Black Bird CO_2 Dragster

By Maria Deiters & Lucia Garay

Understanding

- Our task is to design and produce a race vehicle powered by a standard CO2 cartridge.
- Specifications of wheel size, body length, axle size and cartridge position have been predetermined.
- Goal: Aesthetically Pleasing and Functional
- The vehicles will be raced against each other over a 20m distance with tensioned fishing line to act as a guide. A ‘firing’ device will be used to start the vehicles simultaneously.

Explore

- Develop a basic Knowledge
- Matters to Keep in mind:
- Light weight (vehicle's center)
- Less air friction (hidden wheels)
- Avoid rear end drag

Define

- The CO2 Dragster must stay within the TSA Specifications listed in The Official Car Designer Handbook
- Specifications such wheel size, body length, axle size and cartridge.

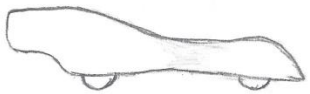
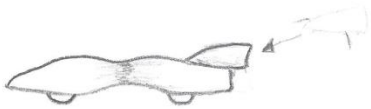
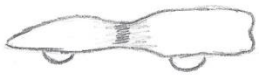
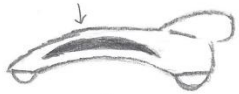
Ideates

Car Designs Ideas

Names Lucía Garay & Maria Deitens — Turn In — 30/30

POSSIBLE SOLUTIONS

In the spaces below, sketch eight possible designs for your dragster. Beside each of these, make notes in the space provided about some of the positives and negatives of each design.

 1	+ye • too much back drag. -ye
 2	• light center +ye • The string that goes underneath -ye
 3	+ye heavy end might tip -ye
 4	• light center +ye • The string that goes underneath might break -ye
✓  5	+ye too much curvature -ye
 6	+ye high backend suction -ye bulky design
✓  7	hidden wheels +ye low backend suction -ye
✓ cut out  8	right weight center +ye hidden wheels ↗ pointed front? -ye might break

Ideates

Top Two Design Choices

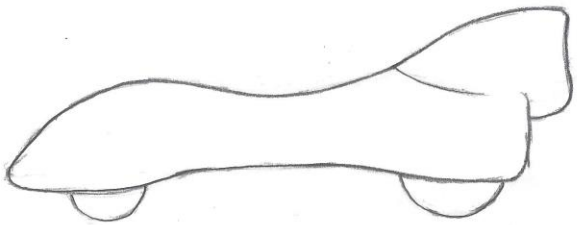
SOLUTION DEVELOPMENT

From the ideas illustrated and investigated earlier, I have selected two for further investigation because they exhibit the following qualities:

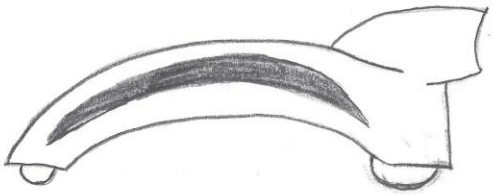
hidden wheels, minimal back drag, light centers, aerodynamic design.

In the boxes include more detailed sketches of your two selected ideas.

Idea No.1



Idea No.2



Ideates

Number One Idea

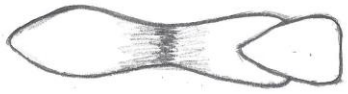
SOLUTION REFINEMENT

After further consideration I have decided to refine idea no. 1 I will refine it for the following reasons:

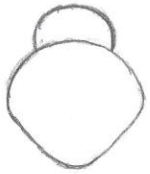
Small wheels front & back

Sketch below the Top and Front Views of your final design.

