APR PERFORMANCE

OVERVIEW

Spanning 60.5 inches over its optimized 3D airfoil shape, the APR Performance New GTC-200 Adjustable Wing supplies maximum downforce in midsize and compact car applications.

GTC-200 Adjustable Wing

DOWNFORCE BALANCE

The Downforce Balance graph (shown at the left) illustrates which areas of the vehicle this product affects.

There are three (3) areas: Front, Center, and Rear. The size of the red bar represents how much this product affects each particular area.

BENEFITS

- Angle adjustment rods allow for easy tuning of downforce
- Reinforced pre-preg carbon fiber withstands extreme loads
- Interchangeable side plates help to further tune downforce levels

SPECIFICATIONS

Pattern

2x2 twill weave

Material

Pre-preg carbon fiber, 3K

Coating

UV-stable clear coat

Wing Span

New: 60.5" w/ variable Angle-of-Attack (AOA) (center section vs outer section angle difference: 14 degrees) original: 59.5" w/ variable Angle-of-Attack (AOA) (center section vs outer section angle difference: 12 degrees)

Hardware

Stainless-steel machine screws, washers, and nuts

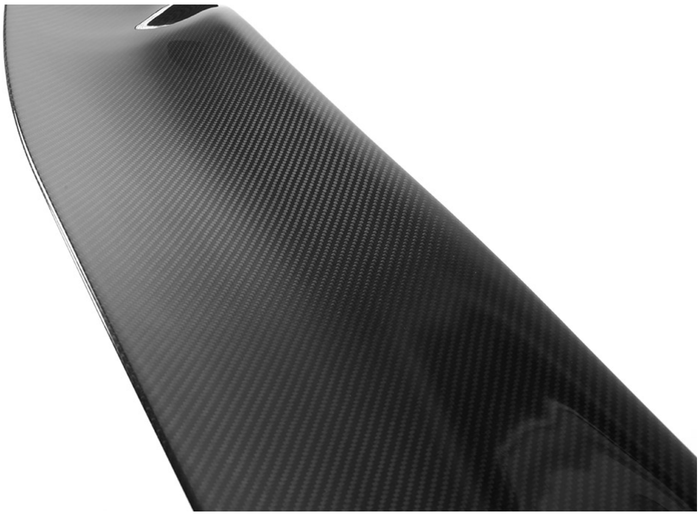
Mounting

6061 billet aluminum brackets/pedestals with application-specific bottom mounting bases

FEATURES

The APR Performance New GTC-200 Adjustable Wing features a 3D airfoil shape that is designed to produce balanced downforce across its span on midsize and compact car applications.

Each GTC Series airfoil is composed of lightweight and durable pre-preg carbon fiber composite materials for superior strength and low weight.

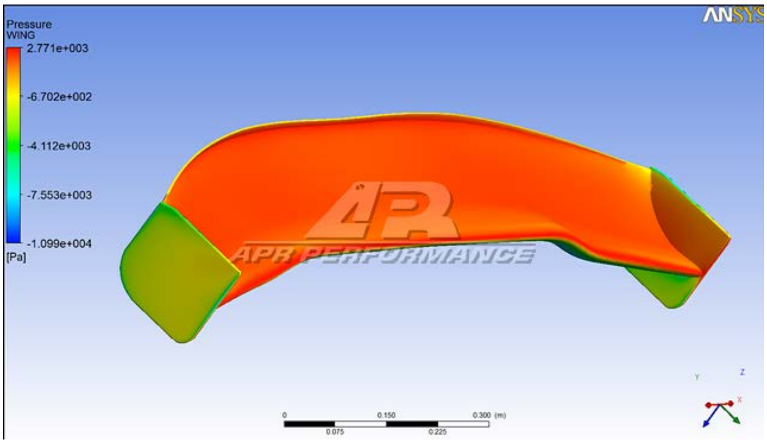


Aerodynamically-tuned side plates (aka end plates), included with every GTC Series Adjustable Wing, are critical components that help to ensure consistent airflow across the full span of the airfoil.

Supporting the airfoils are 10mm "aircraft grade" 6061 billet aluminum pedestals that come in a flat black powder coat finish.

Computational Fluid Dynamics (CFD)

Modeled in 3D and validated using Computational Fluid Dynamics (CFD), the APR Performance New GTC-200 Adjustable Wing is designed to adapt to a variety of midsize and compact car applications.



CFD Data for the New GTC-200 Adjustable Wing

OVERVIEW

Contained herein are the data and results of the Computational Fluid Dynamics (CFD) analysis that was conducted on the New GTC-200 airfoil. This data illustrates how the airfoil performs in different conditions by comparing Downforce vs. Angle-of-Attack (AOA) vs. Speed, and Drag vs. AOA vs. Speed. This data will provide insight with regards to how and how much the airfoil performs with respect to these conditions.

To learn how to interpret and apply this type of CFD data, see sample analysis on the GTC-300 page.

DATA (w/o Gurney)

APR WING CFD DATA PROFILE: APR006 UPDATED GTC200 2012.9.18

All values are pound force (lbf)

Fz = Lift Fx = Drag L/D = Lift/Drag ratio

Positive Fz values are downforce

Prepared by: AMB Aero Design

AOA	Fz	Fx	L/D	Speed
0	78.50	8.40	9.35	80
0	123.40	12.50	9.87	100
0	177.10	18.70	9.47	120
5	98.10	10.60	9.25	80
5	153.10	17.20	8.90	100
5	220.30	24.50	8.99	120
10	115.50	13.00	8.88	80
10	179.70	20.30	8.85	100
10	259.20	28.80	9.00	120
12	117.50	14.00	8.39	80
12	182.80	21.90	8.35	100
12	263.50	31.70	8.31	120

Speed tables

80MPH

AOA		0	5	10	12
Drag		8.40	10.60	13.00	14.00
Downforce		78.50	98.10	115.50	117.50

100MPH

AOA		0	5	10	12
Drag		12.50	17.20	20.30	21.90
Downforce		123.40	153.10	179.70	182.80

160MPH

AOA		0	5	10	12
Drag		18.70	24.50	28.80	31.70
Downforce		177.10	220.30	259.20	263.50

