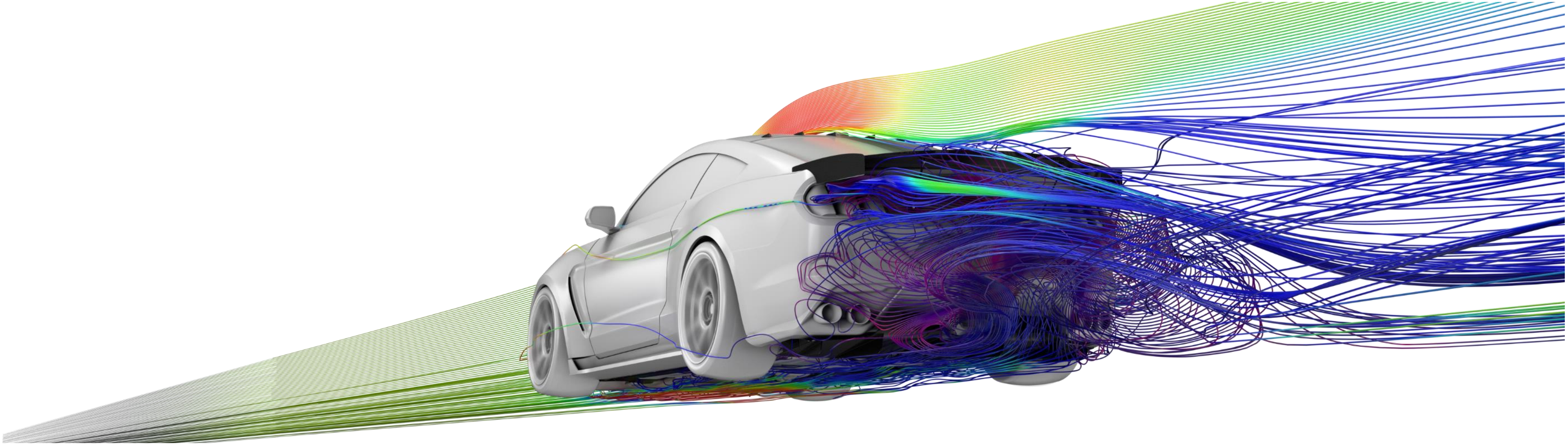


FORD S550 MUSTANG

PERFORMANCE OF VERUS ENGINEERING DRAG WING

OVERVIEW

DEFINITIONS

1. **Coefficient of Pressure (Cp)** = This is a dimensionless number which describes relative pressure to atmospheric pressure. A Cp of 0 equates to atmospheric pressure while a number below 0 represents low pressure and a number above 0 represents high pressure.
2. **CpX** = This is a dimensionless number which describes Cp normal to the x-direction. This helps us visualize locations which create drag. Red represents locations which are creating drag, while blue represents locations where thrust is created.
3. **CpZ** = This is a dimensionless number which describes Cp normal to the z-direction. This helps us visualize location which create downforce or lift. Red represents locations which are creating lift, while blue represents locations where downforce is created.
4. **Total Pressure Coefficient (CpT)** = This is a dimensionless number which describes total energy of the airstream. It is the sum of static pressure and dynamic pressure.
5. **Wall Shear** = This is a force per unit area due to fluid friction on the wall. This is used to visualize areas of separation and rapid changes on the surface.
6. **UNear** = Velocity near the surface, specifically 3mm from the surface.
7. **LIC Plot** = Line integral convolution (LIC) is used to visualize "oil" flow on the surface. It is a great way to correlate to flow vis testing and to study the flow on the surface of the vehicle.
8. **Streamline** = These are fluid tracers which are used to visualize where the air is going or coming from. These are normally colored as velocity where red is high-velocity and blue is low-velocity.
9. **Points** = One point is considered 0.001 of a coefficient. This is used in coefficient of drag (Cd) and coefficient of lift (Cl).
10. **CAD** = computer aided design

