An Owl cannot fly without ...

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Flight Feathers

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MEETINGS

FIRST SATURDAY OF THE MONTH AT 11AM

NO MEETINGS JULY/AUGUST

NEXT MEETING:

MARCH 5th

EMERGENCY CALLS FROM OUR FIELD

352-485-5111

2022
WISE OWLS

RON SANDERS
PRESIDENT &TREASURER

~

VICE PRESIDENT

~

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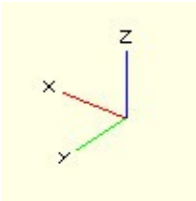
ART SCHEURER
SAFETY COORDINATOR &FIELD MARSHALL

~

BRET MARTIN
FERNANDO MESA
AMA INTRO PILOT INSTRUCTORS

And Now for Something Completely Different...

Photos and events (of which I am aware) are slim-to-none this month so I'm reprinting an article I wrote for another newsletter. Hope to have more club oriented stuff next month.



The Scientist Corner

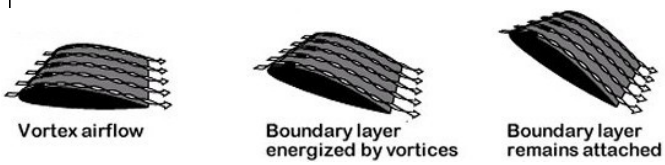
Ed Centanni

Designing, Making, and Installing Vortex Generators

A vortex generator (referred to hereafter as VG) is an aerodynamic device mounted on a lifting surface to increase it's effectiveness during low airflow, high angle of attack conditions.

When a wing's angle of attack increases to a large degree, the layer of air flowing over the wing separates and no longer flows smoothly over the surface, causing loss of lift called a stall.

VGs introduce a high energy turbulent stream of air (a vortex) into the air flow causing a delay in separation of smooth air flow as the angle of attack increases.



Here's an image of VGs in action on the wing tips of an RC airplane:

Notice how the tufts (showing airflow) are straight behind the VGs at the wing tip and in mixed directions on the rest of the wing.

VGs are not only used to lower stall speed or stop tip stalls. If placed directly in front of the hinges of control surfaces (ailerons, elevators, and rudders) they help keep the control surfaces from stalling at low speeds or high deflection. This will increase overall control of the aircraft during extreme maneuvers and help your aircraft make you look even better than you really are.

Designing VGs

Simply scaling down the size of VGs found on full-sized aircraft is not an optimal solution. Air density doesn't scale down for RC aircraft – at least not on this planet. So here are some simple quick design rules for creating your own VGs that are suitable for RC sized aircraft. I placed some references at the end of the article that I used to derive the design rules for those gentle readers who may wish to wallow in the math behind them.

Step 1. Determine your shape. There are many different shapes used for vortex generators. Triangle blocks, vanes with an array of shapes – tapered or not. What I suggest is a simple rectangular vane. It's easy to make and install. Studies on ¼ and less scale wings have shown that shaping them into vertical triangles, tapered leading edges or even curved leading edges does not significantly improve their effectiveness or decrease drag.

Step 2. Determine the dimensions of your VG – length and height. The length (leading edge to trailing edge of the VG) should be between 5-8% of the chord (length from leading edge to trailing edge) of your wing. Length of the VG will help determine the placement also. VG height is an interesting

mystery. Theoretically the optimum height should be within the boundary layer height – typically 80% of the boundary layer height. On RC sized aircraft the boundary layer is extremely short – too short to be practical. However tests have shown that a VG height as much as 200% taller than the boundary layer can have very effective (almost identical) mixing qualities. So just make it 1/8" (3-4mm) or so for practical fabrication.

Design Example: For a wing with a 10" chord let's use 7% of the chord: 10 * 0.07 = 0.7" or 17.78mm. So we have a rectangle VG with a length of 0.7" (17.78mm) and a height of 1/8" or 3.177mm. For wings that taper use the wing chord at the point where the VG will be installed – usually the tip area.

Step 3. Determine the VG placement on the wing. VG placement includes the 1) distance the VG leading edge is back from the wing leading edge, 2) the span-wise spacing of the VGs along the wing, and 3) the angle of incidence (rotation from straight into the wind). Warning: here comes some algebra. The VG leading edge should be placed at a point that is .16* (WC – VGC). That means 16% times the Wing Chord minus the VG Chord.

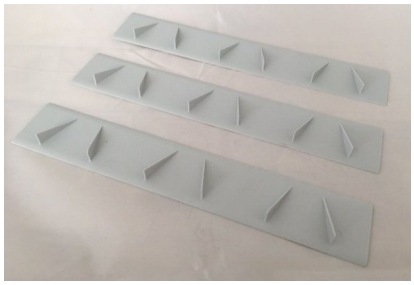
Design Example: For a wing chord of 10" and a VG chord of 0.7" the math is .16 * (10 – 0.7) or 1.488" (call it 1.5") from the wing leading edge.

Span wise spacing is determined by a rather complex formula that can be summarized by just using the VG chord as the spacing value – 1.5". That is the distance between the centers of VGs – remember the VG have an angle of incidence – the leading and trailing edges are not the same distance from each other. Like this: /\ /\ Only the centers are the same distance from each other and that is where the spacing is measured. The spacing can be anywhere from 80 – 120 % of the VG chord.

The angle of incidence can be anywhere from 15-18 degrees. 15 degrees is probably best.

Making the VGs

You can make them out of any material that is stiff enough to stay straight in the wing flow. I recommend making them out of styrene plastic. Easy and quick to shape the parts (just a bunch of rectangles). Use a thin rectangular mounting sheet, mark the placement of the VGs on the sheet and cement the VGs vertically to the sheet like so (excuse the non rectangular VGs in the image) :



Installing the VGs

You can attach the VG assemblies (be sure to rough the bottom) to the wing using your favorite glue, however I recommend Glue Dots or Glue Strips. This is a temporary re-use adhesive. Remember the gooey, rubbery snot-like stuff used to hold credit cards to cardboard during mail delivery? That's it. Available at Walmart. You can experiment with it and re-position them or remove them when you're done.

Here are the references as promised:

"DETERMINING AN OPTIMUM VORTEX GENERATOR CONFIGURATION FOR A PIPER CHEROKEE WING"

https://peer.asee.org/determining-an-optimum-vortex-generator-configuration-for-a-piper-cherokee-wing.pdf

This is a paper written for academic purposes. I have a problem with the use of a scaled-from-full-size VG and wing but I guess ¼ scale is not small enough to cause issues.

"Empirical study on vortex generators for RC sized aircraft"

http://flitetest.com/articles/vortex-generator-design-tips-and-experimentation

Good article with lots of formulas, pictures, video, and practical results. Glosses over some issues covered in previous citation.

So there you have it. Now you can make your own vortex generators to warp time and space and travel to other dimensions – or at least make your plane fly better.

Until next time, keep getting your science on.