Efficiency by Speed

AOA		0	5	10	12
80 MPH		9.35	9.25	8.88	8.39
100 MPH		9.87	8.90	8.85	8.35
120 MPH		9.47	8.99	9.00	8.31

Efficiency by AOA

		80 MPH	100 MPH	120 MPH
0 AOA		9.35	9.87	9.47
5 AOA		9.25	8.90	8.99
10 AOA		8.88	8.85	9.00
12 AOA		8.39	8.35	8.31

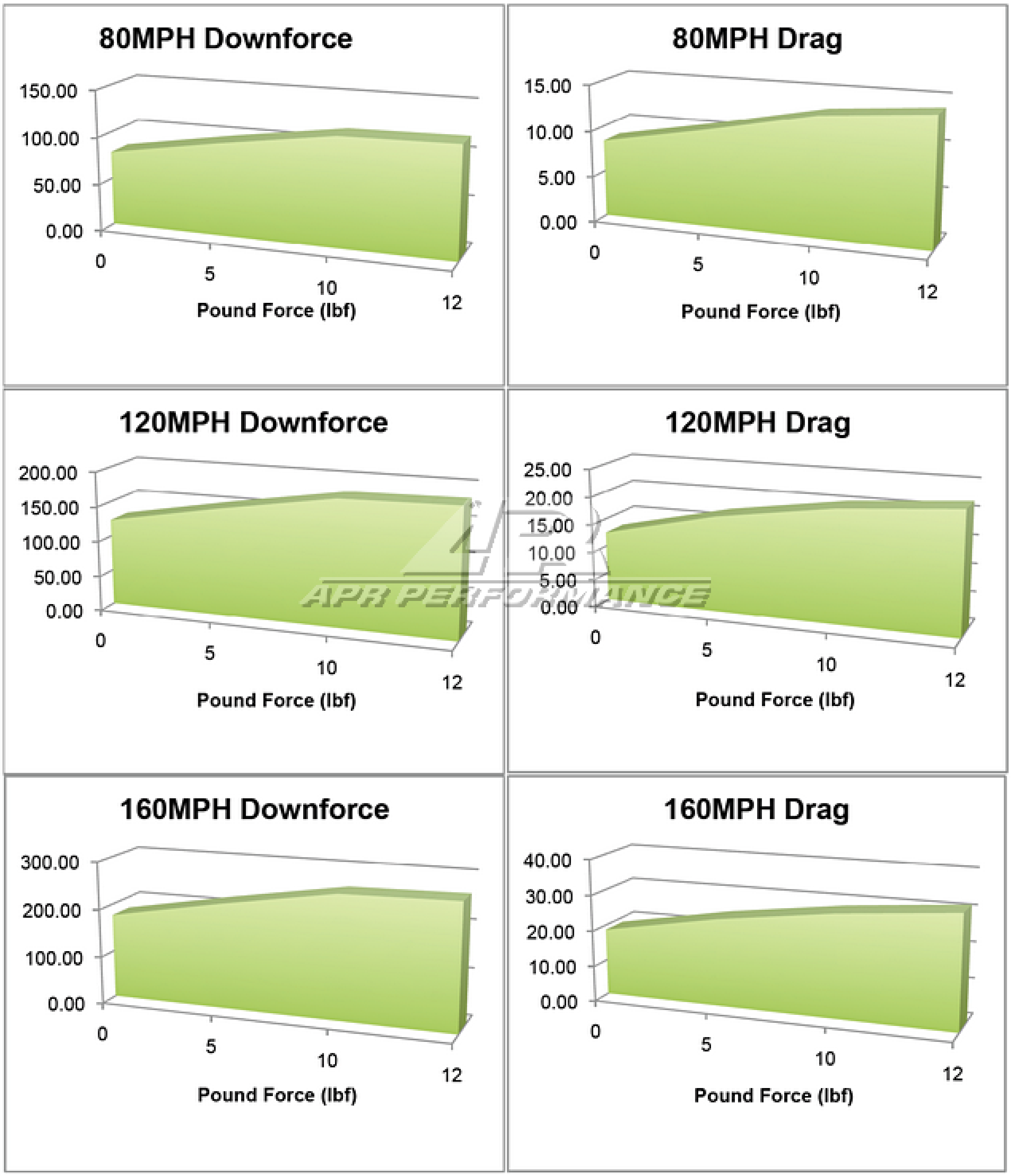
Downforce

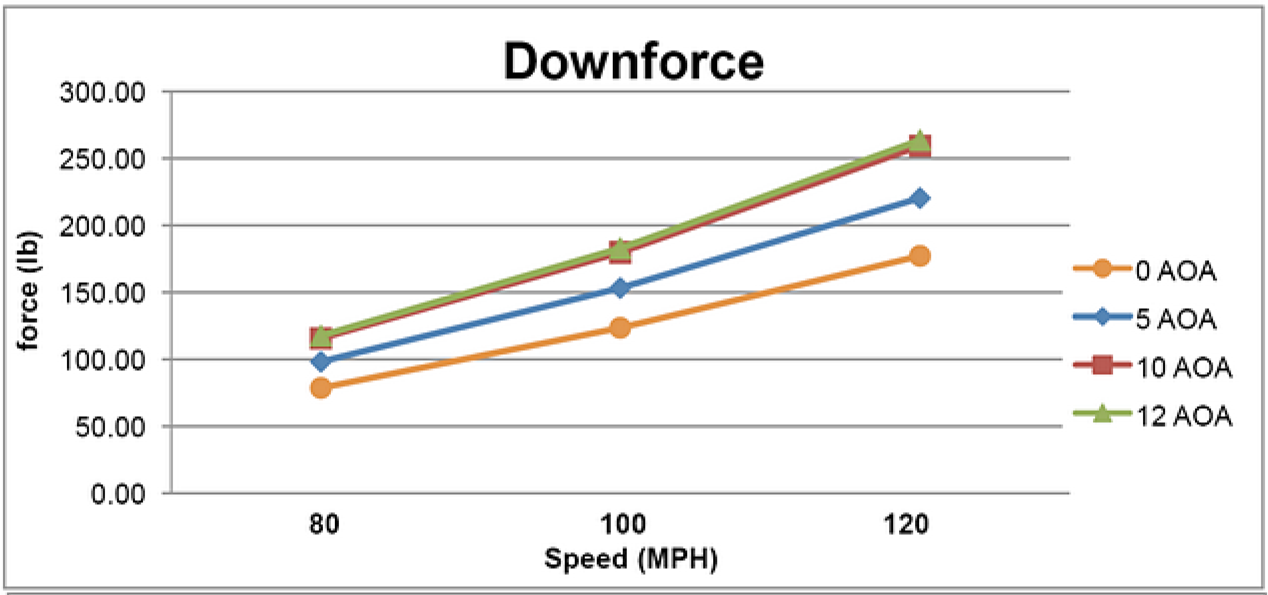
		80 MPH	100 MPH	120 MPH
0 AOA		78.50	123.40	177.10
5 AOA		98.10	153.10	220.30
10 AOA		115.50	179.70	259.20
12 AOA		117.50	182.80	263.50