SUMMARY : AERODYNAMIC FORCES

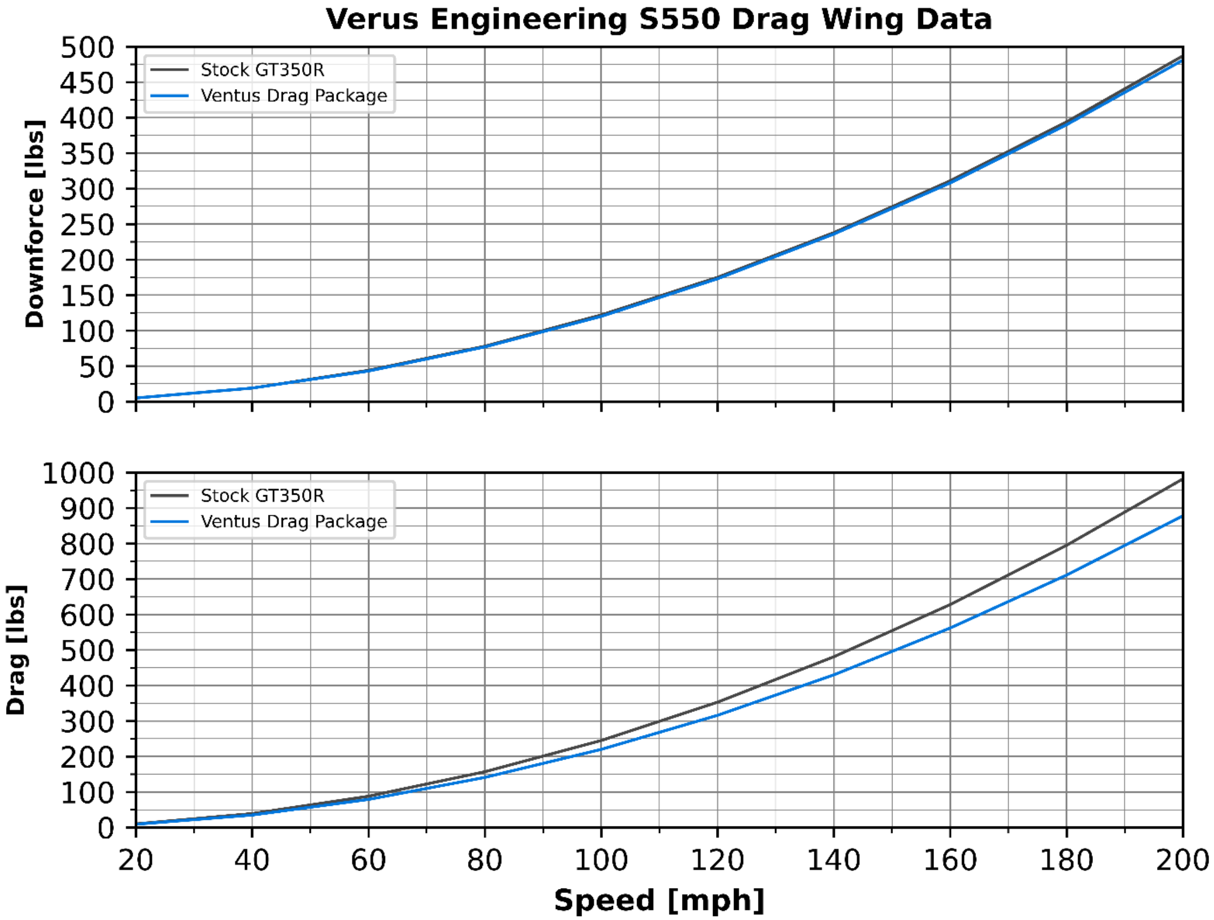
Aerodynamic forces change with the square of vehicle speed which is why we share graphs of data instead of listing a force. The graph to the right displays total forces on the car and not just the drag wing.

When developing the drag wing, the goal was to decrease drag and increase or maintain rear downforce. The Verus Engineering drag package:

- Reduces drag by 11%
- Reduces downforce by 1%
- Improves efficiency (Lift / Drag) by 12%

