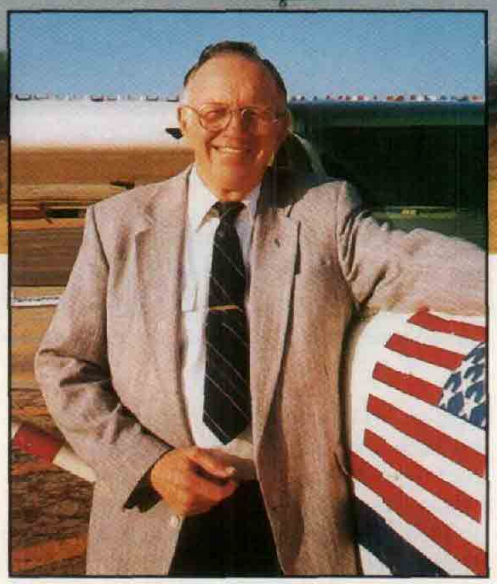
SUPER STOL 150



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Have you ever made a landing approach in a Cessna 150 at 30 knots or less indicated airspeed? Maybe not, but at our local Rock County Airport near Beloit, Wisconsin it happens quite often.

The airplane involved is a 1976 Cessna 150M, N9225U, S/N 15078175, with its standard Continental O-200 engine of 100 hp and some very efficient STOL modifications. It is licensed in the Experimental Research and Development category for flight testing high lift devices and new airfoil designs.

As you read on, you will find some very slow in-flight airspeeds quoted plus some phenominal capabilities claimed for my STOL 150. Please do not take your conventional airplane out and try to duplicate any of these extremely low airspeed maneuvers at low altitudes. If you do, you could get yourself hurt or killed. Don't try to match my airspeed claims even if your airplane is equipped with a commercially made STOL kit. They are all good kits if used as advertised by their manufacturers, however, one must - and I repeat, must - go by their recommended airspeed envelope only. The (extremely) low airspeeds I quote do not apply to any other STOL kit except the one I am developing.

The entire experimenting and testing program dates back to 1985, the year I became motivated to build a super STOL airplane for missionary use in the "back country." I wanted to build a short takeoff/landing airplane that could get in and out of small airfields in the remote areas of the world. I first saw the need for such a STOL airplane while flying the "bush" country of far north Alaska.

My project started from "zero." I didn't have an airplane and I didn't have much money, but I was long on the most important ingredient - faith! Eventually, a Cessna 150 was made available to me with an extremely low down payment. It was hard to scrape even that little amount together, but I somehow managed and, of course, the monthly payments. Today, the airplane is all paid for and has become the airborne test vehicle I needed.

About a year after purchasing the airplane, the STOL project began in earnest. I bought a Horton STOL kit from the factory in Wellington, Kansas. (Horton STOL stands for "SAFER TAKEOFFS AND LANDINGS.") Within two weeks I had the kit installed and the airplane flying. What a difference the kit made! What a help it would be to the missionary pilots in the "bush." I was impressed with the improved performance it gave including a gentler stall, a slower landing speed and greatly improved lateral stability. The kit installation was step number one toward reaching my goal.

As a personal note: I highly recommend the Horton STOL kit in its current configuration for any flyer from the student pilot on up.

My Cessna still has the Horton leading edge cuffs and the two stall

Called the Super STOL 150, the Cessna 150 reveals many of the modifications in this overhead photo. Note the extended "flaplets."

fences on the wing, but from there on it's totally different. The current mods and new aerodynamic designs have made the original kit even better.

This newly developed STOL kit is designed to operate in an "airspeed envelope" all of its own. I have named it the "SUPER STOL CATEGORY", which includes the airspeed range from 35 knots indicated airspeed and on down to zero. To me, flying 35 knots indicated with my Cessna 150 is well above stall speed and gives a good margin of safety above the lower end. Flying the base and final legs of a landing pattern at 35 kts. and below is routine.