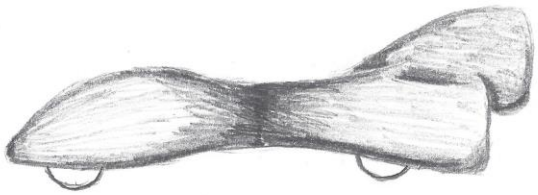
TOP VIEW



FRONT VIEW



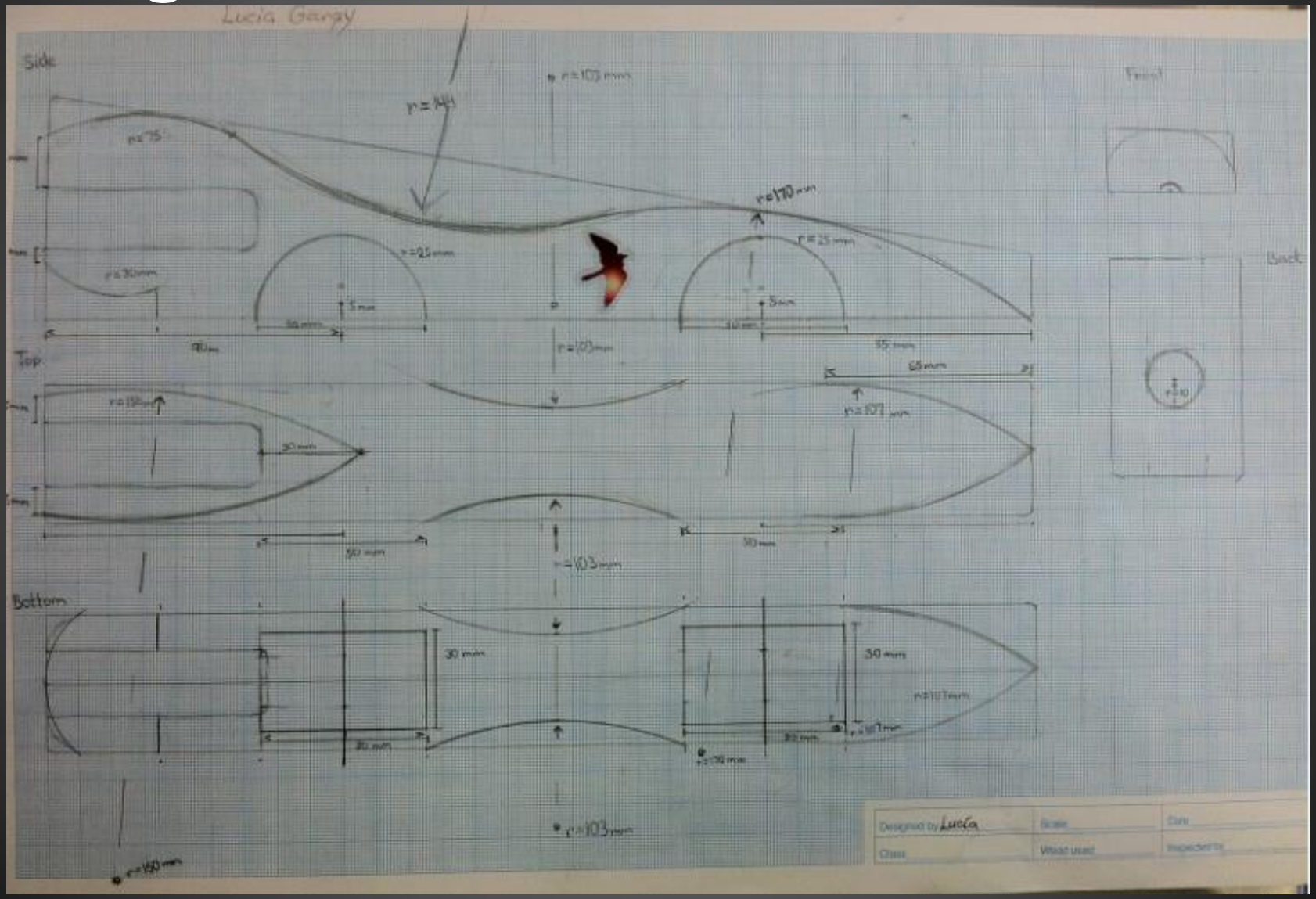
Sketch a pictorial presentation of the final design in the space below.