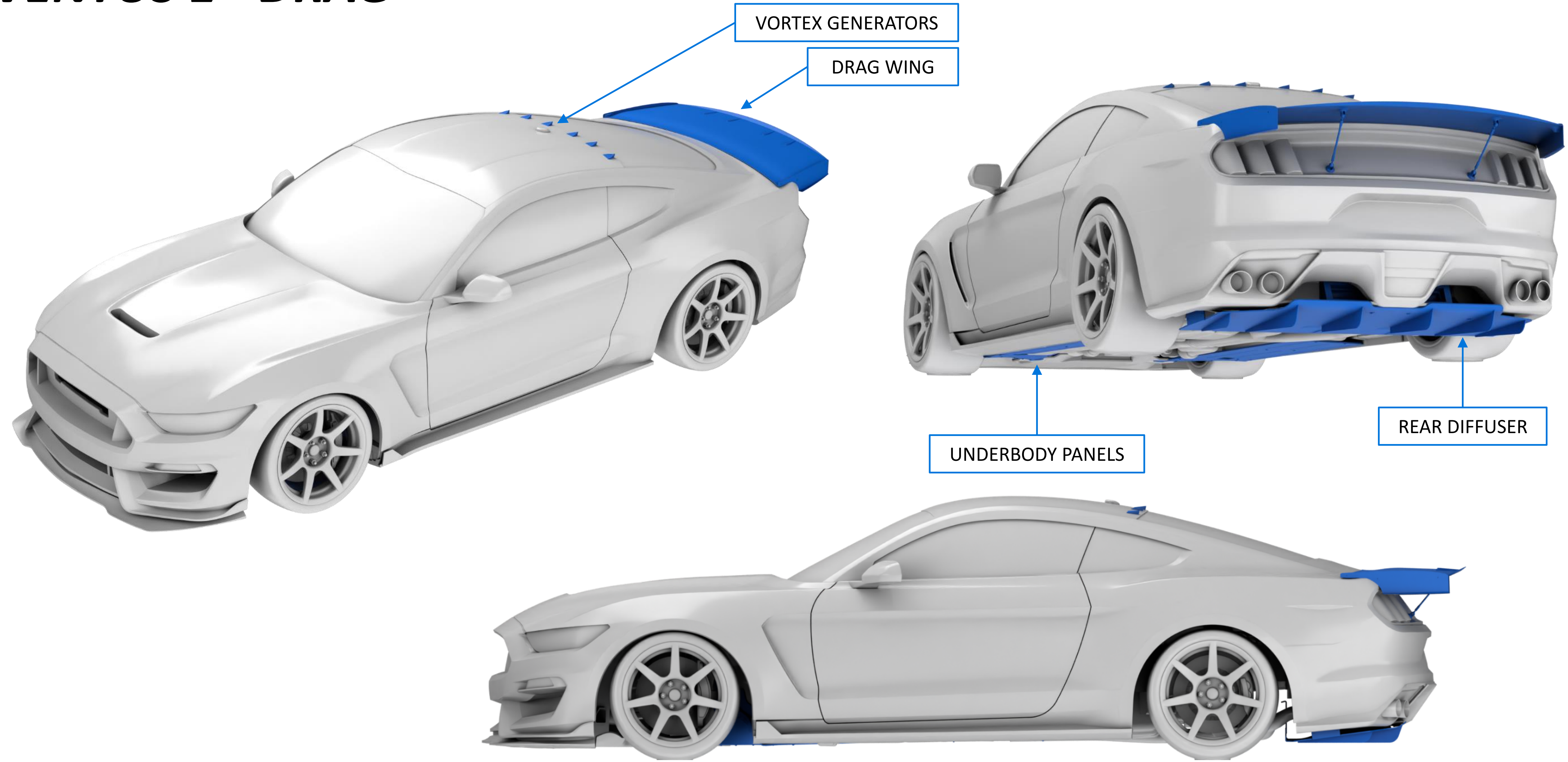
*Above values are comparisons to a GT350R with the OEM rear wing.

