BushCat by SkyReach

For all BushCat and Cheetah-XLS aircraft.

BushCat

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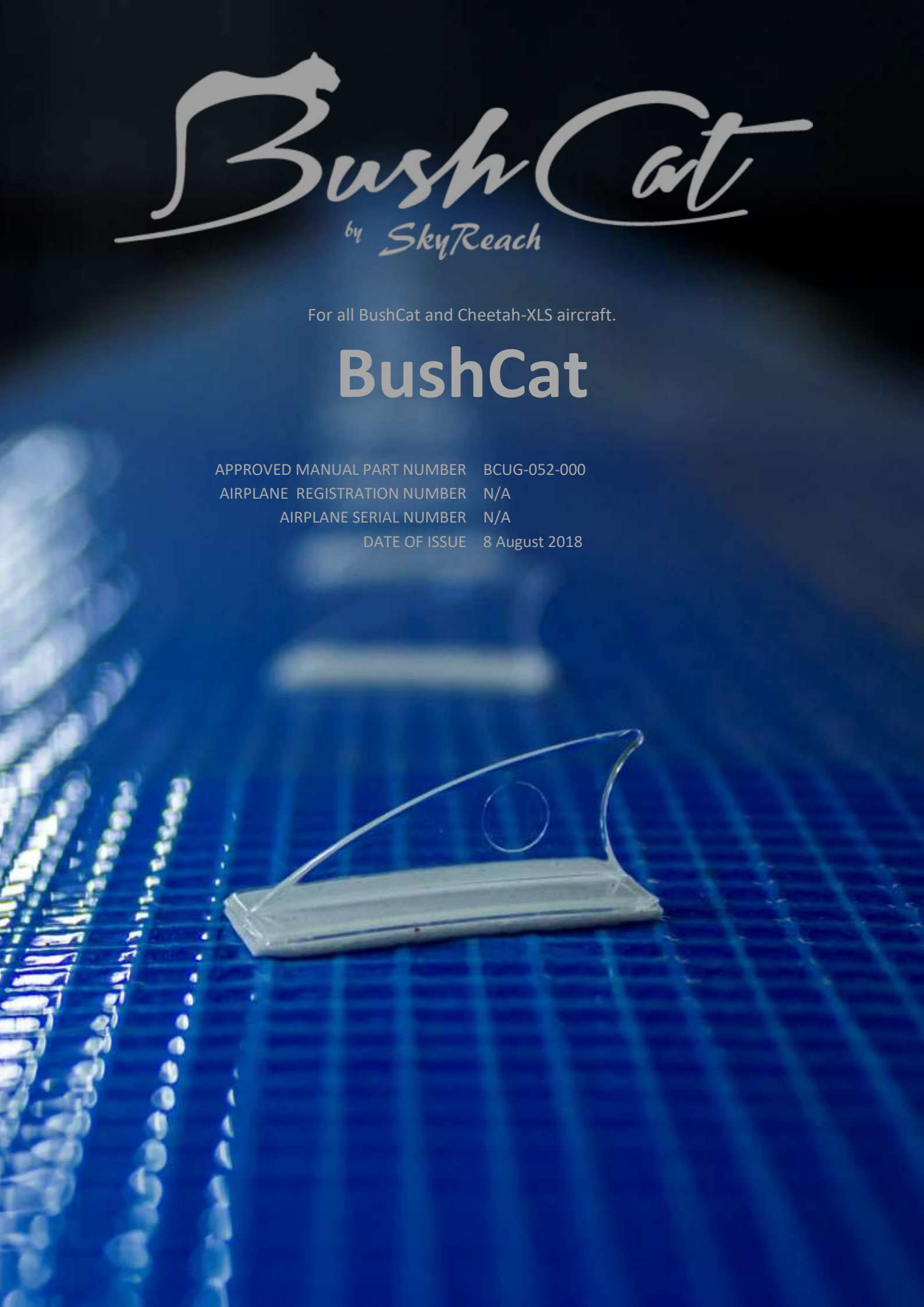

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1.1 Feedback form

Please use the following form to notify us of any improvements or corrections needed, as well as for continued operational safety reporting or for an owner's change of address notice. After completing the form please fax or email it to the relevant contact shown on the next page. In addition, please keep a copy of the completed form in your POH.