PICTORIAL VIEW

Be sure to add dimensions based on the CO2 dragster specification spreadsheet

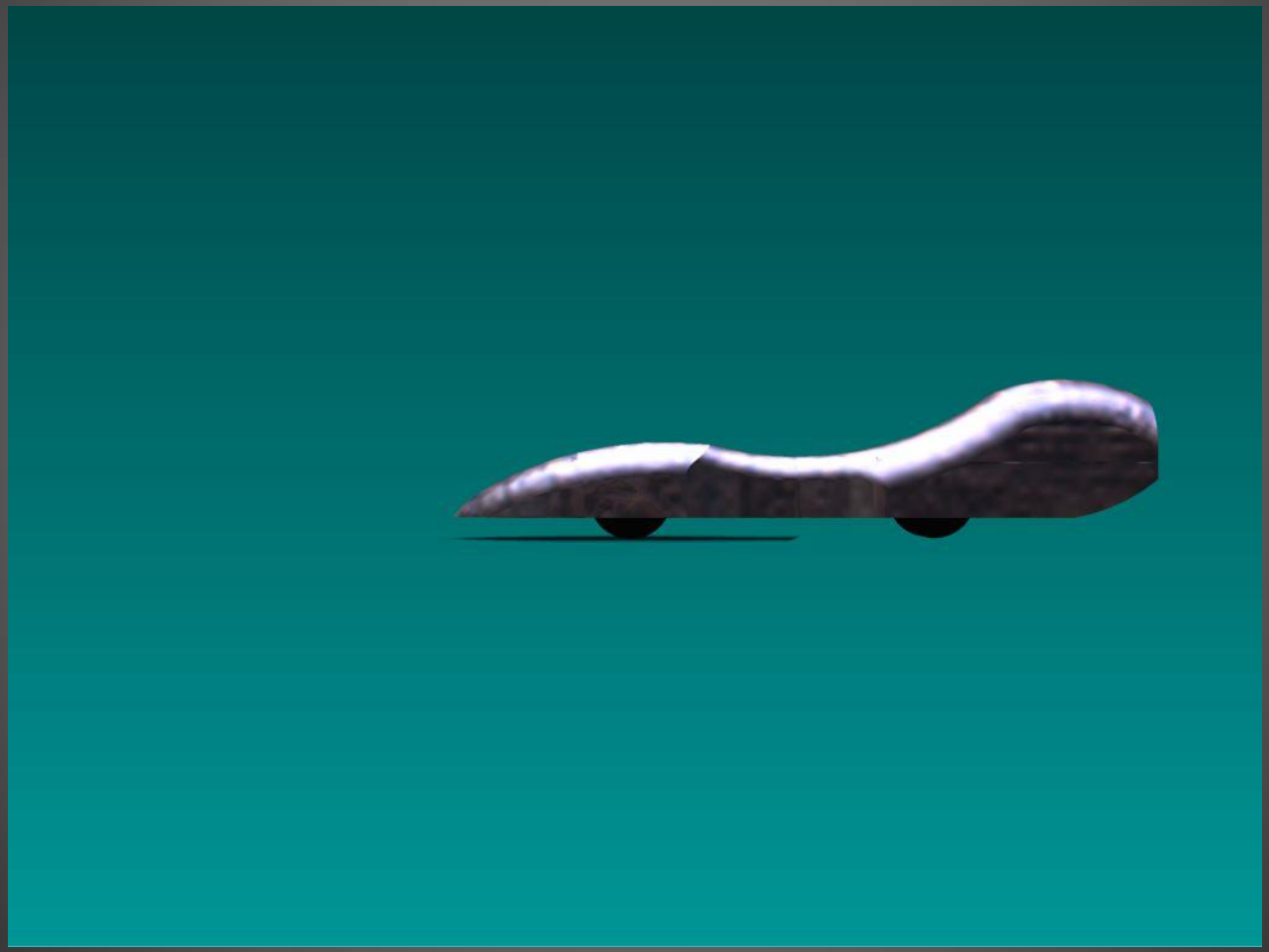
Design Plan


Lucia Gargy
Side
Top
Bottom
Front
Back
r=103 mm
r=170 mm
r=25 mm
r=75
r=30 mm
5 mm
90 mm
55 mm
68 mm
30 mm
50 mm
r=107 mm
r=103 mm
Designed by Lucia
Scale
Date
Class
Wood used
Inspected by

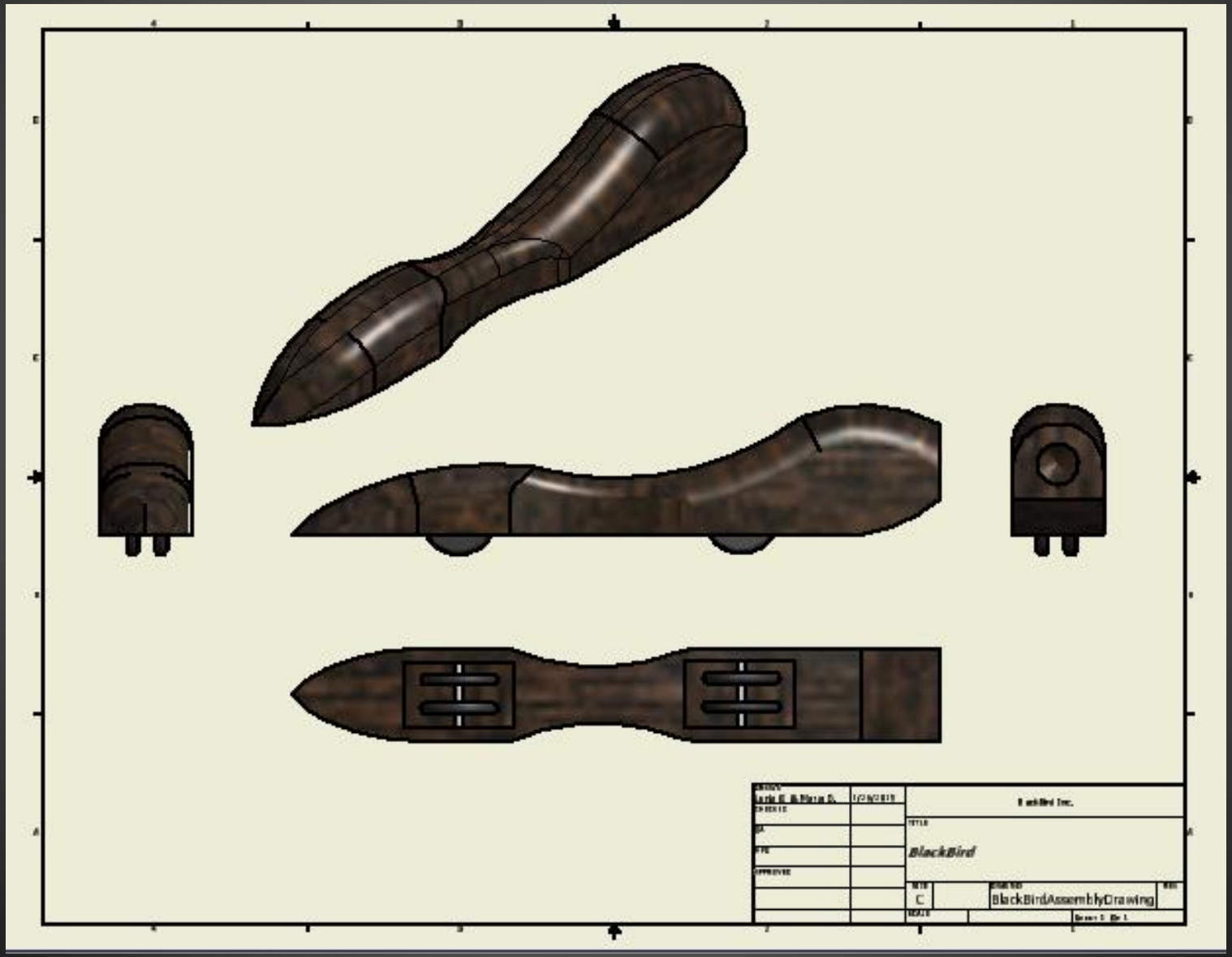
Refine

- In effort to make our car lighter we hollow out the inside of the center of the car.