- Increased downforce on factory wingless cars



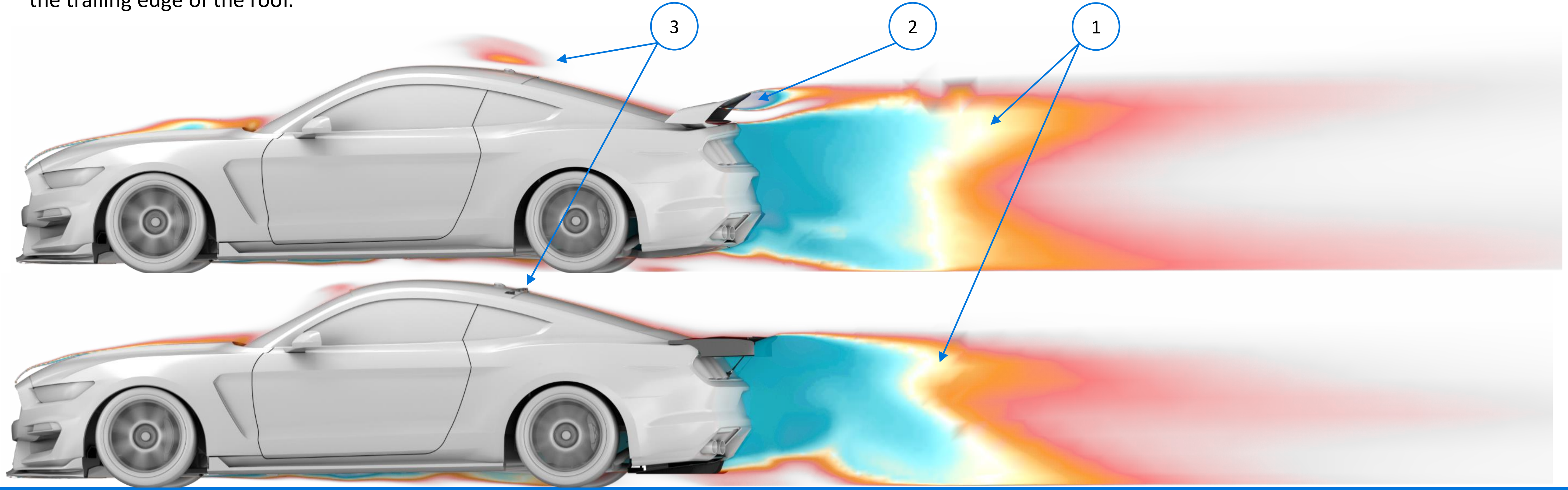
The benefit of increasing downforce is more tractive force on the rear tires. Increasing the force required to break traction improves acceleration. Decreasing drag increases the top speed and also improves acceleration.

VENTUS 1 - DRAG



WAKE

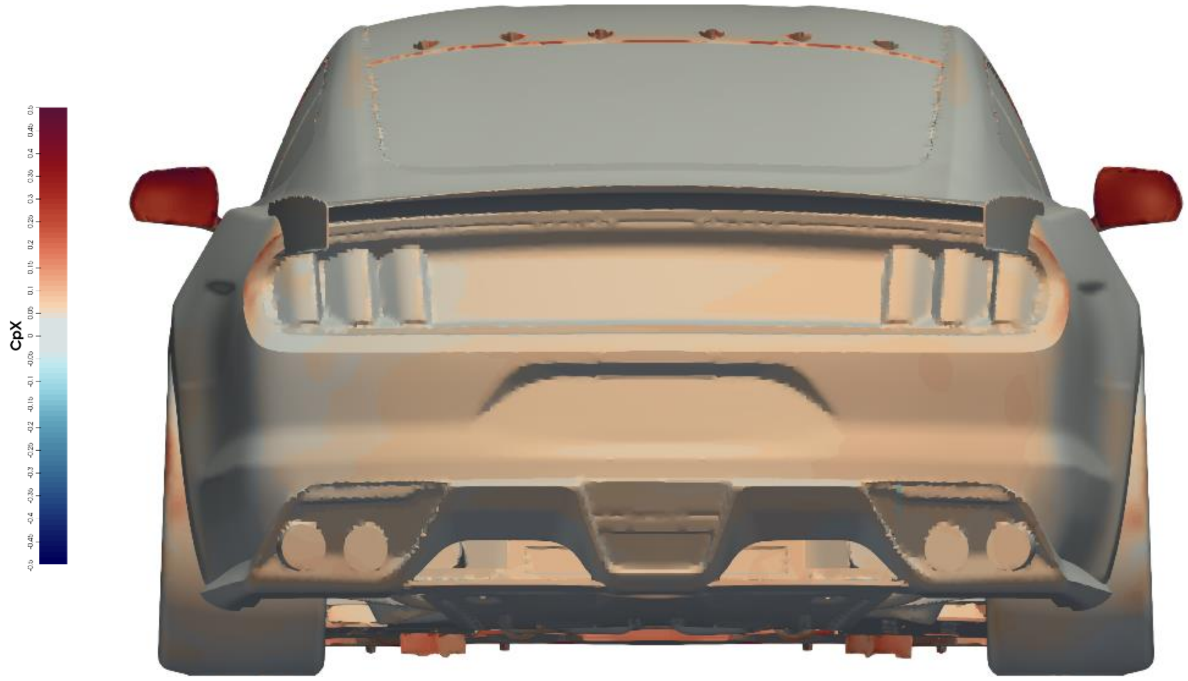
The drag wing reduces the size and energy of the wake region behind the car. The top image shows the wake generated by a GT350R (with wing). The bottom image shows the Verus Engineering drag package. Point 1 shows the difference in wake size and color (magnitude) between the two. The darker blue means lower pressure which is acting to pull the car rearward. Point 2 draws special attention to the extremely dark region behind the GT350R wing. Point 3 notes the impact of the Vortex Generators on the trailing edge of the roof.