Name:

Email:

Phone Number:

Date:

BushCat Serial Number:

Registration number:

Feedback information:

Email or fax to:

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Chapter 2. Introduction to the manual

2.1 Introduction

Congratulations on your purchase of a BushCat upgrade kit. This manual will be your guide as you progress through the build phase of your upgrade. Please be sure to read through this entire manual before beginning any construction.

2.2 Builder assist contact details

Builder assistance is available from both the distributor and the factory. Should you require technical assistance at any point during the build, please contact the relevant facility via the contact details given below.

USA distributor:

AeroSport LLC
Phone number: +1 262 448 1122
Technical support email address: info@aerosportplanes.com

Factory:

Rainbow SkyReach Factory
Phone number: +27 11 817 2298
Technical support email address: builderassist@fly-skyreach.com
Skype: skyreachsupport
Available times: 08h00 to 17h00 CAT (GMT+2)

2.3 Required consumer abilities and responsibilities

This BushCat upgrade kit has been designed and engineered such that it can be assembled with the least amount of difficulty. The customer should be comfortable with the typical uses of the tools listed in the equipment requirements section below. The manufacturer expects the customer to assume responsibility for the entire build and test process, as well all flight authorisation processes.

2.4 Equipment requirements

The following list details the tools and equipment required to complete this upgrade. Please note that all spanners and sockets are listed as metric sizes. While there is a common practice to use similarly sized imperial tools, it is highly recommended that the listed metric sizes are used.

- Masking Tape or similar tape that can easily be removed
- Small step ladder that will allow the installer to reach the top of the wing.
- Sil-Poxy 0.5oz silicone epoxy adhesive.

2.5 Workshop requirements and environmental conditions

It is recommended that the upgrade be done in an indoor facility. Environmental conditions should be determined by the customer's comfort and common sense and the installation facility should be well lit from multiple light sources.

Chapter 3. Safety Summary

3.1 Potential Hazards (precautions)

As is the case with any project there are always hazards which one might encounter. It is the customer's responsibility to identify and eliminate these hazards which will be specific to his/her environment. However, it is impossible to plan for each hazard so we have highlighted a few hazards which we have found common, and listed them below:

- Clean the wing properly before installation.
- Be mindful of the fact that the Sil-Poxy adhesive will take some time to cure and will therefore be able to slide out of position if bumped during the installation process.
- Measure twice, stick once.

Chapter 4. Instructions

4.1 Parts list:

The following parts are required for the upgrade. Items 1 to 5 will be supplied with the kit upgrade.

#	Description	Quantity	Part number
1	Vortex generators	84	STD-000706
2	Vortex generators – self adhesive base	16	BC-00-04220
3	Semi-span template	1	BC-00-04222
4	Trilam square	1	BC-00-04223
5	Airspeed Placard	1	BC-02-01452
6	Masking Tape	-	-
7	Sil-Poxy® 0.5 oz. silicone rubber adhesive	-	-

Read through this entire document before commencing the installation procedure and watch the instructional video that shows how to fit the template and install the vortex generators. The video may be accessed by following the link on our website.

General Information

- If the clear silicon adhesive option was chosen you will receive 84 vortex generator without an adhesive base and 16 with an adhesive base. The windscreen requires the use of the self adhesive base due to the chemical incompatibility of the Sil-Poxy® with the windscreen.
- 2 spares will be provided for the windscreen and 4 for the wing.
- A small piece of Trilam has also been provided in this kit. This is for you to test fit one of the spare vortex generators with the silicone adhesive, to get a feel for how strong the adhesive is and specifically to get an understanding of how much Sil-Poxy® to use, how the silicone adhesive behaves when wet and how long you have to make adjustments before this is no longer possible. The working time on the silicone is stated as 5 minutes and the cure time is stated as 12 minutes. We have found that this may vary depending on temperature and humidity and we recommend 24 hours of curing time, if using Sil-Poxy®, before flying with the vortex generators installed.
- As is the convention, when referring to the forward or leading edge side it is implied that this is the side of the engine, whereas aft or trailing edge is on the side of the empennage. The right or starboard wing is on your right if sitting in the aircraft facing the engine.
- Only the installation steps for the right wing will be provided in this document, the left wing follows the same procedure with the other side of the template.
- The vortex generators are optimally spaced and oriented to provide the best performance, their location at 10% of chord on the wing is also important and it is therefore necessary to follow the correct chord-wise installation procedure and to note that this means that the line of vortex generators will not be parallel to the leading edge of the wing due to the taper of the wing.
- Lastly do not rush this installation, the neatness and efficacy of the installation depends on it.