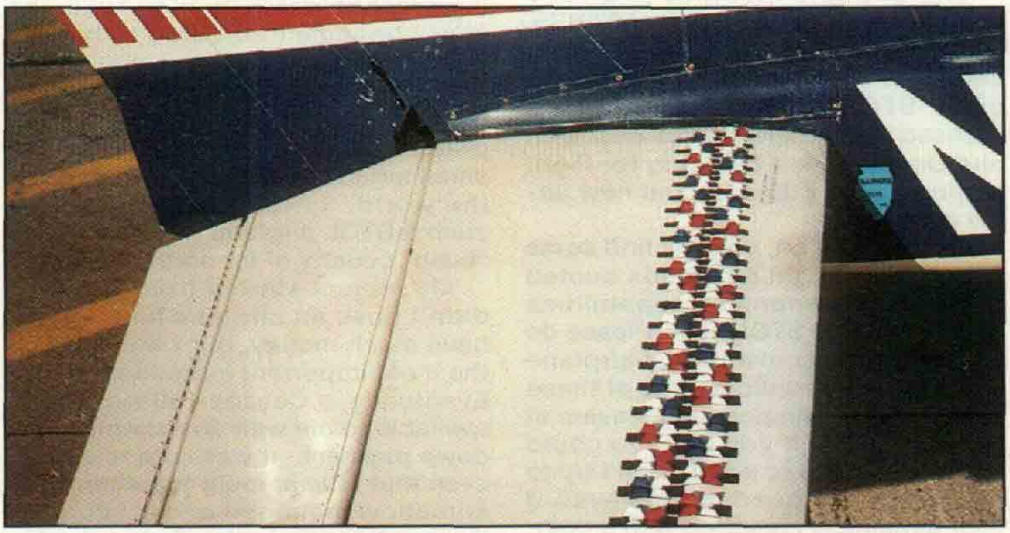
This airplane with the current STOL kit installed cruises at 102 mph. That is a little below the listed cruise speed for a standard Cessna 150, however, I accept the small tradeoff for the advantages gained at the lower end of the speed range, namely the added safety margin during an off airport emergency landing plus the improved STOL flight capabilities. There has been a notable increase in the spread between the cruising speed and the stalling speed of the aircraft.

Let me describe the various parts of the kit that makes the airplane fly so slow. I'll explain each add-on unit in the same sequence that it was installed on the airplane.

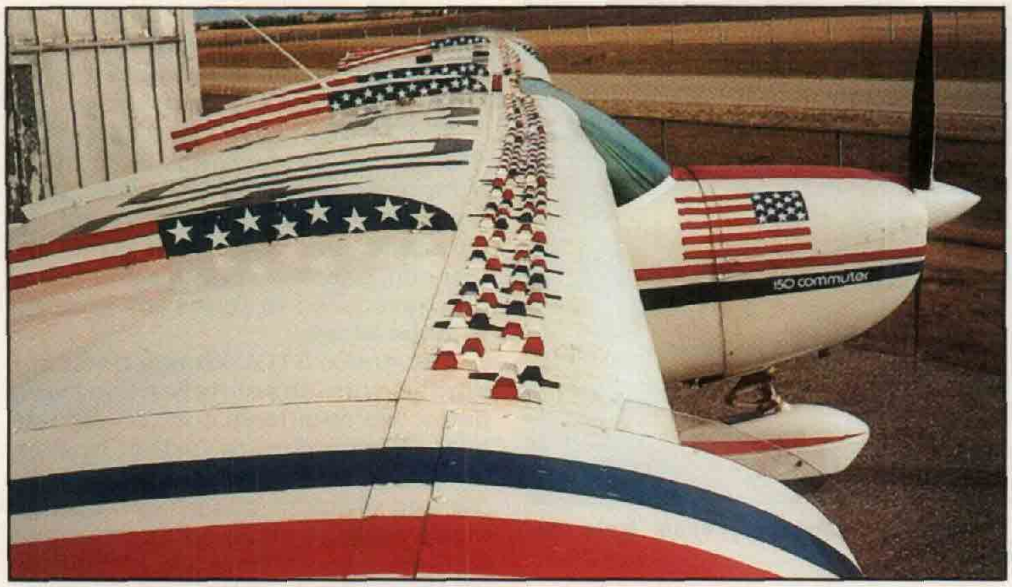
To begin with, I added four individual stall fences of my own design to the top side of the wing, making a total of six fences altogether. The new ones were painted red, white and blue while the two Horton fences remained all white. With two different color designs, it makes it easier to point out to the observer which is which.

You may notice in the picture that the new fences are taller than the original ones. I wanted to make sure that air flowing over the top side of the wing was kept parallel to nornal airflow direction and not drawn inboard into the higher velocity air directly behind the propeller. If the airflow was allowed to jump the fence and cross the wing at an angle, unneeded turbulence would be created. This would interfere with smooth boundary layer airflow and consequently increase the stall speed.

There are many different wingtip designs used to reduce wingtip vortices and lessen drag. After studying



Vortex generators on the stabilizers make the elevators much more effective, especially at low airspeeds.



