W A Technology

Carbon Fiber Splitter

Splitter Increases Downforce and Looks Cool!

At the speeds I mostly travel a Splitter is not doing much other than looking good! John Bednarchik, GM's top aerodynamicist was interviewed about the C7. He said; *"Shapes for improving fuel efficiency typically begin to have an effect at highway speed. However lift and drag components become critical from 150 mph to maximum velocity."*

Aerodynamics is complex; NASCAR, F-1, manufacturers etc., spend thousands of hours and millions of dollars in wind tunnels because it is not intuitive!

Added a carbon fiber *C7 Carbon* (*coincidence in their C7 name!)* model "GTX Front Splitter w/side Splitters." Although *C7 Carbon* calls them "side splitters" GM calls them "End Plates" in the Z06, which we'll use in this report.

Splitter and Air Dam – What They Do?

The main aim of a front Splitter and Air Dam is to optimize of the flow of air to the rest of the car, reduce drag, and create downforce. The desired balance is to achieve minimum drag and maximum downforce, aiding the front tires in achieving more grip.

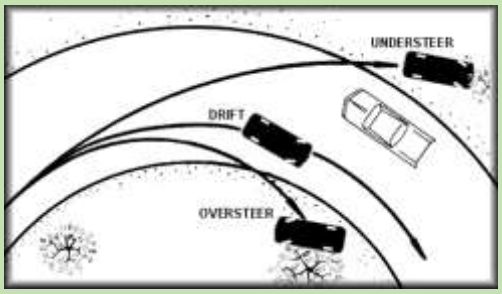
SPLITTER: The front Splitter serves to increase the amount of downforce at the front of the car. Air flow is brought to stagnation above the Splitter causing an area of high pressure. Below, the front Splitter air is redirected away from this stagnation point and accelerates air under the car, which in turn causes a low pressure area. High pressure over the Splitter and the low pressure caused by the airflow under the car creates downforce.

This helps minimize the effects of understeer and gives the front end more turn in response on entering corners at speed.

AIR DAM: An Air Dam's purpose is to reduce the amount of air flowing

underneath the car, which has a number of benefits. Most cars do not have smooth underbodies--exhaust, drivetrain, and suspension hang down, creating considerable additional drag. In this situation, a front Air Dam reduces the air pressure underneath the car. Any air remaining under the car is turbulent, just like air behind the rear of a vehicle.

For the car to perform properly there must be a balance of forces at the front and back. If too much downforce is applied to the front, the rear might get light; conversely, too much rear downforce may result in the front having reduced downforce. Most front-engine, rear-wheel-drive cars with correctly balanced suspensions work best with slightly more downforce at the rear than at the front. This raises and interesting issue, why was the center section Air Dam removed from the C7 Z51? It had been planned but in final testing was eliminated. John Bednarchik was quoted in 2014 interview indicating it was to improve handling but no specifics were mentioned. A recent comment made by Tadge Juechter, Chief Corvette Engineer, may provide some insight. He was discussing the Z06. Paraphrasing his comments, he indicated that the front Air Dam was providing more than the desired front downforce at speeds around 150 mph promoting oversteer. He said, *"It is better to have slight understeer at high speeds."*



Although he didn't say "safer," those of us with Corvairs or early Porsches understand cars with excess oversteer, for which both cars were criticized by the likes of Ralph Nader! As a modified Corvair owner, there was a saying often quoted, *"If you are traveling at excessive speed into a turn you're going off the road. With oversteer, as when driving the rear heavy Corvair, it was better to hit a tree with the rear than plow into it with the front!"*

There is a natural tendency with an understeer car to turn the wheel more when it is sliding to the outside of the turn. If there is some traction left it may help bring the car back on the road. With a rear engine car when the rear "starts to come around" you must steer into the direction of the skid, not as intuitive of a reaction. To reduce the Corvair's front end grip and therefore oversteer, GM specified inflating the front tires to a low 16 psi reducing front traction.

Note an Air Dam reduces drag even at highway speeds. It provides less drag by reducing the air that goes under the car. A good example is the Chevy Volt. Quoting GM, *"With the Air Dam the Chevy Volt has one of the lowest front end ground clearances of any production automobile-as low as some Corvettes. The main purpose for the Air Dam in the Volt is to decrease drag at highway speeds, thus increasing the overall battery range."*

My own experience with adding a large Air Dam was my 260Z. At speeds from 70 to 100 mph the car shape created significant lift. A number of automotive magazines discussed tests to increase downforce. I added a rear spoiler and large from Air Dam, similar to that on the car pic right. It was much more stable at speed. One day I bumped into a parking curb and shattered the Fiberglas Air Dam. I removed the broken Air Dam and ordered a new one. While I waited for the new part to be delivered, painted and I had time to install, the car was definitely less stable at highway speeds. The added rear spoiler probably made the lower front downforce even more an issue. At 100 mph it was concerning. Once the Air Dam was reinstalled it returned to being very stable even at 120 mph.