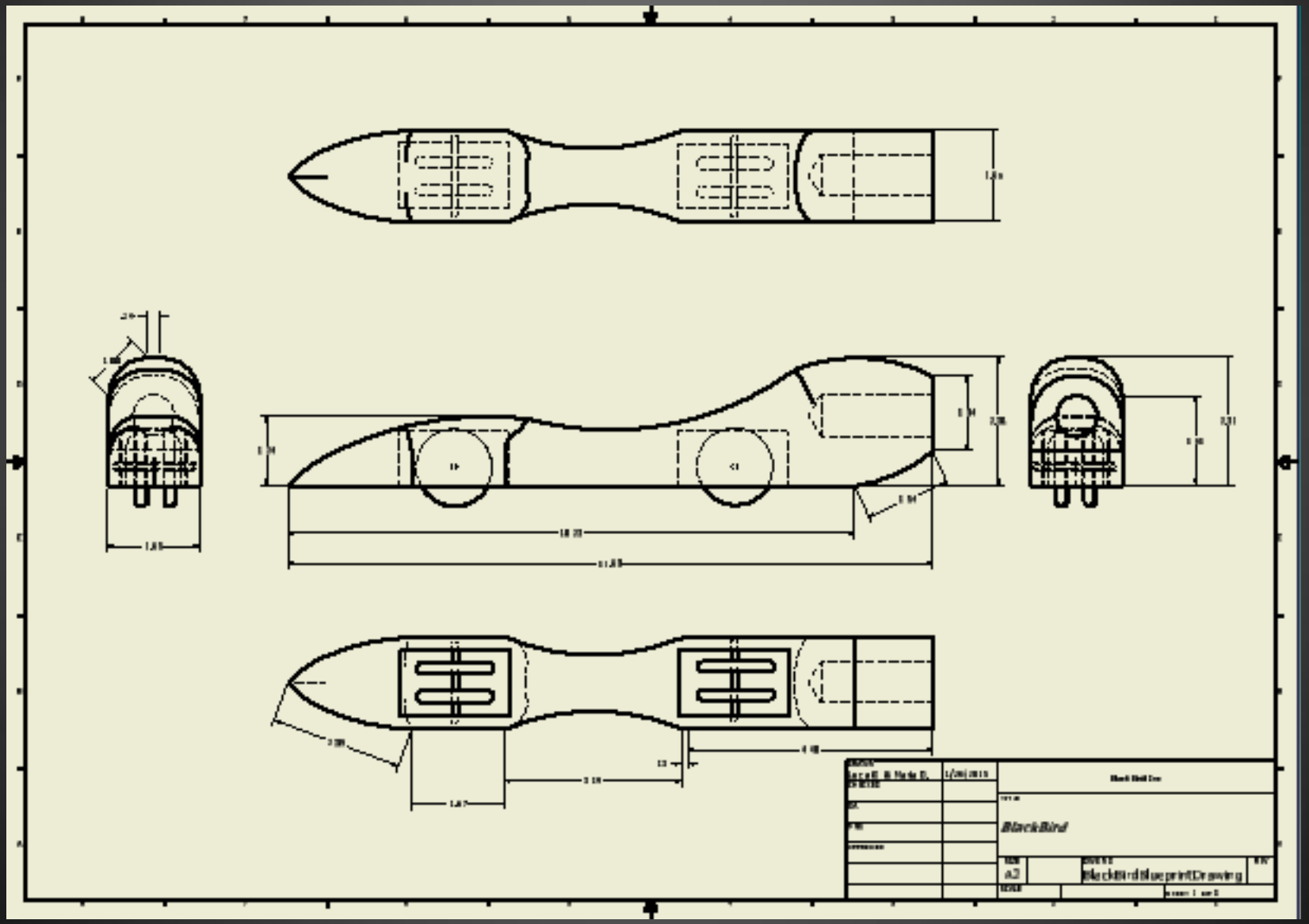
Rendered Image



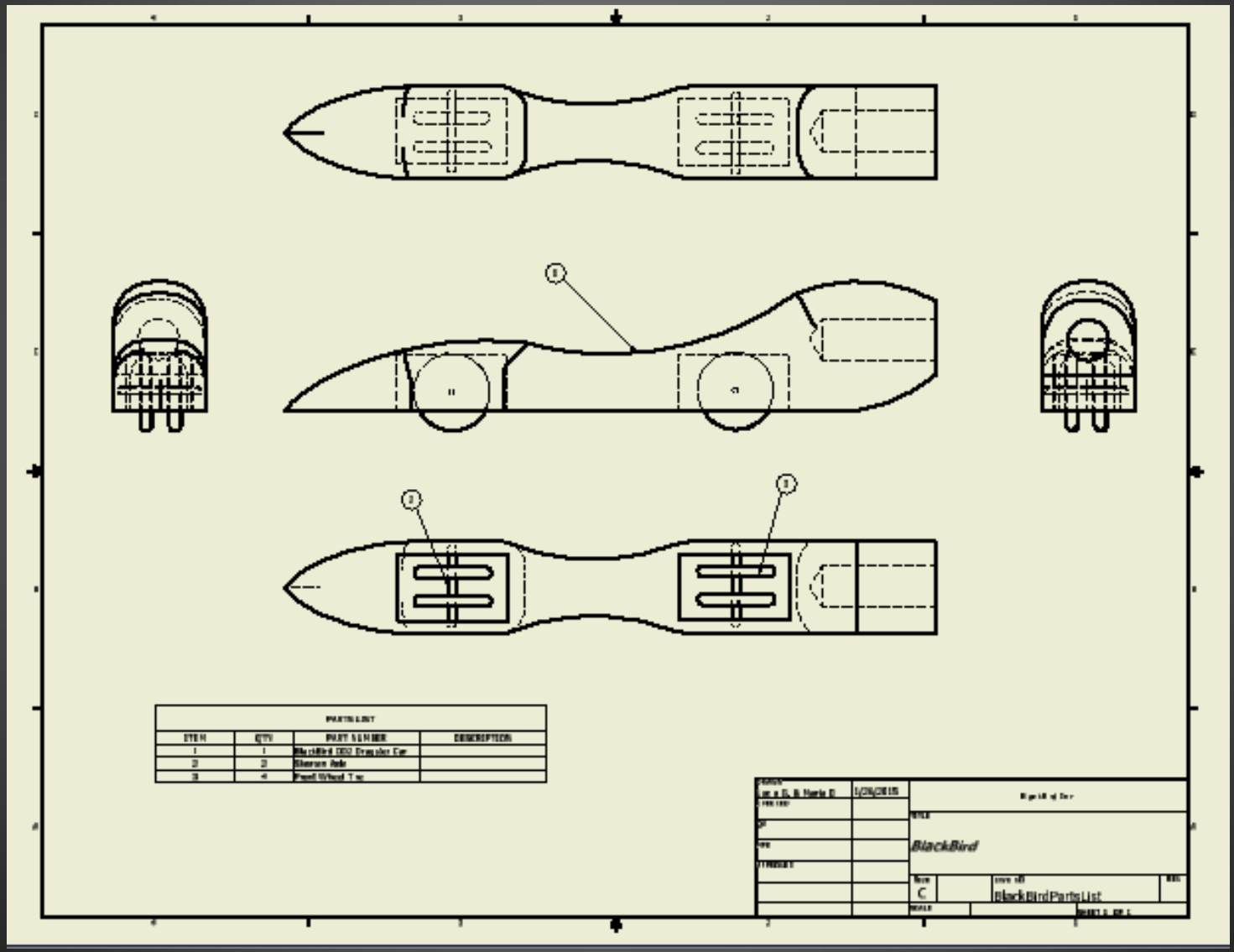
Assembly Drawing