Eight hundred vortex generators are fastened to the top side of the wing leading edge. Note the six "fences" installed on the wing.

the in-flight airflow pattern and varying air pressure areas out at the tip, I came up with my own version of the long used wingtip spill plate to properly direct airflow. They are similar to the spill plates I used on my 450 hp Stearman for crop dusting years ago. Those that I am currently using are transparent and extend outward from the wing surface three inches. The plates taper downward and extend only one inch ahead of the wing leading edge. This allows the air striking the front of the wing to "splash" outward and overboard to give smoother airflow along the outside of the spill plates. This in turn reduces turbulence and drag.

The endplates are made out of a polycarbonate material called Lexan. I chose this material for two reasons. It is very easy to work with, to drill through and to cut to shape. It is not brittle and will take a lot of stress and twist. Secondly, the see-through feature gives the tip a better cosmetic look. The only disadvantage is that it is a heavy material and does not lend itself to lightweight construction.

My first set of added wingtips increased the overall span just two inches.

Next in sequence came the vortex generators on the top side of the wing. To start with, I requested and received some very good information about vortex generators from the King's Engineering Fellowship at Orange City, IA, builders of the twin engine pusher aircraft called the "Angel." The material included a hand sketched drawing of vortex generators with size demensions, mounting angles and a general placement formula.

Going by their instructions, I placed some home made VG's out near each wingtip. Flight testing seemed to prove them effective, but I thought I would add some more. I figured if a few VG's would make a difference, a whole bunch of them would be even better. I continued adding ten more VG's between each flight and checked the performance. This continued until I had a complete row across the top of the entire wing. The overall performance was good with two hundred VG's in place. I used two-sided carpet tape and black electrician's tape to hold them firmly to the surface.

According to the formula that computed space available, I had room for more VG's. I added another row - carefully testing as I went. A third row gave a total of six hundred VG's. Then a fourth row filled in the entire slotted area. The eight hundred VG's seemed to lower the stall speed considerably. I plan to leave them all taped in place until my experimental program is completed.

Here is a fact that might interest you. If properly positioned on the wing, vortex generators do not reduce cruise speed nor will they gather a coating of ice during flight.

In an attempt to improve lateral stability even further, I built two new wingtips that increased the wing span a total of thirty inches. The leading edge extends five inches ahead of the main wing and is drooped downward twelve degrees. The trailing edge extends an extra five inches rearward and is drooped downward about five degrees. The trailing edge acts as a lowered flap creating some extra lift, however, there is a negative side. The extra drag lowers my cruise speed - an item for future attention. The added wingtips have improved lateral stability, but not enough to operate safely with a 25 knot IAS at gross weight.

During slow flight, the aileron response seemed very sluggish and in my opinion not at all adequate. To correct the situation I installed a rather blunt, 3/4 inch wide, 17 inch long metal strip on the trailing edge of the aileron, right at the extreme outboard end. I named it the "aileron leverage bar." I'm not the original inventor. Someone explained the idea to me and how it works. I made a small change in the original design to create more vertical resistance. In my opinion, the increased drag caused by these little bars isn't really noticeable; yet they improve aileron efficiency an estimated fifty per cent.

To increase rudder effectiveness and smooth the airflow, I mounted sixty VG's on the left side of the verti-

Full flap and "flaplet" deflection (plus flow fences on flaps) helps Don slow the 150 down to near zero airspeeds.

Complex wingtip installation is described in the article. Fences are Lexan. Note row of VG's under the wing, just ahead of the aileron.

cal fin in a slanted row parallel to the rudder's leading edge. As an added experiment, I decided to place some vortex generators on the horizontal stabilizers to see if they would improve elevator efficiency at slow in-flight airspeeds. This is a very critical area to be adding anything that would alter air flow over the elevators. Thus I proceeded very carefully and added only six VG's between each test flight. I ended up with a total of three hundred and sixty-eight little red, white and blue VG's mounted approximately six inches behind the stabilizer's leading edges. This constituted over sixty separate flights over a two week period. Besides being exciting, it increased elevator efficiency enough to make their presence well worthwhile. (Note how little elevator deflection is being used in the photo showing a slow flight approach at thirty knots IAS.)

The last two add-ons that I am about to explain have proven to be very successful and in my opinion are a major breakthrough in slow flight technology.

The idea to extend the wingtips even further came to me in a very strange and unusual way. One night I awoke from a sound sleep, turned on the light on my night stand, grabbed some paper and a pen and hurriedly drew a double airfoil. Without stopping, I quickly wrote immediately below the sketch "one foot by two feet." The next morning I studied my unusual drawing and convinced myself that such a design might fly.