SPLITTER END PLATES: End Plates help trap more of the high pressure air on top of the Splitter giving more downforce at the front of the car. The End Plates help stop the high-pressure air on the top of the wing from being encouraged to roll over the end of the wing to the low-pressure air beneath, causing induced drag. They also change the shape of the vortices that occur at the end of the Splitter and help reduce drag caused by the turbulences that are generated by the front wheels.

A Z07 has the option of using the supplied smaller or larger End Plates so they, along with the adjustable wicker bill on the rear spoiler can be used to adjust the cars downforce balance at various tracks.

Of interest, airplanes use wing End Plates and are seen, especially on many newer passenger jets. The initial concept dates back to 1897, when English engineer Frederick Lanchester patented wing end-plates as a method for controlling wingtip vortices. In the United States, Scottish-born engineer William Somerville patented the first functional winglets in 1910. Somerville installed the devices on his early biplane and monoplane designs.

Controlling the size of wing tip vortices with the addition of winglets, as they are also called, increased the 747-400's range by 3.5 percent over the 747-300, which is otherwise aerodynamically identical but has no winglets.

THE FOLLOWING IS A PICTURE REVIEW OF THE INSTALLATION OF THE *C7 CARBON* GTX CARBON FIBER SPLITTER WITH INCLUDED END PLATES

Photo Sequence

The *"GTX Splitter w/Side Splitters,"* (for which we'll use the GM description of "End Plates") was very well packaged and arrived in perfect condition. This is the large box delivered by FedEx. We did have to sign so be sure you'll have someone home the day it's to be delivered.

On the inside was a very well wrapped Splitter. It had an outer layer of bubble wrap. The separate End Plates were carefully wrapped as well. They come with the hardware to install them.

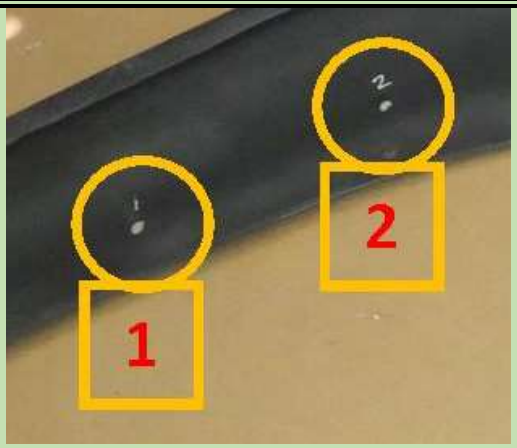
Inside the bubble wrap was a double layer of packaging foam sheet material covering the CF Splitter.

This is a view of the Splitter unwrapped. The gloss finish matched our OEM CF roof, our added CF Side Shirts and added CF Hood Vent.

Hard to get a good color comparison because of the lighting but note the CF pattern is the same as the OEM roof. They are both identically black. This is one of the End Plates sitting on the OEM roof.

Similarly the CF pattern on the Hood Vent matches the End Plate, which matches the Splitter exactly. Differences that appear in this pic are due to lighting and the different depth.

Decided to add some rivets between the OEM attachment bolts. Probably not needed but a number of Splitters use extra supports. Can't hurt! The locations where to be drilled and rivets inserted were marked on the back of the Splitter.



Of the 6 rivets that will be added, 2, 3, 4 and 5 are located 1 ½ inches toward the front of the spoiler, where there is the room for added support. They were marked with a silver ink Sharpie. Numbers 1 and 6 are placed in an area that has a wide space between the OEM screws.

The End Plates were attached to the Splitter with the stainless steel (SS) button bolts and SS fender washers we thought looked better and were a better choice than the 1/4 x 20 carbon steel hex head bolts supplied. We also used SS washers on the inside as well as SS lock washers.

This is a view from the understand, the washers are not visible from the top side

As noted above we used SS Button Head Bolts, SS Fender Washers, SS Lock Washers and SS Nuts instead of the supplied carbon steel hex head bolts washers and nuts. We also bought some black Plastic Scivets for use for the added fastener locations. However the smallest we could get that would have the required support meant drilling a 3/8 hole. Using the same rivets employed when installing the side skirts only required a 3/16 inch drill. We decided as with the side skirts to use rivets with the addition of SS Fender Washers.