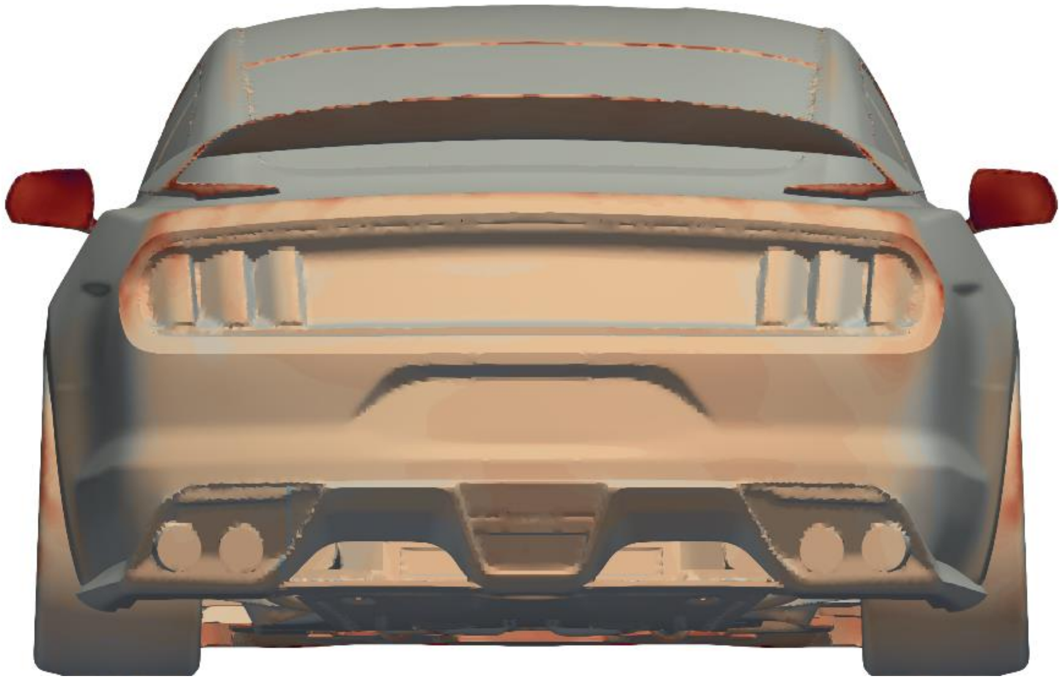
PRESSURE ON THE REAR

These CpX images show the pressure differences that cause drag. The rear of the car has a larger 'red' area and the shade of red is a darker color. This indicates that the drag forces are higher. The difference in color may look small but when that pressure is acting over a large surface area the differences quickly add up.