During the following three months I built up two separate wingtip units to the same proportion as the little drawing. I didn't know if I was wasting my time and a three hundred dollar investment, but I continued on and finally had them ready for flight testing. As in many of my previous flights involving major flight testing, I proceeded very slowly and carefully. I let the airplane just barely get airborne and then decelerate to a landing. If the airplane handled satisfactorily, I'd increase the length of my flights a little more each time, until a trip around the traffic pattern was completed. The flight test with the new wing tiplets was a total success and gave the airplane added lateral stability I never thought possible. I can now fly my airplane right on down to a near zero airspeed indication and still have sufficient lateral control.

Several months ago, I built a set of new "high lift speed brakes" to be attached to the trailing edges of the standard conventional flaps. My need for them was to resist thrust from the propeller during extra power applications in the super slow flight mode.

These tiny "flaplets," as I have named them, extend rearward only 5-1/2 inches behind the standard flap, yet they incorporate and use nearly 51 feet of one-inch diameter aluminum tubing. With a zero angle of attack, each horizontal tube drafts behind the one ahead and creates very little resistance at any airspeed.

Just as the little flaplets are deployed downward, air rushes through the gaps between the tubes creating lift and very little drag. With approximately twenty degrees of flaps deployed, the lift component reaches its maximum lifting force. With the flaps extended more than twenty degrees, the lift component gradually changes into drag. At forty degrees, there is more drag than lift and theoretically, at the ninety degree deflection, the flaplets are producing 100% drag and no lift whatsoever.

Normally the flaps on a standard Cessna 150 may be lowered at 85 kts. IAS. Due to the extra drag and lift produced by the flaplets, I let the airplane slow to 40 kts. IAS before lowering any flaps. I feel it is safer to use a slower airspeed and not put an overload on the flaps and mechanism.

The 31" high letters that spell "SUPER STOL" on the wings were made from good quality electrician's tape and have proven themselves almost indestructible. High winds, hot summer sun, gasoline splashes and heavy rain have failed to cause any problem with the letters.

The entire STOL kit has been designed with absolutely no moving parts. No additional control gadgets enter the cockpit to further burden the pilot's work load. It is a very simple and efficient design and can be made out of light weight composite material to lower cost, yet last indefinitely. All kit parts and designs invented by myself plus some of the proper names mentioned have been recorded at the United States Patent Office in Washington, DC.

Many folks are of the opinion that a STOL airplane is one that can become airborne after an exceedingly short takeoff run and then come to a complete stop in a very short distance after touchdown. Their definition has a great beginning but is rather incomplete. I would like to add one more major requirement before any airplane can earn the true title of STOL and that's positive and very effective lateral stability at super slow "in-flight" airspeeds. This modified Cessna 150 has that needed ingredient.

The next logical step would be to advance this design from the prototype to STC'd kits for the various makes of light aircraft. Doing this would take a rather substantial investment which, unfortunately, I don't have, living on a retirement income. If someone out there in "EAA Land" has some good supportive ideas, write me at the above address. Any comments, ideas or suggestions would be appreciated. (It would almost be a shame to let this whole project die on the vine.)

I am currently 70 years old and enjoy flying and experimenting, however, my fifty years in aviation and 16,000 hours of flight experience has been a positive asset in designing and computing - but it doesn't necessarily help the cost factor!

As for the future, I plan on slow but steady progress, making some revisions on both the wing tiplets and flaplets. From my calculations, the up coming changes could easily double the lifting capacity of each unit and that's worth going for. Every little improvement will help to build that much needed airplane for pilots to

Flow fences and extreme rounded trailing edge of wingtip help the extreme low-speed effectiveness of this unique installation. The aileron "wedge" on the outboard end of the aileron is described in the article.

use in missionary work in remote areas around the globe.

I would like to invite all the EAA folks and fellow flyers to stop in at our Rock County Airport, Janesville, WI to see the SUPER STOL 150 and chat a bit. You will most likely find me at "Margie's Restaurant" in the terminal building where I will be eating, visiting or just plain designing new things for the airplane. I practically live out there and it's almost like a second home to me. My hangar is just a short distance away.

If the outside temperature is at least 40 degreees above, I'll be glad to make some solo demonstration flights - the most enjoyable part of this endeavor.