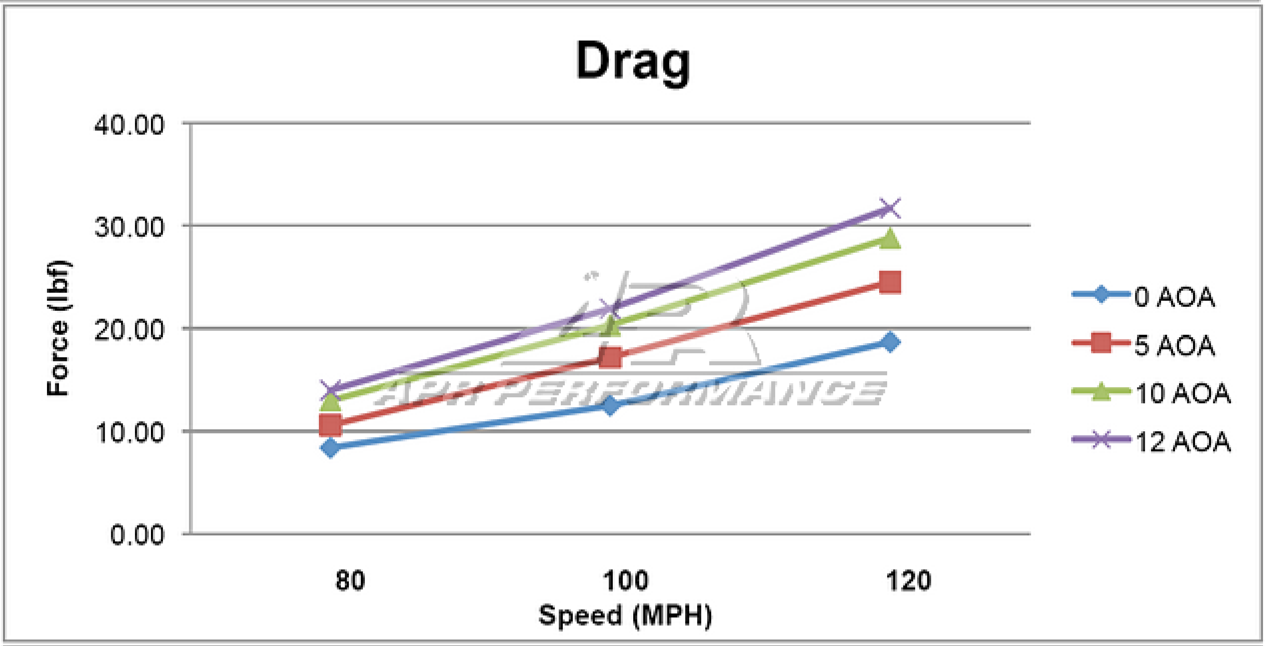
Drag

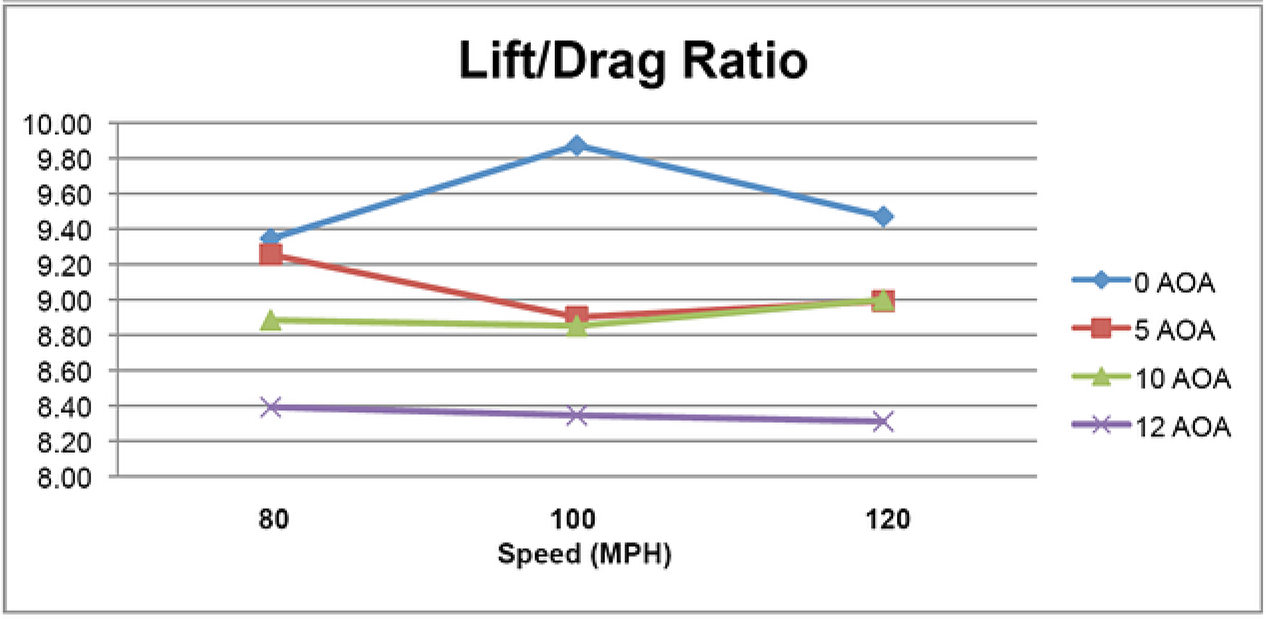
		80 MPH	100 MPH	120 MPH
0 AOA		8.40	12.50	18.70
5 AOA		10.60	17.20	24.50
10 AOA		13.00	20.30	28.80
12 AOA		14.00	21.90	31.70

Wing forces


80MPH Downforce
150.00
100.00
50.00
0.00
0
5
10
12
Pound Force (lbf)
80MPH Drag
15.00
10.00
5.00
0.00
0
5
10
12
Pound Force (lbf)
120MPH Downforce
200.00
150.00
100.00
50.00
0.00
0
5
10
12
Pound Force (lbf)
120MPH Drag
25.00
20.00
15.00
10.00
5.00
0.00
0
5
10
12
Pound Force (lbf)
APR PERFORMANCE
160MPH Downforce
300.00
200.00
100.00
0.00
0
5
10
12
Pound Force (lbf)
160MPH Drag
40.00
30.00
20.00
10.00
0.00
0
5
10
12
Pound Force (lbf)







DATA & RENDERINGS (w/ Gurney)

APR006 (GTC 200 update) Addendum
taper gurney tests and CFD images

80mph

		Downforce	Drag	L/D
neg2 AOA		131.70	12.20	10.82
0 AOA		141.90	13.80	10.30
2 AOA		150.50	15.30	9.83
4 AOA		157.90	16.80	9.38
6 AOA		163.80	18.30	8.97
8 AOA		167.80	18.90	8.89