Unpacking and preparation

1. Unpack the kit and check that all the required parts have been received.
2. Unfold the template and note that one side is for the left (port) wing and the other side is for the right (starboard) wing. Also note that each side has been marked on one edge indicating which edge should be placed against the wingtip.
3. Clean the wing surfaces and windscreen with a damp cloth and allow it to dry before continuing.

Marking out the chord-wise locations

4. Prepare 5 pieces of masking tape that will be used to stick down the template and mark out locations and centre the ailerons.
5. For the right wing, use the side of the template that has “Right wing” written on its one edge. While standing behind the right aileron feed this edge over the wing against the inboard edge of the composite wing-tip until the line that says “Right aileron” is aligned with the aft edge of the aileron.
6. Tape down the template to keep it in position.
7. Move around to the front of the wing and use a small ladder or stool to gain easy access to the front of the template.
8. Check that the template is up against the inboard edge of the wing-tip.
9. Place a small straight piece of tape along the leading edge of the template. The leading edge of the template (and now the aft edge of the tape) is where the aft edge of the vortex generators will be located.
10. Now remove the template and move to the rear of the right flap.
11. Feed the same template over the wing, while keeping it against the outboard edge of the windscreen, until the line marked “Aft of wing bracket” is aligned with the aft straight portion of the aft wing-fuselage bracket.
12. Tape down the template to keep it in position.
13. Move around to the front and again check that the template is against the windscreen, Place a small straight piece of tape along the leading edge of the template. Then remove the template.

Positioning the Template

14. Place the template, still with the correct side facing up, on top of the wing roughly in the position that it will be taped down, the cut-outs should be facing aft.
15. On the wing-tip side, ensure that the edge of the template is up against the inboard edge of the wing-tip and that the rear edge of the template is on top of the rear edge of the tape that was stuck down earlier. Then stick down the leading edge of the template to keep it in place.
16. It is important to only tape along the leading edge of the wing as this reduced the chance of inadvertently moving the silicone adhesive vortex generators once they have been stuck down, and because the template will be flipped forward once completed, for the same reason.
17. Go to the inboard section of the wing where the other chord-wise location was marked out, and again position the aft edge of the template over the aft edge of the tape. Then apply a bit of tension to the template to ensure that it is straight along the wing and that it doesn’t sag towards the leading edge in the middle. Then tape it down along the leading edge in this region.
18. Check that the portion of the template over the windscreen is also straight and aligned with the portion over the wing then tape down the end of the template onto the windscreen.

19. Having secured the template in three locations along the wing, the two pieces of tape under the template may be removed and the template can now be secured further by placing additional pieces of tape along the leading edge, we recommend a piece of tape after every two or three vortex generators.
20. Once the template is secure stand on a small ladder by the wing-tip and look down the wing to check that the line of vortex generators will be sufficiently straight. The vortex generators are allowed to be within a 10mm margin of the ideal position, but the neatness of the installation will depend on how carefully this step is done.

Installation of the vortex generators

21. Start at the wingtip and work your way inward.
22. For the silicone adhesive, apply a small layer of Sil-Poxy® along the underside of the vortex generator. The idea is that when the vortex generator is pressed down on to the Trilam with a bit of force, all air bubbles should be pushed out and glue should fill the base of the vortex generator, but there should not be so much glue that it oozes out the side. Excess silicone around the edges will make for a messy finish and may glue the template to the vortex generator which will make removal of the template difficult without dislodging the vortex generator. Best is to put a small amount of silicone first, the vortex generator can easily be removed when the silicone is still wet if more Sil-Poxy® needs to be applied, whereas removing excess silicone later when it has started to cure is difficult. We recommend perfecting the amount of Sil-Poxy® required by practicing with a spare vortex generator and the provided piece of Trilam. Lastly, note that the vortex generator can easily slide around on the Trilam if the silicone has not cured yet, therefore care must be taken to not bump the template.
23. After applying all the vortex generators to the wing, apply the remaining self adhesive vortex generators to the windscreen.