The Reamer was used to slightly enlarge the End Plate holes and matching holes in the Splitter to make room for the bolts.

INSTALLATION: First remove the existing screws holding the front bumper to the plastic flat panel with a 7 mm socket. They can be identified by the hole locations in the Splitter. Note only 1 screw holding the side air dam will be used to secure the splitter, the outer most; you'll need to remove all three to cut a slit it to clear the splitter edge.

Packing foam was taped to the bumper to avoid the End Plates scratching the car during the installation.

Empty boxes were placed as supports to position the splitter.

To clear the Splitter with End Plates and to provide more access room we found it was desirable to jack up the front slightly. To clear the side skirts used our 2 inch high x 2 ½ inch diameter jack pads and low profile hydraulic jacks.

With the boxes in positon, the Splitter was put in the final location. Several boards were placed under the center box to raise it to the desired height to install screws near the center. These first screws held the Splitter in position. We used stainless steel fender washers under the OEM screws to provide a larger surface area and reduce the local force on the splitter.

The OEM screws are easy to install as they are going thru holes in the Splitter into plastic so don't over torque. However we found two that were not holding with enough force so we used larger diameter sheet metal screws that held well. Like the OEM screws with use a stainless steel fender washer to spread the load.

The Air Dam hits the Splitter and must be slit to fit. The slit was marked where the clearance was needed. However the bottom has no support and it would probably be as good to remove the whole corner section. Can always to that while it is in position.

We found the alignment of the end hole was off perhaps ¼ inch. However rather than elongate the mounting hole we just angled the screw and used our ratchet to pull it in alignment. The Splitter is flexible and fit tightly as the screw was tightened.

Placed rivets in the 6 extra fastening locations mentioned above. #2 and #5 were moved toward the outside when it was determined there was not intimate contact between the Splitter and the bumper in the original location. As mentioned we also found two areas where the OEM # 8 screws were not tightening fully so they were replaced with # 10 screws, one of which is visible in this view.

Was concerned about clearance issues when adding the Splitter. Was pleased to see it was 1 ¾ inches higher than the bottom of the Air Dam. Unlike the Air Dam in my Z51 C6 I seldom scrape the Air Dam in the C7. Therefore don't expect it will be an issue. A good test is our driveway where we occasionally hear the OEM rubber Air Dam scrape.

Front View of Splitter

Checked the Splitter and OEM rubber Air Dam clearance at the end of our driveway. That is where we occasionally hear the Air Dame scrape if leaving fast. We moved forward in increments to locate the least amount of clearance. This pic shows the Air Dam would hit before the Splitter. It appeared the minimum extra clearance was about 2 inches,

Carbon Fiber Splitter w/End Plates, Carbon Fiber Hood Vent and Carbon Fiber Side Skirts match the OEM Carbon Fiber Roof.

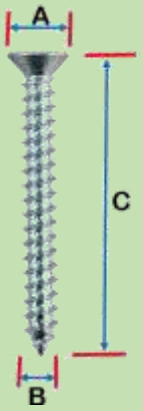
Airplanes use wing End Plates and are seen on many newer planes. The initial concept dates back to 1897, when English engineer Frederick Lanchester patented wing end-plates as a method for controlling wingtip vortices. Controlling the size of wing tip vortices with the addition of winglets, as they are also called, increased the 747-400's range by 3.5 percent over the 747-300, which is otherwise aerodynamically identical but has no winglets.

We tried our Nylon Bra to see how it would work with the Splitter. It stretched easily to cover the Splitter and if we could have used the snaps that originally replaced the OEM screws, it would have fit. However we need a longer snap screw. See below.

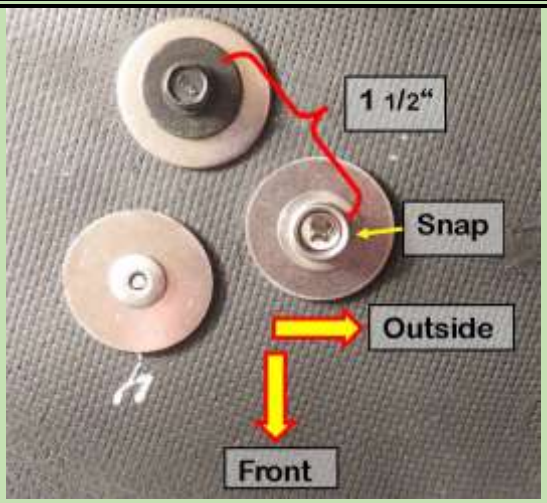
After looking at the end it obvious the original method of having the Bra fasten to the bottom of the wheel opening by wedging in the Air Dam, would not work. In addition the extra material available by not trying to fasten to the corner helps provide the extra stretch needed to go around the bottom of the Splitter. In fact the Bra instructions state fastening to the lower corner is an option for best fit but not required. In this case we'll allow the extra materiel to help it fasten underneath.