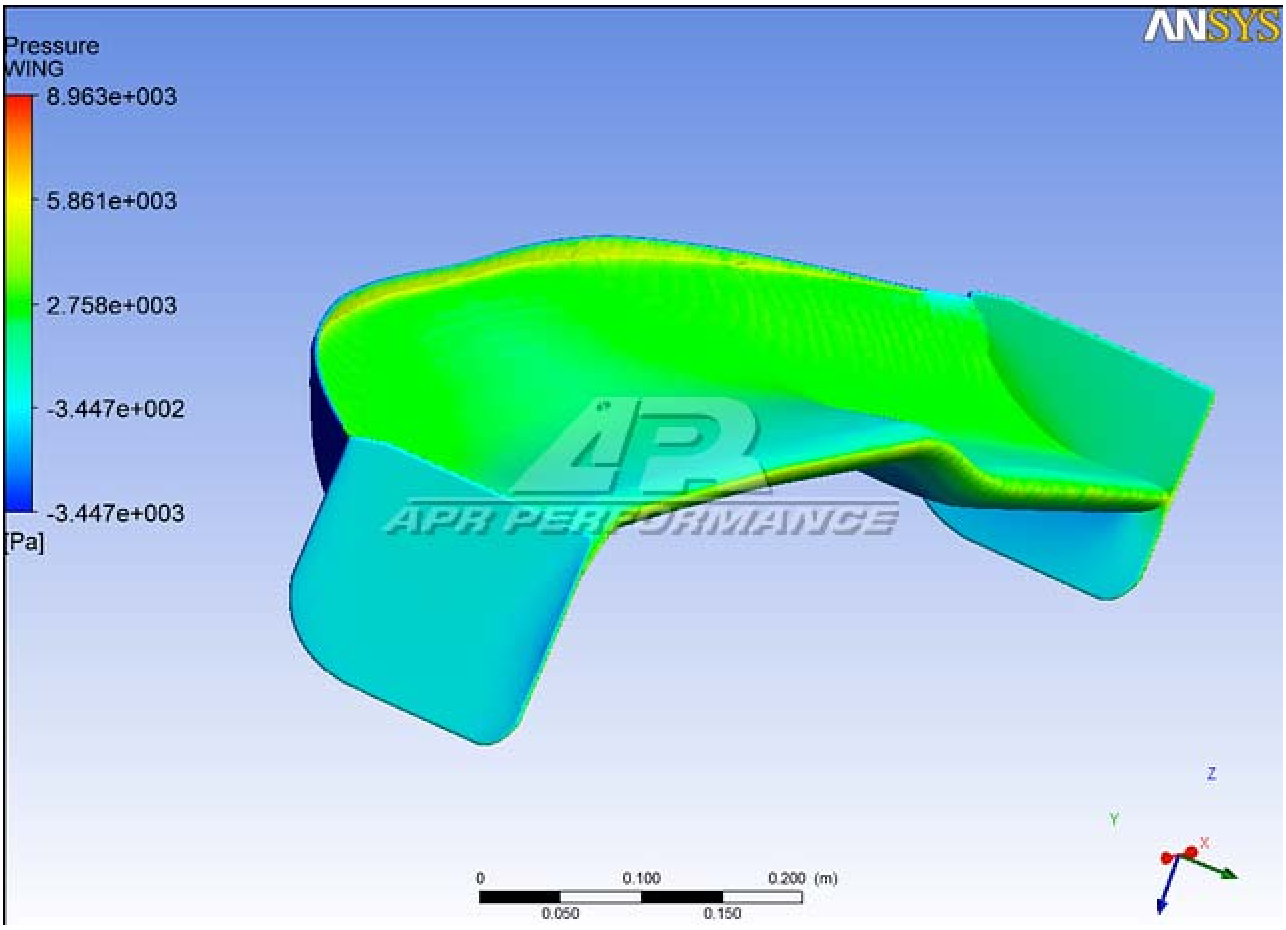
100mph

		Downforce	Drag	L/D
neg2 AOA		206.30	18.80	11.00
0 AOA		221.90	21.90	10.14
2 AOA		234.40	23.40	10.00
4 AOA		246.90	26.60	9.29
6 AOA		256.30	28.10	9.11
8 AOA		262.50	29.70	8.84

