can be a forward coupler. Optionally, the first coupler **144** can be a forward coupler, and the second coupler **146** can be an aft coupler. The inboard surface **145** is opposite from an outboard surface **147**. The first coupler **144** and the second coupler **146** are spaced apart a distance **148**. Each of the first coupler **144** and the second coupler **146** includes coupling legs **150** and **152** separated by a gap **154**. The cover plate **140** can include fewer or more couplers than shown. For example, the cover plate **140** can include a single coupler. As another example, the cover plate **140** can include three couplers.

[0030] A proximal end **160** of the lower blade **136** is proximate to (such as abuts against) the outboard surface **147** of the covering panel **142**. The lower blade **136** includes attachment fittings **164**, which extend through channels formed through the covering panel **142**. Each attachment fitting **164** extends between coupling legs **150** and **152** of one of the first coupler **144** or the second coupler **146**. One or more fasteners **166**, such as bolts, secure the attachment fittings **164** to the first coupler **144** and the second coupler **146**. The fasteners **166** are non-frangible.

[0031] The upper blade **134** also includes attachment fittings **170**. Each attachment fitting **170** extends between coupling legs **150** and **152** of one of the first coupler **144** or the second coupler **146**. One or more fasteners **172**, such as bolts, secure the attachment fittings **170** to the first coupler **144** and the second coupler **146**. In at least one example, the fasteners **172** are frangible fasteners (such as frangible bolts), which are configured to break at a predetermined force, to allow the lower blade **136** to separate from the winglet system **130**. The frangible fasteners are configured to sustain flight loads, but break in response to predetermined excessive loads, such as from impacts of a certain magnitude. The fasteners **166** are configured to sustain greater loads than the fasteners **172**. In this manner, the fasteners **166** ensure that the cover plate **140** remains secured to the winglet system **130**, even if the frangible fasteners **172** break to allow the lower blade **136** to separate from the winglet system **130**. Optionally, the fasteners **172** can be removable fasteners, instead of frangible fasteners.

[0032] As an example, if ground support equipment impacts the lower blade **136** with sufficient force, the lower blade **136** may need to be removed and repaired. For removal, the fasteners **166** can be removed so that the lower blade **136** can be removed, but the cover plate **140** remains in place.

[0033] FIG. 4 illustrates a cross-sectional view of a coupler, according to an example of the present disclosure. The coupler can be the first coupler **144**. The second coupler **146** can be similarly configured. The attachment fitting **164** extends between the legs **150** and **152** of the coupler at a first end **180**, while the attachment fitting **170** extends between the legs **150** and **152** at an opposite second end **182**. The attachment fitting **164** does not extend to, or contact, the attachment fitting **170**. In this manner, in at least one example, the fasteners **166** that secure the coupler to the attachment fitting **164** do not contact the attachment fitting **170**. Similarly, the fasteners **172** that

secure the coupler to the attachment fitting **170** do not contact the attachment fitting **164**.

[0034] As shown in FIG. **4**, one or more couplers (such as the first coupler **144** and/or the second coupler **146**) secure to one or more attachment fittings **170** of the upper blade **134** through one or more fasteners **172**. The coupler(s) further secure to one or more attachment fittings **164** of the lower blade **136** through one or fasteners **172** (such as frangible bolts). The fasteners **172** are different than the fasteners **166**.

[0035] FIG. **5** illustrates a perspective side of the winglet system **130** with the lower blade removed, according to an example of the present disclosure. Referring to FIGS. **2-5**, in the event the lower blade **136** is removed, the cover plate **140** remains within an opening **190** of the transition joint **138** of the winglet system **130**. The covering panel **142** is configured to conform to the size and shape of the opening **190**. As shown, the covering panel **142** has a profile shaped as an airfoil. As noted, the covering panel **142** includes channels **192** into which attachment fittings **164** are configured to pass.

[0036] In the event the lower blade **136** is removed from the winglet system **130**, the cover plate **140**, which is integrally formed with the winglet system **130**, provides the covering panel **142** that covers the opening **190**. As such, a separate and distinct covering structure does not need to be separately secured to the winglet system **130**.

[0037] FIG. **6** illustrates a perspective top view of the winglet system **130** at the transition joint **138**, according to an example of the present disclosure. FIG. **7** illustrates a top view of a second coupler **146** of the cover plate **140**, according to an example of the present disclosure. FIG. **8** illustrates a top view a first coupler **144** of the cover plate **140**, according to an example of the present disclosure.