The snap supplied with the Bra (left of picture) is only 0.6” long #8 screw. It was too short to go thru the carbon fiber Splitter and two layers of composite to supply sufficient holding power. Was able to fabricate snap with a 1” screw from other disassembled snaps. Where the suppled snap has a 0.11” recess without modifying the screw it only had a 0.01” recess and would not attach to the female snap. By narrowing the screw head and recessing the metal section of the female snap, a 0.05” recess was achieved, enough for a good attachment. ***Subsequently a forum member mentioned a 1“ screw snap is available.***

Supplied with Bra



	Supplied Snap	Purchased	Modified
A	na	0.303	0.260
B	0.161	0.163	0.163
C	0.60	0.99	0.97
D	0.11	0.01	0.05



Installed the modified snap with a 1 inch long screw as noted in the pic 1½ inches to the outside and forward of the original location. Used the original screw snap to make the “treads” after drilling a 3/32” pilot hole. It actually felt tight so the original Snap may have worked in a newly drilled hole. However it felt like it was mostly only going into the GTX splitter, which is a combination of carbon fiber over fiberglass. The modified snap with the long screw felt very secure and was going thru the bumper bottom as well.

This is the finished Bra installation. Used a right angle attachment to a Demel tool so did not have to jack the car to install the snaps.

Fit is excellent. It easily snaps over the Splitter. It’s also very easy to install and fits in a quart plastic bag in the rear storage compartment. Great to use for longer trips or when bugs are prevalent in the summer.

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Other Stingray PDF's Available:

Some 37 items discuss improvements or information about the Stingray function and/or esthetics. Some are minor and others, like the genuine carbon fiber side skirts, include detailed install information.

Below are the PDF's available. Click on picture (may need Ctrl pressed.) Or just copy and paste the PDF info (Blue type) into your browser. Or email me at GUttrachi@aol.com **and state the title desired, shown in Yellow:**

Rusty C7 Muffler ***Why the C7 muffler is rusted and a simply way to make rust turn matte black.*** ***Bottom pic rusted, top pic treated*** **http://netwelding.com/Muffler_Rust.pdf**	
Change C7 Oil ***WHY change your own oil and HOW to do it*** ***Revised, includes C7 Lifting Methods*** **http://netwelding.com/Changing_Oil.pdf**	
Latch Hatch ***Window Valet Helps 2014/2015 Latch*** ***Includes M7 Crazy Seat Memory Recall*** **http://netwelding.com/Hatch_Latch.pdf**	

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C7 Carbon Fiber Side Skirts ***How to install side skirts with jacking information for DIY's without lifts*** **http://netwelding.com/Side_Skirts.pdf**	
Carbon Fiber Splitter w/End Plates ***How to install Splitter & Nylon bra fit*** **http://netwelding.com/CF_Splitter.pdf**	
Removing GM Plastic Film ***How To Remove The Rocker Panel Film*** **http://netwelding.com/Rocker_Panel_Film.pdf**	
C7 Mirrors 2 3/8" Wider Than C6 ***Device assists with 8 foot garage door*** **http://netwelding.com/Narrow_Garage_Device.pdf**	
Mirror Proximity Alarm ***Limit switch alarm warns when passenger mirror is too close to door frame*** **http://netwelding.com/Mirror_Proximity_Alarm.pdf**	
Making Jacking Pads for C7 ***Jacking Pads must 2 1/2 inch max OD. Made four. Also Hockey Puck pad and 2 1/2 inch OD x 2 inch high pads bought after installing side skirts.*** **http://netwelding.com/Jacking_pads.pdf**	
C7 Radar Power ***The C7 cannot tap the mirror or sun visor for power !*** **http://netwelding.com/Radar_Detector_Power.pdf**	
C7 Belt Rattle ***Passenger seat belt rattles against the seat back. The solution, add a shoulder belt pad.*** **http://netwelding.com/Eliminate_Rattle.pdf**	
Aluminum C7 Chassis and Weld Repair ***The C7 has an all aluminum chassis, made from 117 welded pieces*** **http://netwelding.com/Aluminum_Chassis.pdf**	
Carbotech Ceramic Brake Pads ***The Z51 has very dusty brakes. These pads help!*** **http://netwelding.com/Ceramic_Pads.pdf**	