Removing the template

24. After installing all the vortex generators, work your way back along the wing and check that all the vortex generators are still in position and stuck down properly.
25. Allow some time for the silicone to cure to the point where the vortex generators do not slide around easily. Then starting at the inboard section of the wing the template will slowly be flipped forward, clear of the vortex generators. Press down firmly on the first vortex generator and pull up on the rear of the template to lift it above the vortex generator; this will prevent the vortex generator from being peeled from the Trilam if the Sil-Poxy® has stuck the template to the vortex generator. Then move on to the next vortex generator and repeat the process until the entire template has been flipped forward (an extra set of hands may be helpful here).
26. Once fully flipped forward, recheck all the vortex generators to ensure that none were displaced during the previous step. If they are all still in the correct position the template may be removed.

The other wing

27. Repeat Steps 4 to 27 on the other wing by using the other side of the template.

Care and maintenance

- Both adhesives are water resistant.
- Take care when cleaning the top of the wing, although the vortex generator is difficult to pull off when pulling on the vane, if a rag or microfiber cloth gets hooked on a corner with enough force it could result in the adhesive in that region delaminating, and once that starts it may compromise the rest of the adhesive.
- Aircraft fitted with an optional dust-cover, may continue to use the dust-cover as always although we recommend paying attention when fitting the dust cover over the wings so as to prevent damage to your dust cover or vortex generators.

Removal of vortex generators

If for whatever reason a vortex generator needs to be removed here are some suggestions.

- The adhesive is strong once applied and cured, care should be taken upon removal. Do not simply pull the vortex generator until it comes off, as this may damage the Trilam, especially on older aeroplanes where the Trilam is reaching the end of its operational lifespan.
- We recommend using a small craft knife with the blade held parallel to the base of the vortex generator and angled ever so slightly upward to avoid cutting into the Trilam. Then slowly cut your way through the adhesive.
- Again practice on the provided piece of Trilam before attempting a removal on your aircraft.

General Information

Supplied in this installation kit are a set of 100 vortex generators (of which 6 are spares) to be installed along the leading edge of the wing and over the windscreen. A brief description of how the vortex generators work and how they will affect the aircraft is presented in this document followed by the installation procedure.

Vortex generators are small vanes that are placed on an aerodynamic surface to delay flow separation at slow speeds and higher angles of attack. In normal flight conditions the airflow over a wing (and the fuselage to an extent) stays relatively well attached to the top surface for most of the wing's chord before being shed at the trailing edge. As the airplane slows down and the angle of attack increases the air has less energy to stay attached to the wing and at a certain point the air does not have enough energy to curve over the wing's top surface and a stall occurs.

The vortex generators, when placed correctly on the wing and windscreen, create a tip vortex from each of the vanes. This tip vortex is a highly energized stream of air that rotates downward into the wing helping the flow to stay attached by adding energised air into the boundary layer; as a result the wing can operate at higher angles before stalling, hence allowing stall speed to be reduced.

FAQ's

How will the vortex generators affect my aircraft's flying characteristics?

The following areas of your aircraft's performance will be noticeably affected.

1. Stall speeds will be reduced by roughly 8 mph. Exact figures may vary for each aircraft depending on the condition of the Trilam and various other factors.
2. Landing and takeoff distances will be greatly reduced due to a slower approach speed.
3. During landing, caution must be exercised and we recommend paying close attention to the approach speed, it is important that the published approach speed in the latest version of the POH be adhered to.
4. Stalls, especially in the clean configuration will be more noticeable, where in the past the aircraft started to descend without a pronounced pitching down; it now pitches down in a more defined manner.
5. Care must be taken during slow flight, the aircraft can now be flown at a much slower speed with power on, and especially in the landing-flap configuration, if ailerons are used excessively during such a manoeuvre it could cause the outboard portion of the wing to stall before the inboard portion, which may lead to a spin if the aircraft is not controlled with the rudder.
6. A slight reduction in maximum level speed (Vh) in the order of 1- 3% will be seen, values may vary depending on propeller pitch and aircraft configuration.
7. An increase in lateral stability when approaching the stall will be noticed.