Autodesk Dimensions Blueprint



Parts List

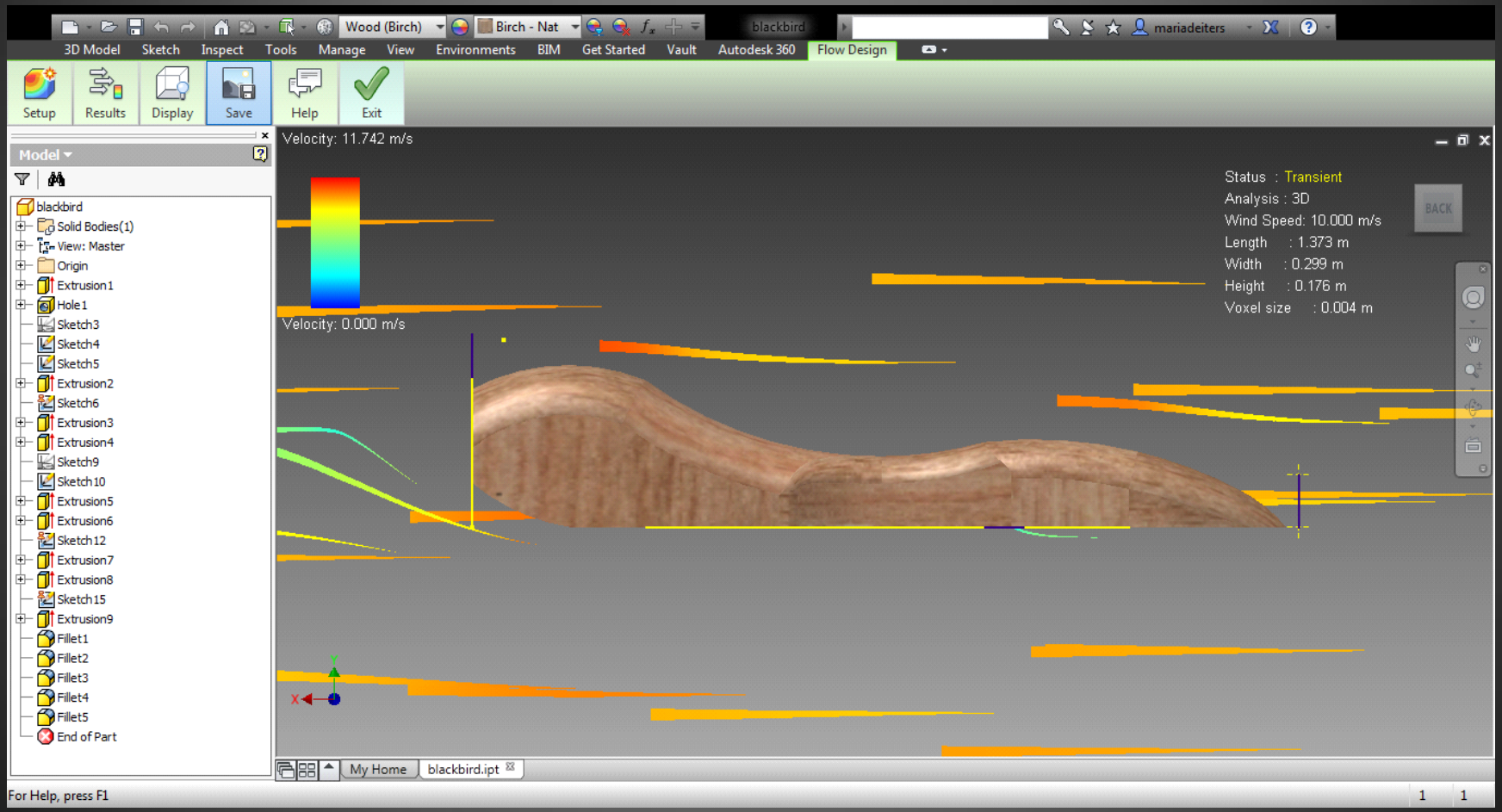

PARTS LIST
ITEM
QTY
PART NUMBER
DESCRIPTION
BlackBird