Drag Wing



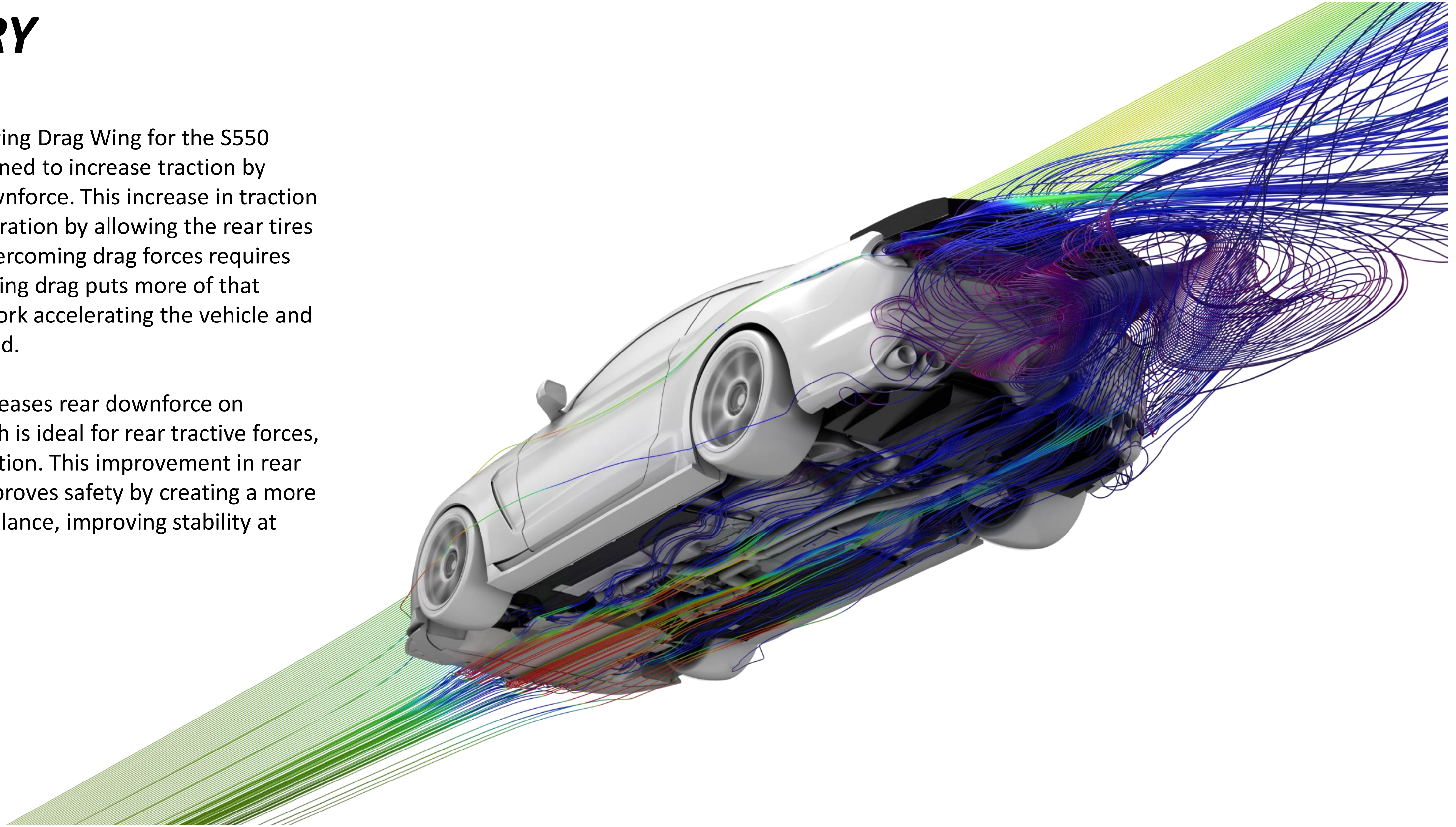
Stock



SUMMARY

The Verus Engineering Drag Wing for the S550 Mustang was designed to increase traction by increasing rear downforce. This increase in traction will improve acceleration by allowing the rear tires to work harder. Overcoming drag forces requires horsepower. Reducing drag puts more of that engine power to work accelerating the vehicle and improving top speed.

The draw wing increases rear downforce on wingless cars, which is ideal for rear tractive forces, increasing acceleration. This improvement in rear downforce also improves safety by creating a more rear biased aero balance, improving stability at high speed.



THE SCIENCE

This analysis was done using OpenFOAM v2106 which is a finite volume CFD software. The solver was SIMPLE and the turbulence model was K-Omega SST using standard wall conditions. We use standard automotive arrangement when setting up boundary conditions and running a full-car. The case was simulated using slight yawed airflow of 0.5 degrees. This yawed airflow is to ensure we are not analyzing a condition the car will almost never see which is perfectly straight airflow down the length of the car.