DON DRESSELHAUS

By Norm Petersen

Although born in Iowa, Don Dresselhaus moved with his family to Beloit, WI at the age of two and has pretty much been a resident ever since. His introduction to flying came in 1939 when he rode his bicycle 18 miles to the Rockford, IL airport for a flying lesson in a 37 hp Taylor Cub. (He even got hit by a car on the way home!)

Eventually Don soloed a Luscombe 8A in 1940 at the Rock County Airport under the tutelage of Stiles Whipple (EAA197212) and his brother, Bill. Working hard at learning to fly, Don earned his Private license in early 1941 and his Commercial in late '41. He then went to work for Howard Morey (EAA100455) as an instructor followed by an instructing job with Russ Van Gelder at South Beloit.

About 2,000 more hours of instructing were added to Don's logbook at McChesney Airport in Rockford during the WTS program. He was then drafted into the Navy, spending the balance of WW-II as a Control Tower Operator in California. At the end of the war, he purchased a surplus Stearman and flew it home to Beloit - using a road map and car gas.

Don well remembers flying his immaculate Stearman to Chicago in 1947 in an attempt to sell the airplane for $300 - with absolutely no takers.

A chance to go crop dusting with an 85 hp J-3 Cub brought more hours at Pecatonic Dusters before Don went to work at West Bend, WI for Cliff DuCharme's Aerial Blight Control flying 450 Stearman sprayers. After several years of Stearman ag work, Don had a chance to become a civilian flight instructor for the Air Force in 1951. To begin with, most of Don's work involved instructing in the AT-6. At one time during four classes in a row, his students took first place in the aerobatic competition - a point he mentions with a twinkle in his eye.

From AT-6 work, Don moved on to instructing in T-34's and T-28's. He estimates he has over 5,000 hours of T-28 time among his total logged time of over 16,000 hours. After nine years as a civilian instructor, Don returned to Beloit in 1960 and two years later, became a Rock County Deputy Sheriff. During the next 20 years in this occupation, Don was occasionally called upon to fly search and rescue missions for the department. He retired from the Sheriff's Department in 1982.

During this time Don wrote a book entitled, "I Never Flew Alone," which includes 51 stories and 26 pictures from his many flying experiences - including one midair collision! While flying a Piper PA-12 Super Cruiser on a cross-country trip with a Luscombe piloted by his lady friend, the Luscombe ran into the Cruiser from behind and above; about the four o'clock position. Don somehow managed to get the PA-12 on the ground in one piece, however, the Luscombe spun in and his friend, Harriet, was killed.

Another time Don spun a Taylorcraft and the left rudder pedal would not return to normal position. With full left rudder, Don rode the airplane all the way to the ground, impacting a cornfield. Although he was not injured, the farmer's dog wanted to bite him as he crawled out of the wrecked airplane!

From 1984 to 1989, Don spent the summers at his son's fixed base operation at North Pole, Alaska, flying "bush" with a Super Cub, Helio Courier and a Cessna 185. Flying within a 200 mile radius of Fairbanks, AK, Don learned first hand what the Alaska bush pilots have to endure on their many trips in all kinds of weather. It was the culmination of these many experiences that led Don to develop the Super STOL 150.

The Cessna 150 is the 54th airplane that Don has owned. He has checked himself out in about 30 different aircraft including a Grumman F8F-2 "Bearcat" that he went down to Florida in 1961 and purchased for a friend ($6,000) and just got in and flew it! After the second landing at Valdosta, GA, Don called the new owner and told him to get another pilot - he didn't feel good about the airplane. The new pilot flew it north and while landing at Valpariso, IN made a beautiful landing about 30 feet in the air. The resulting crash sounded like two cars hitting head on - and the Bearcat cartwheeled, ending upside down. The Valpariso Fire Department was having a fire drill at the airport so they rescued the pilot who was straddling a leaking 140 octane gas tank. The F8F-2 sat dormant for several years until finally Lyle Shelton bought it and built it into "Rare Bear" - the great unlimited racer.

Don also flew on the airshow circuit for about five years in the early 1970's, usually doing the car-to-plane transfer with two rope ladders and two climbers. During this period, Don had a Letter of Competency from the FAA from ground level and on up. His only close call came in 1972 when one of the climbers fell off the rope ladder and was only bruised. He was back at the air show within an hour.

As Don says, "It's the fabulous people you meet over the years that mean so much, especially in the air show business. Even the great Bob Hoover came over to console me after I lost the climber. I will never forget him."

(Editor's Note: Don's book, "I Never Flew Alone," is available for $2.95 from Don Dresselhaus, 1703 Ashland Ave., Beloit, WI 53511.) ◆