C
BlackBirdPartsList

Final Product

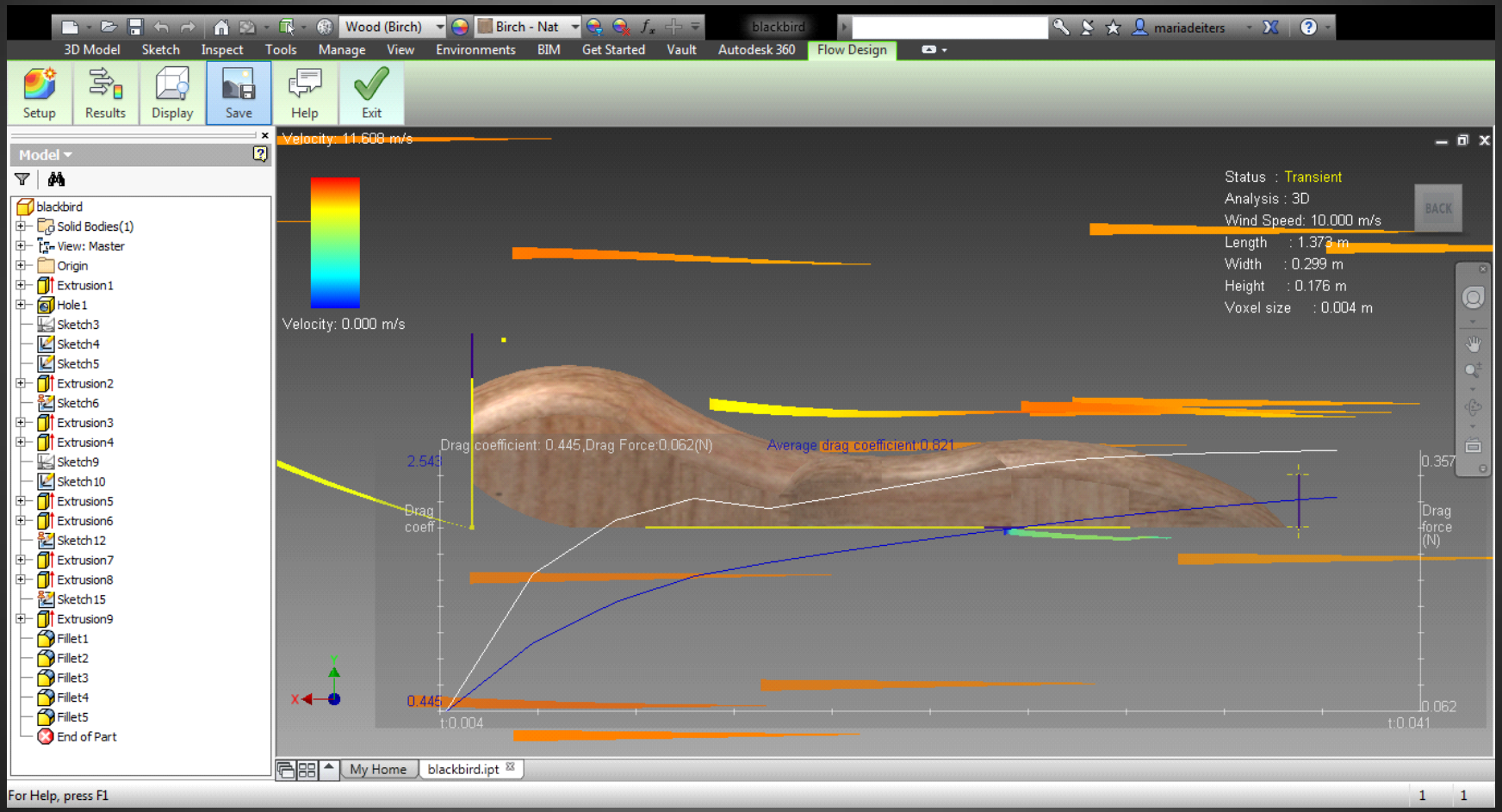
Final Product (Top View)

Final Product (Side View)