[0038] Referring to FIGS. **6-8**, in this example, the attachment fittings **170** of the upper blade **134** includes opposed fins **200** and **202** separated by a gap **204**. The attachment fittings **170** extend between the legs **150** and **152**. The attachment fittings **164** of the lower blade **136** extend between the fins **200** and **202**. Fasteners **206**, such as bolts, secure the couplers **144** and **146** to each of the attachment fittings **164** and **170**. That is, each fastener **206** secures to each of the attachment fittings **164** and **170**. In at least one example, the fasteners **206** are frangible, and configured to break at a predetermined force, thereby allowing the lower blade **136** to separate from the winglet system **130**.

[0039] One or more retaining fasteners **220**, such as bolts, secure one or both of the couplers **144** and/or **146** to the attachment fitting **170**. In at least one example, the retaining fasteners **220** do not connect to, nor secure to the attachment fitting **164**. The retaining fasteners **220** are configured to ensure that the cover plate **140** remains secured to the upper blade **134** in the event the lower blade **134** separates from the winglet system **130** (such as when the lower blade **134** is removed for repair or maintenance).

[0040] As shown, the first coupler **144** can include the retaining fastener **220**, which provides an auxiliary connection with the attachment fitting **170** of the upper blade **134**. The second coupler **146** may not include a retaining fastener **220**. Optionally and/or additionally, the second coupler **146** may include the retaining fastener **220**. In at least one example, both the first coupler **144** and the second coupler **146** can include a retaining fastener, such as the retaining fastener **220**.

[0041] Referring to FIGS. **1-8**, examples of the present disclosure provide a winglet system **130** having an integrally formed cover plate **140**, which is configured to remain secured to the winglet system **130** when the lower blade **136** is separated from the winglet system **130**. When the lower blade **136** separates from the winglet system **130**, the cover plate **140** remains secured to the winglet system **130**, such as within the opening **190** of the transition joint **138**. As such, if the lower blade **136** does separate from the winglet system **130**, the aircraft **100** can be still be flown, and there is no need for a separate and distinct cover structure to be installed on the winglet system **130**. If the lower blade **136** does separate from the winglet system **130**, thereby exposing the covering panel **142** within the opening **190**, the exposed channels **192** of the covering panel **142** can be

covered within a covering agent, such as speed tape.

[0042] As described herein, the winglet system **130** includes the cover plate **140**, which provides an integrated split blade wing tip cover. The cover plate **140** is installed and integrally formed with the winglet system **130** when the winglet system **130** is manufactured. If there is an issue which requires removal of the lower blade **136**, the cover plate **140** is already in place, and an operator of the aircraft does not need to acquire a separate and distinct covering structure in order to fly the aircraft. In at least one example, the cover plate **140** secures to one or more attachment fittings (individually or both) of the lower blade **136** with frangible fasteners **206**, such as frangible bolts, while securing to one or more additional attachment points (such as portions of the attachment fittings **170** of the upper blade **134**) with additional fasteners.

[0043] As described herein, referring to FIGS. **1-8**, the winglet system **130** is configured to be secured to a wing **116** of the aircraft **100**. The winglet system **130** includes the upper blade **134**, the lower blade **136**, and the cover plate **140** integrally formed with the upper blade **134** and the lower blade **136**. That is, the winglet system **130** is manufactured having the cover plate **140** coupled to the upper blade **134** and the lower blade **136**. The cover plate **140** is not separately secured to the winglet system **130** after the winglet system **130** is manufactured. The cover plate **140** covers the opening **190** within the transition joint **138** between the upper blade **134** and the lower blade **136**. The cover plate **140** remains coupled to the upper blade **134** if the lower blade **136** is separated from the winglet system **130**.

[0044] Further, the disclosure comprises embodiments according to the following clauses:

[0045] Clause 1. A winglet system configured to be secured to a wing of an aircraft, the winglet system comprising: [0046] an upper blade; [0047] a lower blade; and [0048] a cover plate integrally formed with the upper blade and the lower blade, wherein the cover plate covers an opening within a transition joint between the upper blade and the lower blade, and wherein the cover plate remains coupled to the upper blade if the lower blade is separated from the winglet system.

[0049] Clause 2. The winglet system of Clause 1, wherein the cover plate comprises: [0050] a covering panel disposed within the opening; and [0051] one or more couplers extending from the covering panel.

[0052] Clause 3. The winglet system of Clause 2, wherein the one or more couplers comprise: [0053] a first coupler; and [0054] a second coupler.

[0055] Clause 4. The winglet system of Clauses 2 or 3, wherein the one or more couplers comprise legs separated by a gap.

[0056] Clause 5. The winglet system of any of Clauses 2-4, wherein the lower blade comprises one or more attachment fittings secured to the one or more couplers.

[0057] Clause 6. The winglet system of Clause 5, wherein the covering panel comprises one or more channels, and wherein the one or more attachment fittings extend through the one or more channels.