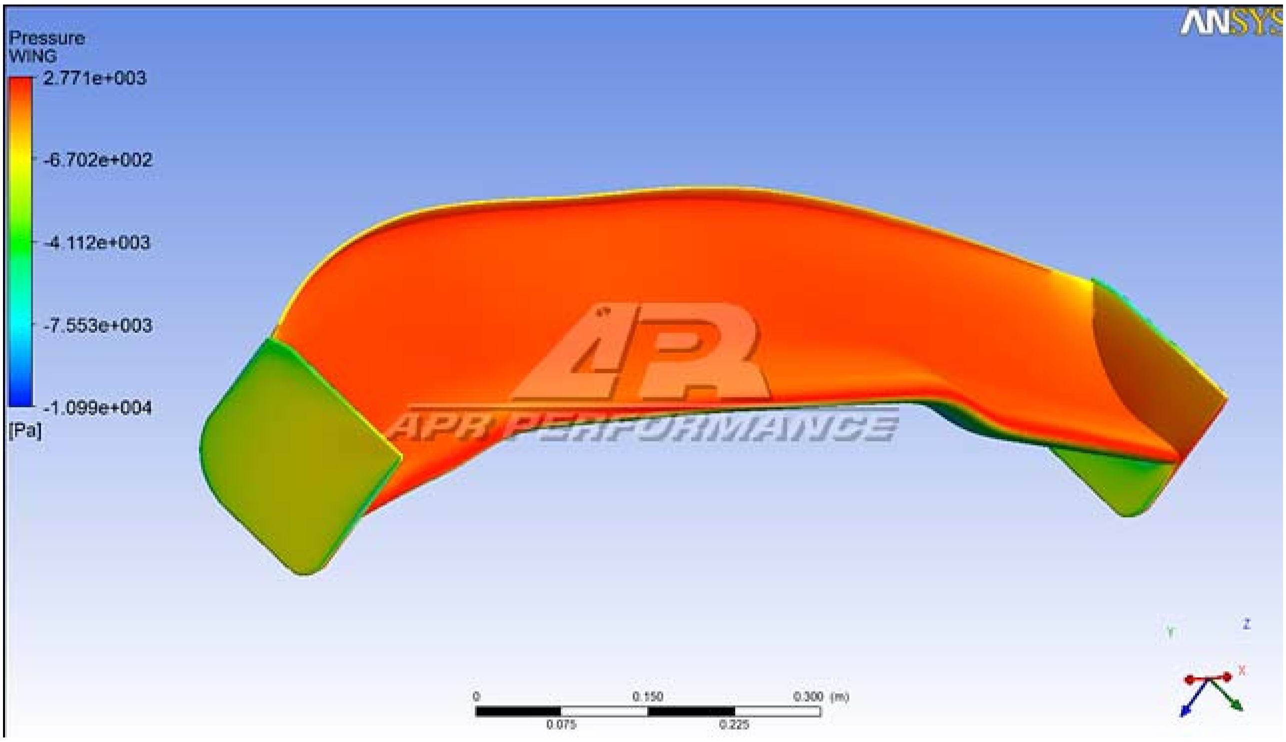
120mph

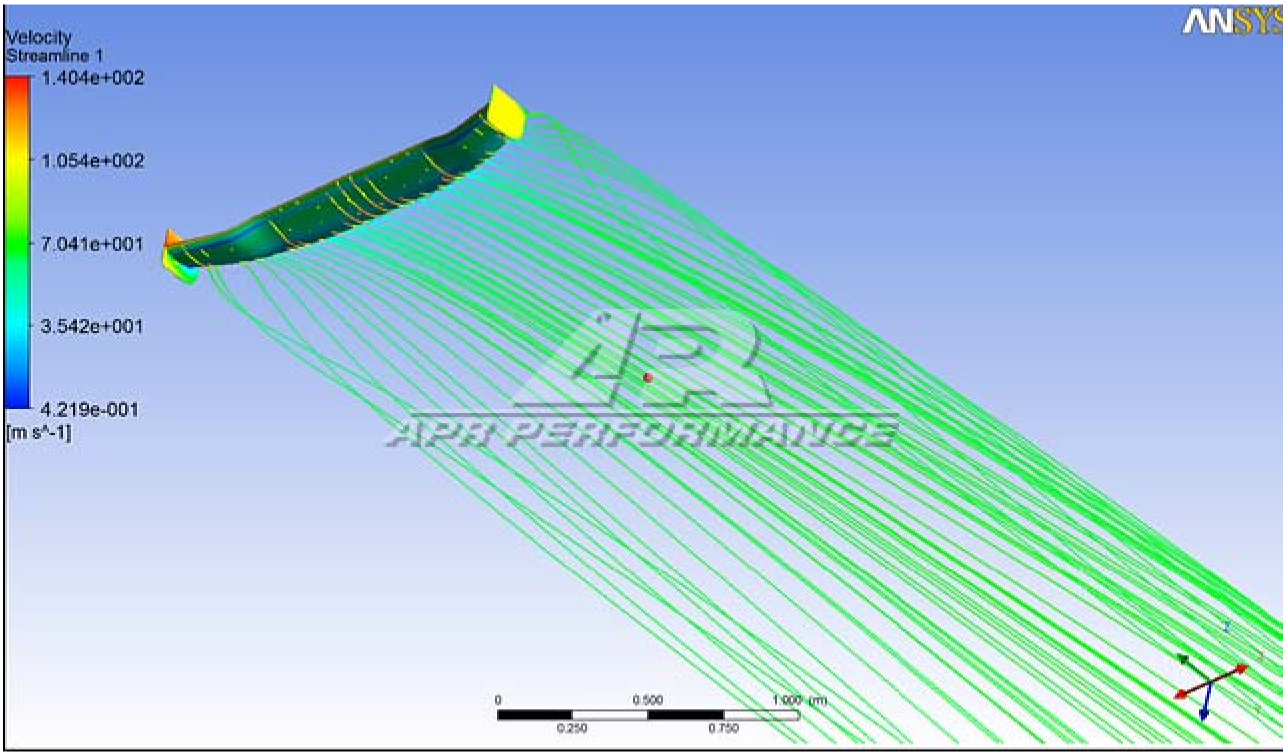
		Downforce	Drag	L/D
neg2 AOA		296.60	27.40	10.84
0 AOA		319.70	31.70	10.09
2 AOA		337.00	33.10	10.17
4 AOA		355.70	38.90	9.15
6 AOA		368.60	40.30	9.14
8 AOA		378.70	43.20	8.77

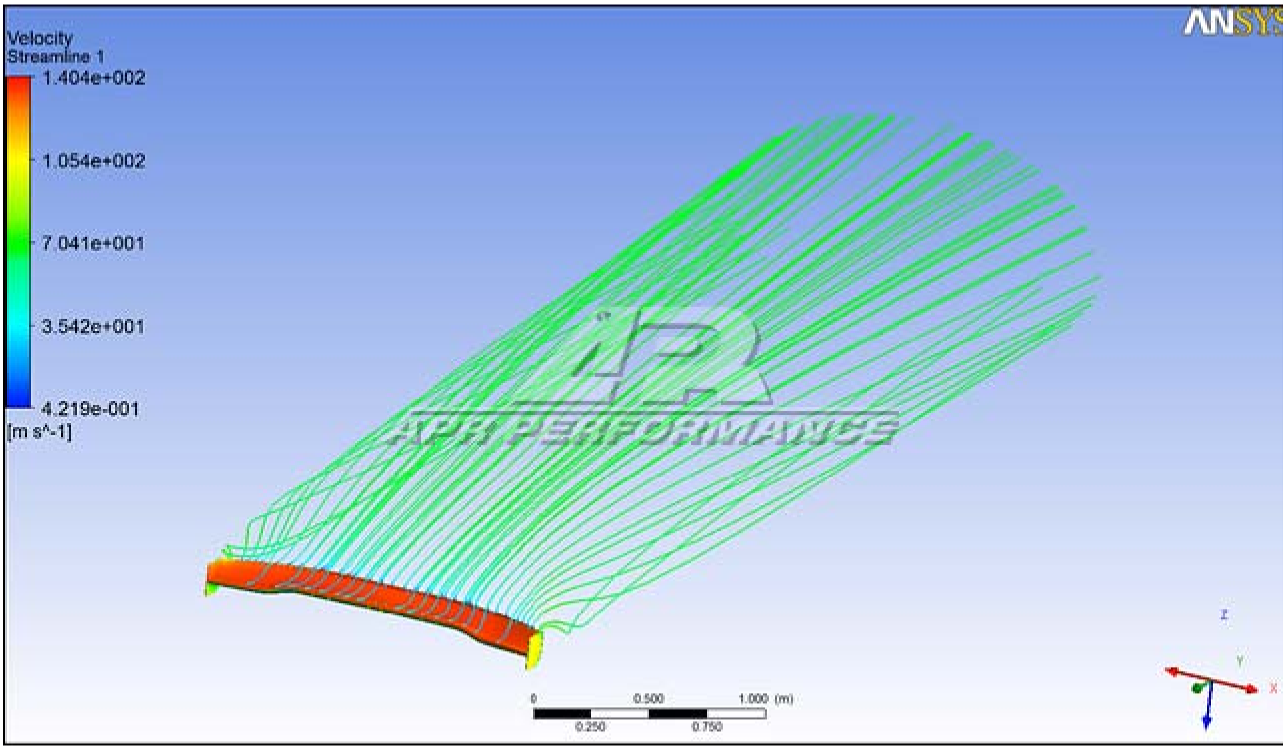

ANSYS
Pressure
WING
2.771e+003
-6.702e+002
-4.112e+003
-7.553e+003
-1.099e+004
[Pa]
APR PERFORMANCE
0
0.200
0.400 (m)
0.100
0.300


ANSYS
Pressure
WING
8.963e+003
5.861e+003
2.758e+003
-3.447e+002
-3.447e+003
[Pa]
APR PERFORMANCE
0
0.100
0.200 (m)
0.050
0.150


Pressure
WING
2.771e+003
-6.702e+002
-4.112e+003
-7.553e+003
-1.099e+004
[Pa]
0
0.350
0.700 (m)
0.175
0.525


Pressure
WING
2.771e+003
-6.702e+002
-4.112e+003
-7.553e+003
-1.099e+004
[Pa]
0
0.150
0.300 (m)
0.075
0.225


ANSYS
Velocity
Streamline 1
1.404e+002
1.054e+002
7.041e+001
3.542e+001
4.219e-001
[m s^-1]
APR PERFORMANCE
0
0.500
1.000 (m)
0.250
0.750


ANSYS
Velocity
Streamline 1
1.404e+002
1.054e+002
7.041e+001
3.542e+001
4.219e-001
[m s^-1]
APR PERFORMANCE
0
0.500
1.000 (m)
0.250
0.750

CFD Data for the original GTC-200 Adjustable Wing

OVERVIEW

Contained herein are the data and results of the Computational Fluid Dynamics (CFD) analysis that was conducted on the original GTC-200 airfoil. This data illustrates how the airfoil performs in different conditions by comparing Downforce vs. Angle-of-Attack (AOA) vs. Speed, and Drag vs. AOA vs. Speed. This data will provide insight with regards to how and how much the airfoil performs with respect to these conditions.