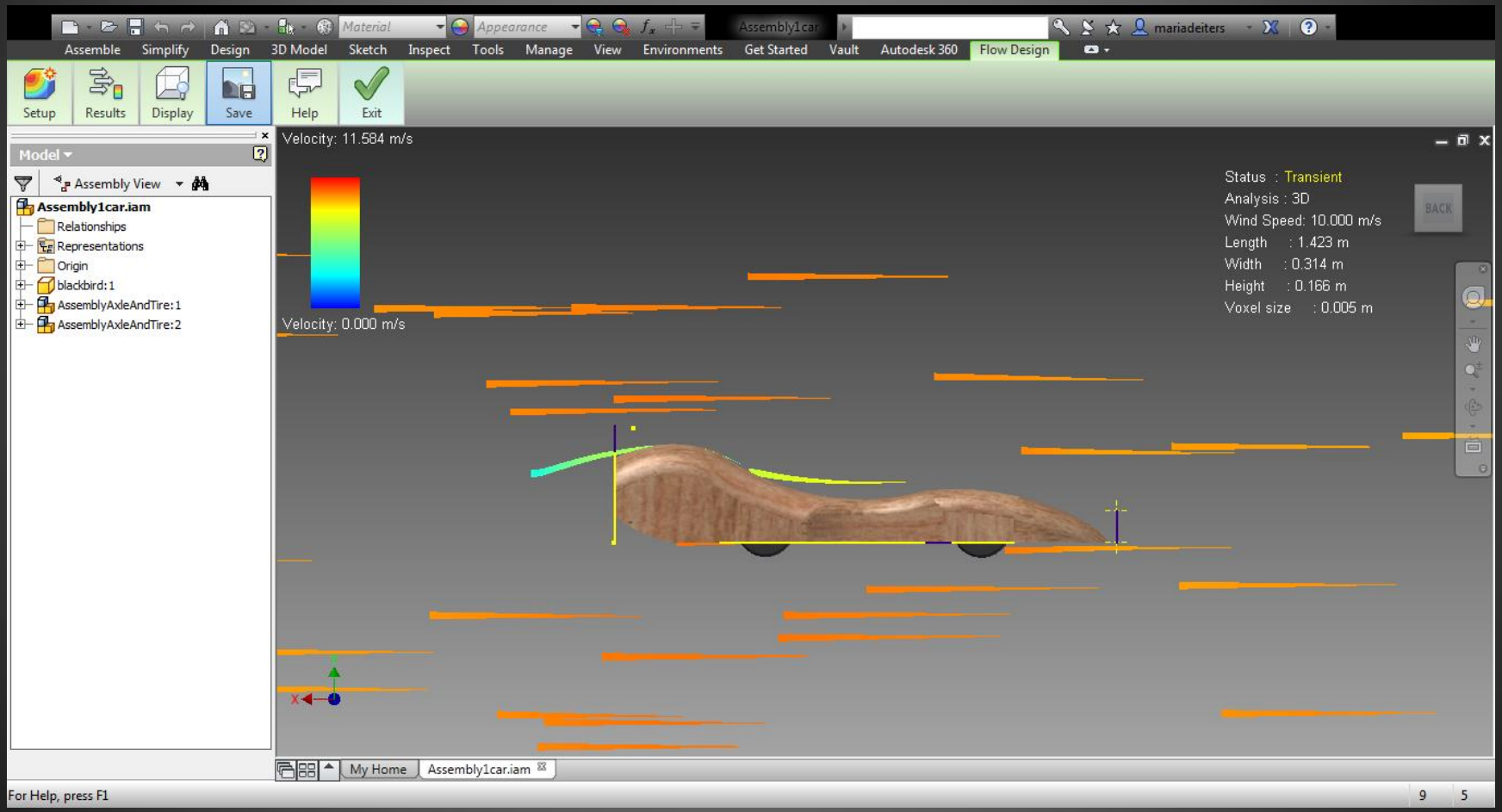
Flow Picture (Without Wheels)