[0058] Clause 7. The winglet system of Clauses 5 or 6, wherein the one or more attachment fittings are secured to the one or more couplers through one or more frangible fasteners.

[0059] Clause 8. The winglet system of any of Clauses 2-7, wherein the upper blade comprises one or more attachment fittings secured to the one or more couplers.

[0060] Clause 9. The winglet system of any of Clauses 2-7, wherein the one or more couplers secure to one or more first attachment fittings of the upper blade through one or more first fasteners, wherein the one or more couplers secure to one or more second attachment fittings of the lower blade through one or more second fasteners, and wherein the one or more first fasteners are different than the one or more second fasteners.

[0061] Clause 10. The winglet system of Clause 9, wherein the one or more first attachment fittings do not extend to or contact the one or more second attachment fittings.

[0062] Clause 11. The winglet system of any of Clauses 2-9, wherein at least one fastener secures

the one or more couplers to one or more first attachment fittings of the upper blade and one or more second attachment fittings of the lower blade.

[0063] Clause 12. The winglet system of Clause 11, wherein one or more retaining fasteners secure the one or more couplers to the one or more first attachment fittings of the upper blade, and wherein the one or more retaining fasteners do not connect to the one or more second attachment fittings of the lower blade.

[0064] Clause 13. A method for a winglet system configured to be secured to a wing of an aircraft, the method comprising: [0065] integrally forming a cover plate with an upper blade and a lower blade, wherein the cover plate covers an opening within a transition joint between the upper blade and the lower blade, and wherein the cover plate remains coupled to the upper blade if the lower blade is separated from the winglet system.

[0066] Clause 14. An aircraft comprising: [0067] a fuselage; [0068] wings extending from the fuselage; and [0069] a winglet system secured to each of the wings, the winglet system comprising: [0070] an upper blade; [0071] a lower blade; and [0072] a cover plate integrally formed with the upper blade and the lower blade, wherein the cover plate covers an opening within a transition joint between the upper blade and the lower blade, and wherein the cover plate remains coupled to the upper blade if the lower blade is separated from the winglet system.

[0073] Clause 15. The aircraft of Clause 14, wherein the cover plate comprises: [0074] a covering panel disposed within the opening; and [0075] one or more couplers extending from the covering panel.

[0076] Clause 16. The aircraft of Clause 15, wherein the one or more couplers comprise: [0077] a first coupler; and [0078] a second coupler.

[0079] Clause 17. The aircraft of Clauses 15 or 16, wherein the one or more couplers comprise legs separated by a gap.

[0080] Clause 18. The aircraft of any of Clauses 15-17, wherein the lower blade comprises one or more first attachment fittings secured to the one or more couplers, wherein covering panel comprises one or more channels, wherein the one or more first attachment fittings extend through the one or more channels, wherein the one or more first attachment fittings are secured to the one or more couplers through one or more frangible fasteners.

[0081] Clause 19. The aircraft of Clause 18, wherein the upper blade comprises one or more second attachment fittings secured to the one or more couplers.

[0082] Clause 20. The aircraft of Clause 19, wherein the one or more couplers secure to the one or more second attachment fittings of the upper blade through one or more fasteners.

[0083] As described herein, examples of the present disclosure provide an improved winglet system. Further, examples of the present disclosure provide systems and methods for effectively and efficiently compensating for a removed lower blade of a winglet.

[0084] While various spatial and directional terms, such as top, bottom, lower, mid, lateral, horizontal, vertical, front and the like can be used to describe embodiments of the present disclosure, it is understood that such terms are merely used with respect to the orientations shown in the drawings. The orientations can be inverted, rotated, or otherwise changed, such that an upper portion is a lower portion, aft may be changed to forward, and vice versa, horizontal becomes vertical, and the like.

[0085] As used herein, a structure, limitation, or element that is “configured to” perform a task or operation is particularly structurally formed, constructed, or adapted in a manner corresponding to the task or operation. For purposes of clarity and the avoidance of doubt, an object that is merely capable of being modified to perform the task or operation is not “configured to” perform the task or operation as used herein.

[0086] It is to be understood that the above description is intended to be illustrative, and not restrictive. For example, the above-described embodiments (and/or aspects thereof) can be used in combination with each other. In addition, many modifications can be made to adapt a particular

situation or material to the teachings of the various embodiments of the disclosure without departing from their scope. While the dimensions and types of materials described herein are intended to define the parameters of the various embodiments of the disclosure, the embodiments are by no means limiting and are exemplary embodiments. Many other embodiments will be apparent to those of skill in the art upon reviewing the above description. The scope of the various embodiments of the disclosure should, therefore, be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled. In the appended claims and the detailed description herein, the terms “including” and “in which” are used as the plain-English equivalents of the respective terms “comprising” and “wherein.” Moreover, the terms “first,” “second,” and “third,” etc. are used merely as labels, and are not intended to impose numerical requirements on their objects. Further, the limitations of the following claims are not written in means-plus-function format and are not intended to be interpreted based on 35 U.S.C. § 112(f), unless and until such claim limitations expressly use the phrase “means for” followed by a statement of function void of further structure.