Can I change the arrangement of the vortex generators?

No, the vortex generators specified by SkyReach must be placed as specified in the installation guide. Altering the angle, spacing or chord-wise position of the vortex generators will have a negative impact on the flight characteristics of the aircraft. Any deviation from these parameters or using different vortex generators to those prescribed by SkyReach could result in your aircraft not complying to the published aircraft speeds in the latest Pilot's Operating Handbook. The current configuration, amount of vortex generators, angle, spacing and chord-wise position have been optimised with numerous flight tests, and is the only approved configuration.

Can I operate the aircraft with some Vortex generators missing?

No, while further testing is being conducted to establish what the minimum amount of vortex generators are that the aircraft can be legally operated with, all the vortex generators must be in place before flight, as specified in the installation manual. Spares have been provided in the case of any vortex generators being lost or damaged.

The vortex generators over the windscreen must be in place, as the airflow over the fuselage also contributes to the lift produced by the wing and the effectiveness of the empennage.

Under absolutely no circumstances should the aircraft ever be flown with vortex generators only applied to one wing, or only partly applied to either/both wings.

Should I apply vortex generators to my Horizontal stabiliser and/or elevator?

No, manufacturers of vortex generators often instruct operators to install additional vortex generators along the horizontal stabiliser when installing vortex generators on the wing. This is to increase elevator authority at low speeds because the tail is often not designed to handle the increased angle of attack attainable by the wing with the vortex generators fitted, resulting in a stalled elevator.

The BushCat was tested so that you can legally operate within the published Centre of Gravity envelope without requiring any additional vortex generators on the empennage. Fitting vortex generators to the empennage could lead to adverse handling characteristics in critical phases of flight, therefore we strongly advise against it.

How was the stall speed defined for the BushCat?

When establishing the stall speeds of an aircraft there are certain methods that must be adhered to in order to get accurate, repeatable and representative results. The method presented here is the accepted standard for defining stall speeds and was the method used when testing the stall speeds of the BushCat.

All tests were conducted in still air at altitude to avoid any wind gusts from affecting the data. The engine power is then reduced to idle and the aircraft is allowed to descend at a rate that gives a rate of deceleration not exceeding 1.15mph until the stall is reached. The stall is called either at a notable pitch down (aerodynamic pitch break), or at the point where the elevator reaches the rear control deflection limit and the speed does not decrease further. The test is then repeated numerous times to ensure that the data is correct. The test aircraft is also fitted with a secondary pitot-static instrument and a data logging system that records over 30 parameters on the aircraft numerous times per second,.

These tests are done (as required by law) at idle power, at the most critical CG location and at the maximum take-off weight for your country. As the heavier an aircraft is and the further forward the cg is, the higher the stall speed will be.

Finally the matter of airspeed is addressed; the indicated airspeed is not a true representation of the speed of the aircraft through the air. The indicated airspeed (IAS) on all aircraft suffer from two sources of error*. **Position error** results from an incorrect pressure reading in the pitot tube and static source due to the altered airflow over the wing and around the fuselage. The second source of error, **Instrument error**, arises from any inaccuracies associated with the airspeed indicator itself. In order to correct for these errors to determine the actual calibrated airspeed (CAS) of the aircraft through the air, a calibration curve (presented in the latest version of the POH) must be used to convert the IAS to the CAS. Only then can the true stall speed be determined. See the Technical Guidance Material published on the SkyReach website for further information and calibration.

* Note that a leak in the pitot-static system will result in the airspeed indicator under-reading.

** The location of the CG and the mass of the aircraft (since moment-arms, pilot masses and fuel may vary from flight to flight) were determined before every flight by weighing the aircraft on a set of calibrated scales.

*** The idle setting on the engine was check to be at its minimum possible setting while still ensuring smooth running at idle power to ensure minimum additional airflow over the wing from the propeller.