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C7 License Plate Frame; **Must Meet South Carolina Law** **http://netwelding.com/License_Plate_Frame.pdf**	
Manage C7 Spilled Gas ***Protect the side of the C7 when filling up with gas*** **http://netwelding.com/Manage_Spilled_Gas.pdf**	
C7 License Plate & Cargo Lights ***LED license plate light & cargo area bulbs are brighter and whiter*** **http://netwelding.com/License_Plate_Light.pdf**	
C7 Rear Cargo Area ***Rear cargo area needs storage device and rear protector*** **http://netwelding.com/Rear_Cargo_Area.pdf**	
C7 Door Panel Protector ***protector plate added to prevent scuffing of door when exiting*** **http://netwelding.com/Door_Panel_Protector.pdf**	
C7 Improved Cup Holder ***A solution to the cup holder spilling under hard braking or shape turns.*** **http://netwelding.com/Improved_cup_Holder.pdf**	
C7 Wheel Chatter/Hop ***Why sharp, low speed turns with cold tires causes the front tires to chatter/hop.*** ***http://netwelding.com/Wheel_Chatter.pdf***	
Carbon Fiber Grille Bar ***Install genuine carbon fiber grille bar overlay*** ***http://netwelding.com/CF_Grille_Bar.pdf***	
Jacking a C7 Vette ***Safely jacking either front only or back and front*** ***http://netwelding.com/Jacking_A_C7.pdf***	

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Deer Whistle Installed on C7 ***Do they work? Plus Install Info*** ***http://netwelding.com/Deer_Whistle.pdf***	
C7 Battery Issues ***Even after using a GM type charger and showing fully charged, voltages were still low!*** **http://netwelding.com/Battery_Issues.pdf**	
C7 Splash Guards ***GM offers splash guards for the C7 Corvette. An easy DIY installation.*** ***http://netwelding.com/Splash_Guard.pdf***	
C7 Blind Spot Mirror ***Smaller rear and side windows cause C7 blind spots. Small "blind spot mirrors" help*** **http://netwelding.com/Blind_Spot.pdf**	
C7 Skid Pad Protector ***After the air dam, the aluminum "skid pad" hits driveway ramps etc. Plastic protector helps.*** **http://netwelding.com/Skid_Pad_Protector.pdf**	
C7 Wheel Locks ***Wheel locks, torqued to required 100 ft-lbs, help protect your expensive wheels from theft.*** **http://netwelding.com/Wheel_Locks.pdf**	
C7 OnStar Lights ***The OnStar LED's in the rear view mirror, at a quick glance, look like a police car flashing light! This is a fix.*** **http://netwelding.com/OnStar_Lights.pdf**	
C7 Skip Shift Eliminator ***Skip Shift Eliminator install with suggestions on jacking a C7.*** **http://netwelding.com/Skip_shift_Eliminator.pdf**	

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C7 Catch Can & Clean Oil Separator

Direct inject engines like the LT1, are particularly subject to "coking." What is Coking and how to reduce the potential?

http://netwelding.com/Catch_Can.pdf

C7 Round Shift Knob

A round shift knob shortens throw.

http://netwelding.com/Shift_Knob.pdf

C7 Stingray Sill Plate

Stingray sill plate replaces original.

http://netwelding.com/Sill_Plate.pdf

C7 Nylon Bra

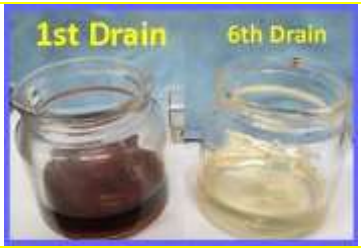
Nylon Bra Stops Bugs on Front and Grill.

http://netwelding.com/Nylon_Bra.pdf

C7 Clutch Fluid Change

Clutch fluid after 3000 miles gets dirty

http://netwelding.com/Clutch_Fluid.pdf



Carbon Fiber Hood Vent

Replaces Plastic Hood Vent

http://netwelding.com/Hood_Vent.pdf

Cold Air Intake

Low Restriction Air Filter & Duct

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May Be Of Interest:

Engineering a ProStreet Rod

How Our '34 ProStreet Rod Was Designed and Built 8.2 Liter Engine, 4 Wheel Disk Brakes & Coilover

http://netwelding.com/Engineering%20Street%20Rod%203-08.pdf

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