[0087] This written description uses examples to disclose the various embodiments of the disclosure, including the best mode, and also to enable any person skilled in the art to practice the various embodiments of the disclosure, including making and using any devices or systems and performing any incorporated methods. The patentable scope of the various embodiments of the disclosure is defined by the claims, and can 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 the examples have structural elements that do not differ from the literal language of the claims, or if the examples include equivalent structural elements with insubstantial differences from the literal language of the claims.

Claims

1. A winglet system configured to be secured to a wing of an aircraft, the winglet system comprising: an upper blade; a lower blade; and a cover plate integrally formed with the upper blade and the lower blade, wherein the cover plate is disposed within an opening within a transition joint between the upper blade and the lower blade, wherein the cover plate covers the opening, and wherein the cover plate remains coupled to the upper blade if the lower blade is separated from the winglet system.
2. The winglet system of claim 1, wherein the cover plate comprises: a covering panel disposed within the opening, wherein the covering plate conforms to a size and a shape of the opening; and one or more couplers extending from the covering panel.
3. The winglet system of claim 2, wherein the one or more couplers comprise: a first coupler; and a second coupler.
4. The winglet system of claim 2, wherein the one or more couplers comprise legs separated by a gap.
5. The winglet system of claim 2, wherein the lower blade comprises one or more attachment fittings secured to the one or more couplers.
6. The winglet system of claim 5, wherein the covering panel comprises one or more channels, and wherein the one or more attachment fittings extend through the one or more channels.
7. The winglet system of claim 5, wherein the one or more attachment fittings are secured to the one or more couplers through one or more frangible fasteners.
8. The winglet system of claim 2, wherein the upper blade comprises one or more attachment fittings secured to the one or more couplers.
9. The winglet system of claim 2, wherein the one or more couplers secure to one or more first attachment fittings of the upper blade through one or more first fasteners, wherein the one or more couplers secure to one or more second attachment fittings of the lower blade through one or more

second fasteners, and wherein the one or more first fasteners are different than the one or more second fasteners.

10. The winglet system of claim 9, wherein the one or more first attachment fittings do not extend to or contact the one or more second attachment fittings.

11. The winglet system of claim 2, wherein at least one fastener secures the one or more couplers to one or more first attachment fittings of the upper blade and one or more second attachment fittings of the lower blade.

12. The winglet system of claim 11, wherein one or more retaining fasteners secure the one or more couplers to the one or more first attachment fittings of the upper blade, and wherein the one or more retaining fasteners do not connect to the one or more second attachment fittings of the lower blade.

13. A method for a winglet system configured to be secured to a wing of an aircraft, the method comprising: integrally forming a cover plate with an upper blade and a lower blade; and disposing the cover plate within an opening within a transition joint between the upper blade and the lower blade, wherein the cover plate cover the opening, and wherein the cover plate remains coupled to the upper blade if the lower blade is separated from the winglet system.

14. An aircraft comprising: a fuselage; wings extending from the fuselage; and a winglet system secured to each of the wings, the winglet system comprising: an upper blade; a lower blade; and a cover plate integrally formed with the upper blade and the lower blade, wherein the cover plate is disposed within an opening within a transition joint between the upper blade and the lower blade, wherein the cover plate covers the opening, and wherein the cover plate remains coupled to the upper blade if the lower blade is separated from the winglet system.

15. The aircraft of claim 14, wherein the cover plate comprises: a covering panel disposed within the opening, wherein the covering plate conforms to a size and a shape of the opening; and one or more couplers extending from the covering panel.

16. The aircraft of claim 15, wherein the one or more couplers comprise: a first coupler; and a second coupler.

17. The aircraft of claim 15, wherein the one or more couplers comprise legs separated by a gap.

18. The aircraft of claim 15, wherein the lower blade comprises one or more first attachment fittings secured to the one or more couplers, wherein covering panel comprises one or more channels, wherein the one or more first attachment fittings extend through the one or more channels, wherein the one or more first attachment fittings are secured to the one or more couplers through one or more frangible fasteners.

19. The aircraft of claim 18, wherein the upper blade comprises one or more second attachment fittings secured to the one or more couplers.

20. The aircraft of claim 19, wherein the one or more couplers secure to the one or more second attachment fittings of the upper blade through one or more fasteners.

21. The winglet system of claim 2, wherein the covering panel has a profile shaped as an airfoil.