To learn how to interpret and apply this type of CFD data, see sample analysis on the GTC-300 page.

CFD DATA (TABLES)

The following table shows the actual data that were collected from the CFD analysis (w/o Gurney flap). The numbers in the table are represented in Newtons (a unit of force). To convert to "pounds," divide the numbers by 4.44822 (where 1 Newton (N) = 4.44822 Pounds-force (lbf)). For example, a downforce of 1286.89 N would equal 289.3 lbf.

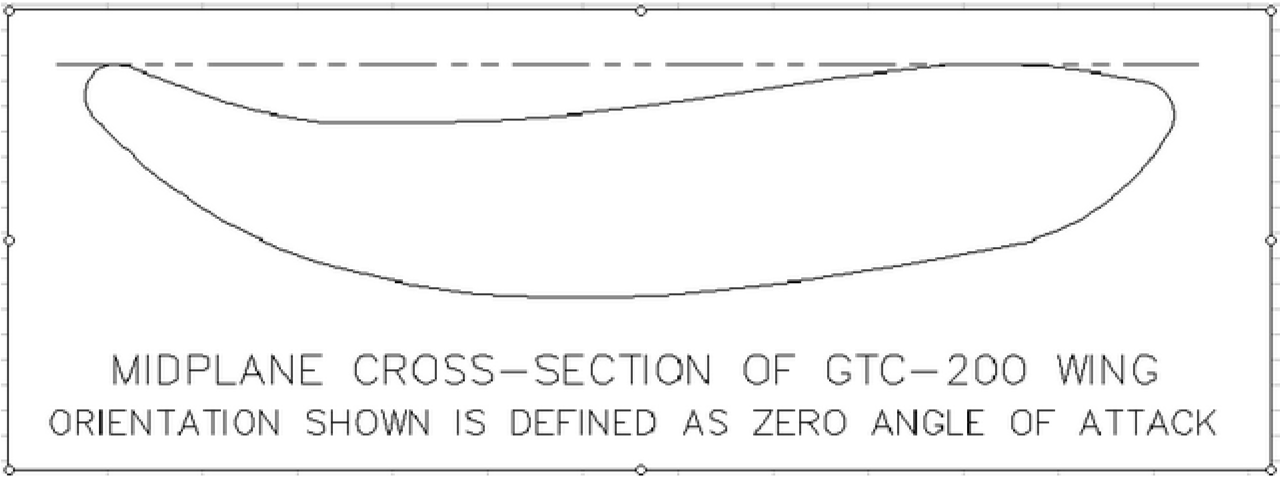
CFD Analysis of APR Performance GTC-200 Wing
Performed by Chirath Thouppuarachchi using ANSYS CFX, completed 4/8/2007

Forces in Newtons, AOA in degrees (as defined in the figure below)

		80mph	100mph	120mph	120/80
0AOA	down force	343.244	544.644	793.374	2.31
	drag	37.39	59.2353	86.4313	2.31
		80mph	100mph	120mph	
5AOA	down force	398.014	630.753	919.635	2.31
	drag	48.5552	76.882	112.269	2.31
		80mph	100mph	120mph	
10AOA	down force	442.332	698.843	1016.27	2.30
	drag	61.3774	97.1054	141.648	2.31
		80mph	100mph	120mph	
15AOA	down force	487.852	770.613	1084.48	2.22
	drag	73.328	115.913	167.493	2.28

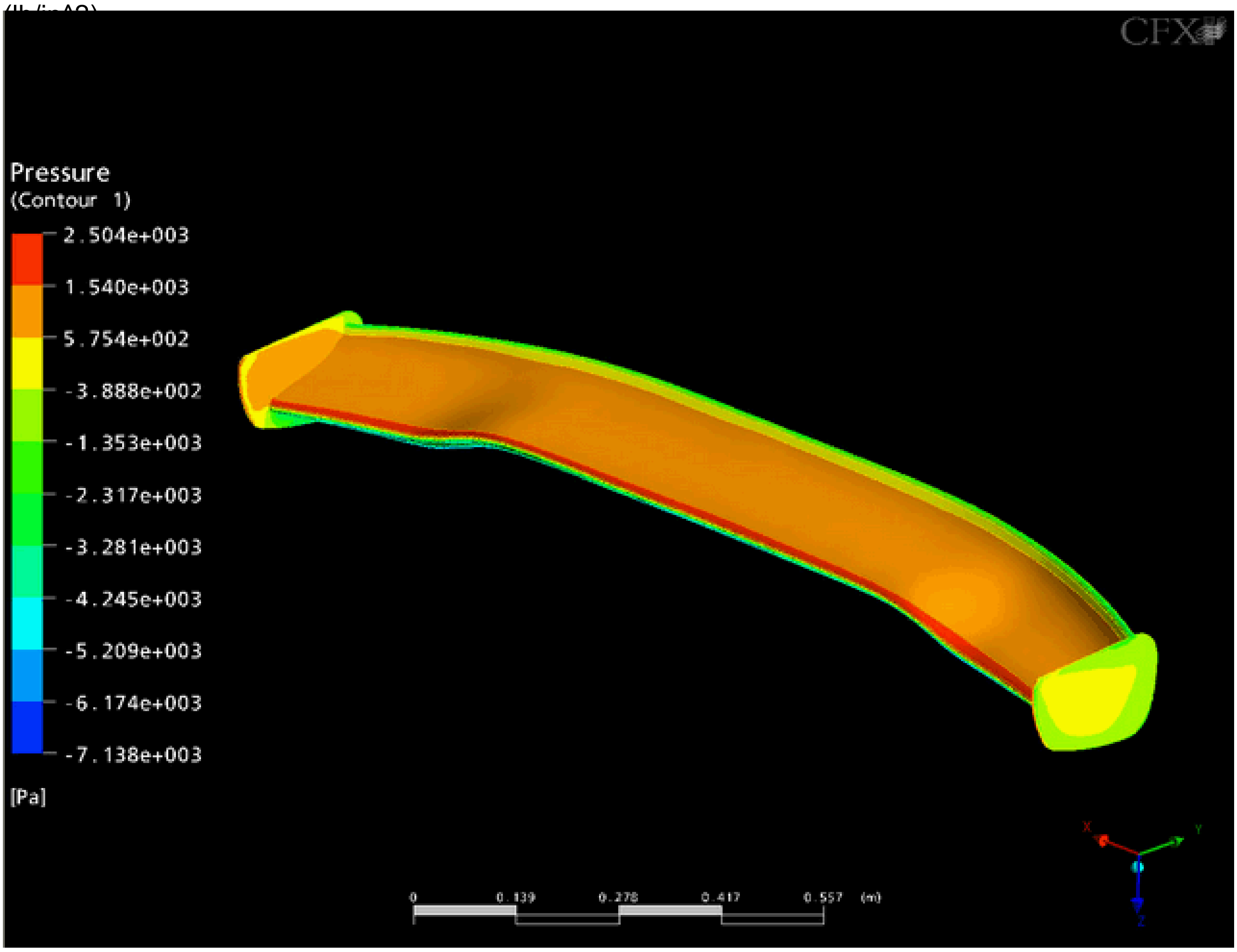
	80	100	120
down force (0AOA)	343.244	544.644	793.374
drag (0AOA)	37.39	59.2353	86.4313
down force (5AOA)	398.014	630.753	919.635
drag (5AOA)	48.5552	76.882	112.269
down force (10AOA)	442.332	698.843	1016.27
drag (10AOA)	61.3774	97.1054	141.648
down force (15AOA)	487.852	770.613	1084.48
drag (15AOA)	73.328	115.913	167.493

