# AN EXPEDITER AND HIS AIRTABS

By Ken Slaughter

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Wind resistance and aerodynamic drag is the MPG killer. All other things being equal, like weight of the vehicle, driving speeds, even driving habits, it is wind resistance that affects everything. Driving slower, no jack rabbit starts, using the brakes less, and discarding unnecessary items to reduce weight are all things you can do to help increase your fuel mileage. But whether you do any or all of these things, the one constant is wind resistance. You can't eliminate wind resistance and drag, but you can reduce it, in some cases dramatically, to mitigate its effects on everything you do.

When you drive down the road you must push the air in front of you out of the way. The mathematics of what happens as you do this can get very complicated, but what it all means is, when you push the air in front of you out of the way, it causes the air pressure in front of you, as well as around you to increase, and the area directly behind you will have reduced air pressure. This area of reduced air pressure is called "aerodynamic drag" because the reduced air pressure wants to "drag" you back into it.

To reduce air resistance and drag, the first thing you need to do is eliminate anything you can which causes resistance in the first place. Side mirrors and the brackets cause quite a bit of resistance, but you don't want to remove those. An exterior sun visor is a major factor in wind resistance, and many people have removed it for that reason. I installed a bug shield and side window rain guards on my Sprinter and noticed an immediate hit on fuel mileage, which didn't come as a surprise. The surprise was just how big a hit it was – more than half a mile per gallon. The Sprinter's front end is pretty streamlined, so it didn't take much to mess it up.

Knowing that the bug shield and rain

guards increased resistance, I ordered Airtabs to help reduce the drag. Airtabs themselves will cause wind resistance, of course, as they will interrupt the airflow along the vehicle. But the vortex they create reduces the size and intensity of the low pressure aerodynamic drag far more than any resistance they may cause.

I had the rare opportunity to get my Sprinter into the wind tunnel at a local college to observe what happens before and after the Airtabs, as well as with and without the bug shield and rain guards. What we observed was rather dramatic.

Turns out, the bug shield and rain guard added a combined 7% increase in wind resistance, which translates to about a 3 ½% to 4% hit on fuel economy. At 22 MPG that's about .8 MPG, which is a lot.

After a day of the students gathering the "before" data, Airtabs were mounted as close to the trailing edge of the Sprinter as you can get and still have them on a flat surface. With the Airtabs installed, the drag was dramatically reduced and showed a wind resistance reduction of more than 10%, which translates into a fuel economy savings of about 5% or 6%, which coincides with my own actual calculations. Without the bug shield I could expect at least a 3% to 4% gain in fuel economy, so the wind tunnel math and the 2% to 4% claims made by Airtab are the same. With the Airtabs and no bug shield, I'd be getting 22-23 MPG instead of the 21-22 that I currently get. (I need to dump a couple hundred pounds of junk that have accumulated inside the van, too).

The whole wind tunnel thing was very interesting, but mainly just confirmed stuff I already had a pretty good idea about. It was fun watching it all. One thing it showed that I haven't done anything about is, it wouldn't hurt to place a row of Airtabs underneath the rear step bumper of the Sprinter, as that bumper causes quite a bit of drag on its own. Most of it is pulled out by the installed Airtabs, but it certainly appeared that there could be some benefit from adding them there, albeit just a small benefit. I'm just not sure they would hold up under the stresses of the road grime, as there is no optimal flat surface under the bumper to affix the Airtabs. The other installed Airtabs have held up just fine after nearly two years, however. I was surprised at how little of an impact that the Qualcomm satellite bubble and mount had on wind resistance. There was some, but the Airtabs on the roof took care of it. I was also surprised at how little of an impact that the Sprinter side mirrors had on resistance. Apparently, the bracket that holds them out there also acts as sort of a vortex generator on its own and mitigates drag behind the mirrors. That's not the case with most side mirrors, however, and Airtabs would almost certainly be a benefit to them. An open roof vent showed a large amount of resistance and drag, as well.

In test after test at the tunnel, a dirty vehicle, especially one with a bug covered windshield, would show up to a 3% hit in wind resistance at speeds above 55 MPH, which translates into a 1-2% hit in fuel economy. That's way more than I would have guessed. They also partially confirmed the myth of windows down versus air conditioning, in that at speeds of 55 MPH or greater, the wind resistance is so high that running the air conditioner

is more fuel efficient (10% hit) than with the windows down (12-15% hit depending on speed). But at speeds below 55 MPH, running with your windows down saves fuel.

Tests showed that a larger, taller bug shield as you might find on a big truck would benefit from having Airtabs on the front of the shield. Tests also confirmed what I already knew, that above 60 MPH the effectiveness of my bug shield was reduced to near zero as the high wind and air pressure would just slam the bugs into the windshield, anyway.

The thing about wind resistance and aerodynamic drag is, once you have taken the simple steps to reduce them, it's a set-it-and-forget-it kind of thing. At that point, the only thing that affects resistance and drag is speed. Aerodynamic drag can be calculated, although with the many nooks and crannies on a vehicle it is hard to calculate. But it is as simple as:

## AERODYNAMIC DRAG = 1/2 D x A x VSQUARED

**D** is the Density of the air, **A** is the frontal area of the moving shape, and **V** is the Velocity of the shape.

But that's just the math. You have to translate that into the real world of real body shapes, like a truck, and to do that you need to know the Drag Coefficient of the vehicle, which nobody knows unless you have easy access to a wind tunnel. The Drag Coefficient is important because, in combination with the frontal area of the vehicle, it determines the power cost of pushing object (truck, van, car) through the air at a given speed. Certain geometric shapes, like a sphere, cube, rectangle, etc., all have mathematically established coefficients (sphere=.47, cube=1.05, rectangle=.82, airplane wing=.04). But these are regular shapes, not real bodies with irregularities like mirrors and grilles and bumpers and headlights. But even if you don't know the Drag Coefficient of your vehicle, all you need to know is that Airtabs will greatly reduce it.

For real body shapes, roughly standard air conditions of average atmospheric pressure and altitude, **V** in MPH, and drag measured in pounds of force, the above translated equation becomes:

**Drag = 1/391 x Cd x A x Vsquared**

This illustrates that to calculate the drag you need to know: **Cd**, the Drag Coefficient; **A**, the frontal Area of whatever you're driving through the air; and **Vsquared**, the speed of the air past it. The **1/391** fraction accounts for the air density conditions.

To the average person, me included, that formula means exactly squat, 'cause no one is gonna take the time to do the measurements required to figure it all out. But, it does tell us one very important thing: **aerodynamic forces are proportional to the square of the speed**. In other words, when you *double* the speed you *quadruple* the drag. It also tells us that since driving 60 MPH into a 15 MPH headwind, the same as driving 75 MPH on a windless day, the airspeed is increased by 25%, and thus *doubles* the drag.

Anything you can do to reduce wind resistance and aerodynamic drag will benefit your bottom line fuel economy. Airtabs are a no-brainer. I like no-brainers. ***EN***