The following image illustrates where and how the AOA is referenced. At 0 degrees AOA, the reference plane is parallel to the direction of the free air stream (the stream would travel from right-to-left in this image). This reference plane can be simulated by placing a ruler across the top of the center section of an actual airfoil.

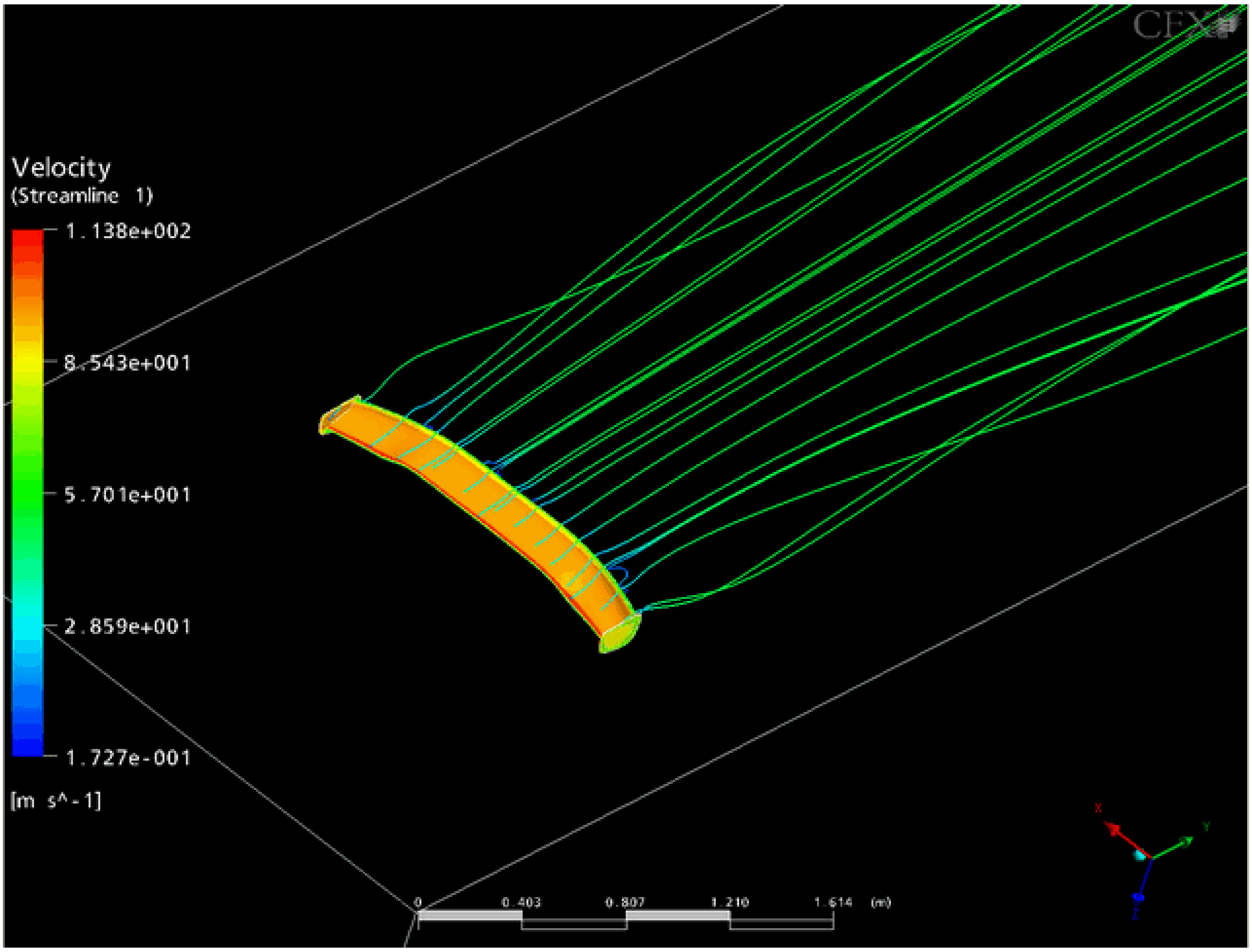


CFD DATA (RENDERED IMAGES)

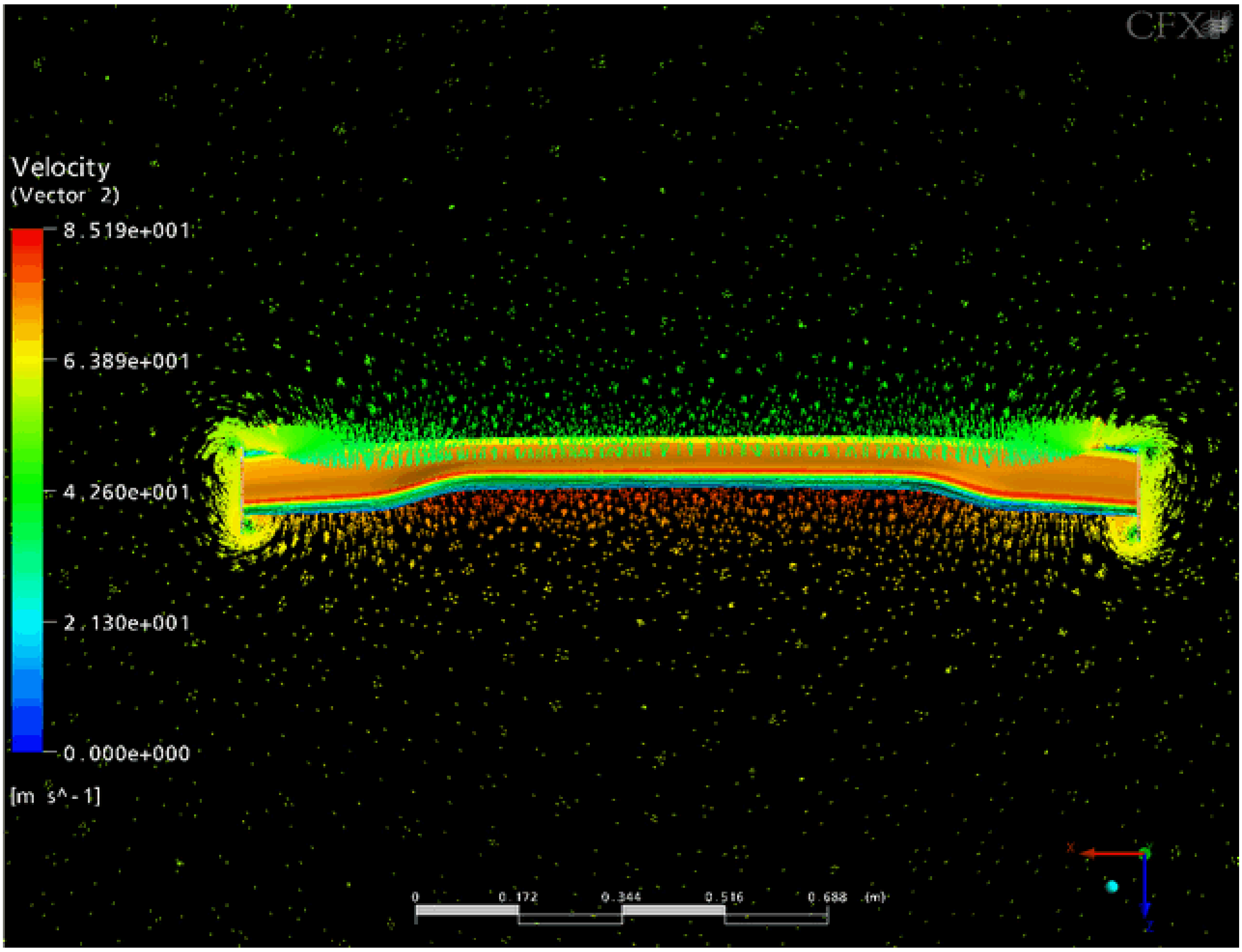
The following image illustrates the pressure distributions across the surfaces of the airfoil (w/ Gurney flap). The units are in Pascals (Pa), where 1 Pa = 1.45 x 10^-4 Pound Per Square Inch (lb/in^2).



The following image illustrates both the pressure distribution and streamlines associated with the airfoil (w/ Gurney flap).



The following image illustrates both the pressure distributions and vector fields around the airfoil (w/ Gurney flap).


CFX
Velocity
(Vector 2)
8.519e+001
6.389e+001
4.260e+001
2.130e+001
0.000e+000
[m s^-1]
0
0.172
0.344
0.516
0.688
(m)

Gurney Flaps

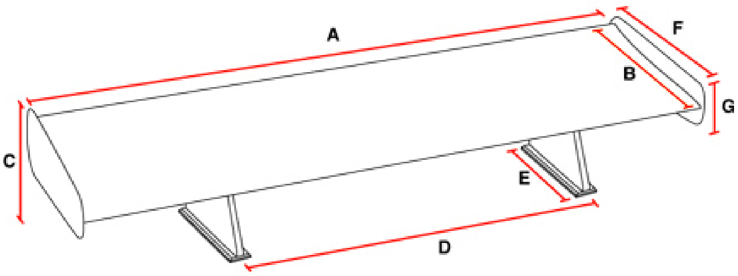
Gurney flaps are available for all APR Performance
GTC Series (200/300/500) wings. These are super lightweight, made using pre-preg carbon fiber processes, and conform perfectly to the contours of the GTC series 3D airfoils. They are easily attached using the included double-sided tape.

HISTORY OF THE GURNEY FLAP

The Gurney flap (a.k.a. wickerbill) is an aerodynamic device that was originally pioneered and developed in the 1970s by a racing driver named Dan Gurney. Unbeknownst to his competition, this device was used to increase downforce while minimizing increase in drag. He found that not only did this device increase the lift/drag (L/D) ratios, it also increased the stalling angles (so he could operate the airfoils at greater pitch angles). It took a few years for everyone else to catch on to its purpose, and now, the Gurney flap (or similar device) can be seen in race cars and even airplanes all over the world.

Wing Dimensions

Measurements for the GTC-200 Adjustable Wing (same for New and original models) are shown in the table below. Pedestal-to-pedestal distances are indicated for standard applications. Custom pedestal-to-pedestal distances can be accommodated for custom applications.



WING DIMENSIONS TABLE

	A	B	C	D	E	F	G
GTC-200 Universal	%	#	10.0"	29.5"	6.25"	9.5"	5.5"
GTC-200 SCCA Spec.	48"	#	10.0"	29.5"	6.25"	9.5"	5.5"
Acura RSX 2002-2006	%	#	10.5"	OEM	7.25"	9.5"	5.5"
Ford Mustang S197 2005-Up	%	#	10.0"	OEM	7.25"	6.0"	6.0"
Honda S2000 2000-Up	%	#	10.5"	OEM	7.25"	9.5"	5.5"
Lotus Elise 2002-Up	%	#	10.0"	19.0"	7.25"	4.5"	4.5"
Lotus Exige 2007-Up	%	#	10.0"	19.0"	7.25"	4.5"	4.5"
Mazda Miata 1990-2005	%	#	10.5"	40.0"	7.25"	9.5"	5.5"
Mazda RX-8 2004-Up	%	#	10.5"	OEM	7.25"	9.5"	5.5"
Mitsubishi Evolution 8/9 2003-2007	%	#	10.0"	OEM	9.0"	10"	7.5"
Mitsubishi Evolution X 2008-Up	%	#	10.0"	OEM	9.0"	9.5"	5.5"
Subaru Impreza WRX 2002-2007	%	#	10.0"	OEM	7.25"	9.5"	5.5"
Toyota Celica 2000-2005	%	#	10"	OEM	7.25"	9.5"	5.5"

Special Notes:
%Wingspan
original GTC-200: 59.5"
New GTC-200: 60.5"

#Variable cord length
original GTC-200: 8.50" Inner Max / 6.75" Outer Max
New GTC-200: 9.50" Inner Max / 6.75" Outer Max

Notice

Effective September 5, 2013, the New GTC-200 foil replaces the original GTC-200 foil. All orders as of this date have been shipping with the New GTC-200 (except for the SCCA application, which will continue to come with the original GTC-200 foil).

NEW GTC-200 VS ORIGINAL GTC-200

The New GTC-200 has:
- Larger chord than the original GTC-200.
- More aggressive camber than the original GTC-200.
- Higher lift/drag (L/D) ratio than the original GTC-200.
- More downforce than the original GTC-200.
- Backwards compatibility with all original GTC-200 mounting brackets and pedestals.