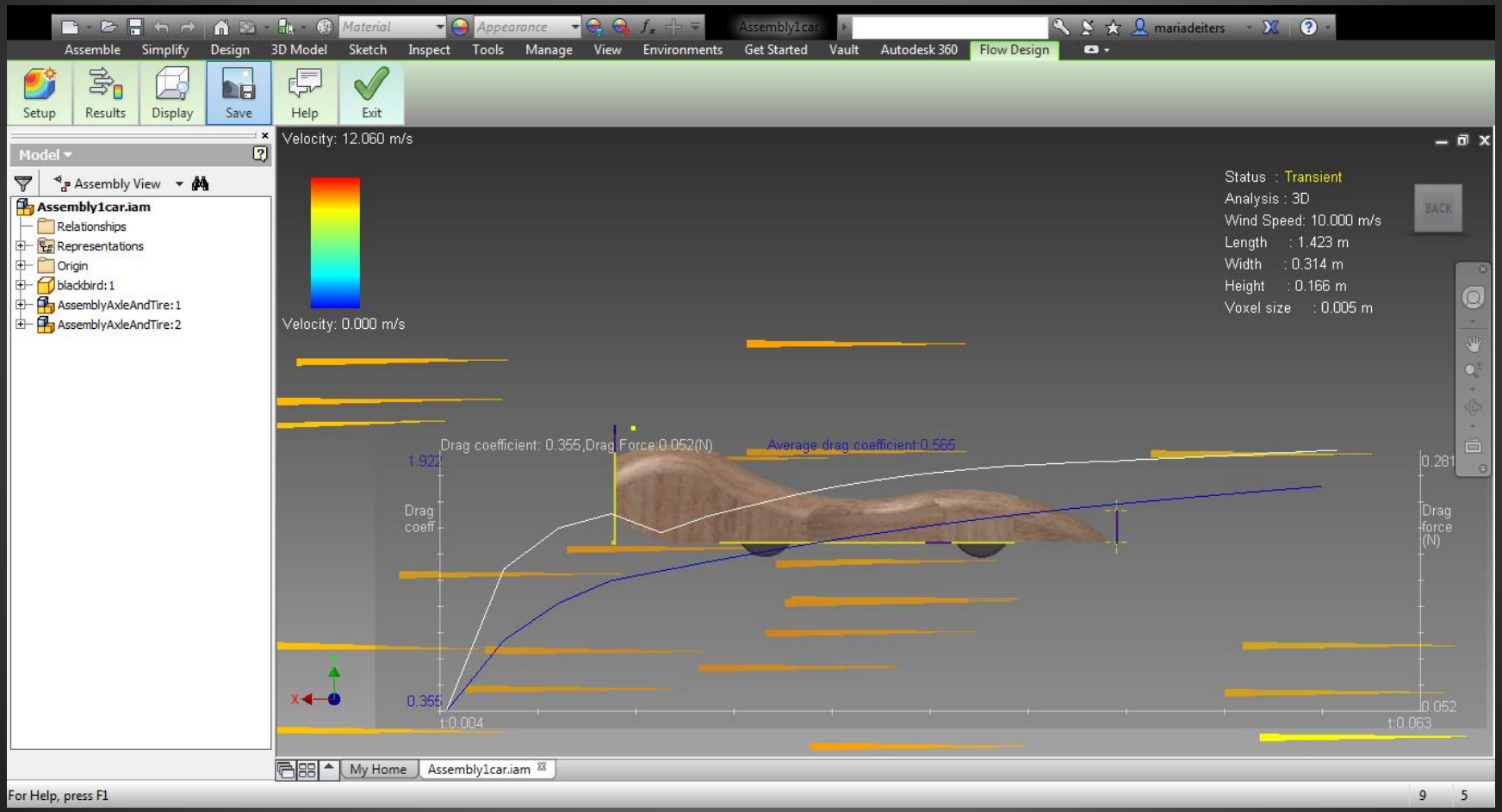
Flow Results (Without Wheels)



Flow Picture (With Wheels)



Flow Results (With Wheels)



Flow Design Results

Autodesk Flow Design Report Name(s) _____Lucia Garay & Maria Deiters_____

Data Table

Part	Velocity (m/s)	Avg Cd	Cd	Drag Force (N)	% change Drag force from blank
Blank	10	.612	.613	.13	----------
Car without wheels	10	.821	.445	.06	.07/.13x100= 53.8%
Car With wheels	10	.565	.355	.05	.08/.13x100=61.5%

Final Product Results

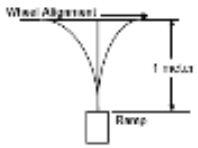
CO2 Dragster Unit Design Testing **Name Maria Deiters and Lucia Garay**

These results should be in the "solution" portion of your design journal

Weight:
The heavier a dragster is, the slower it will travel. The weight of the dragster will be the most important factor in determining how well it will perform in the real race. Use the scale to record the mass of your car to the nearest gram. Convert to Newtons for weight
Mass:__128___ WEIGHT: _1254.4_____

My place in the class competition (both classes)
___10_____ out of ___12____ CO2 Dragsters

Wheel Alignment:
If the wheel alignment of a dragster causes it to veer sideways, it will create friction between the tires and the track and friction between the string and the "screw eye". Friction will cause the dragster to slow. We can measure the wheel alignment of dragsters by rolling them down a short ramp, and measuring how far it veers to the side on a one meter run.



WHEEL ALIGNMENT: #1: _12__ #2: 16___ #3: _7__ Average: _30.333___mm

Wheel spin:
If the wheels on a dragster are wobbly or if they stick, it will slow the dragster down. To measure the wheel spin of a dragster, turn it over and spin each wheel in turn with your finger. Try to be as consistent as possible in the force used to spin the wheel Time how long each wheel spins using a stop watch.

Left Front Wheel #1: _.85__ #2: 1.1___ #3: _1.06__ average ___1.003__

Right Front Wheel #1: _.53__ #2: _.59__ #3: _.87__ average _.663____

Left Back Wheel #1: .95___ #2: _1.06__ #3: _1.17__ average __1.06___

Right Back Wheel #1: _1.56__ #2: __1.25_ #3: _1.52__ average __1.443___

Wind Tunnel:
If the air gets "caught" on your car as it travels by, your car will be slowed down. This force is called "drag" and is measured in grams. The lower your drag, the less your dragster will be slowed down by the wind as it travels down the track. Test your dragster in the wind tunnel 2 times and record the results below

DRAG #1: _.076_____ Newtons DRAG #2: __.080_____ Newtons

My place in the class competition (both classes)
___2____ out of ___12____ CO2 Dragsters

Race Results

Trial	Time (s)	Speed (m/s)	Speed (km/hr)	Speed (miles/hr)
1	2.194	10.30	7.898	4.907
2	2.387	9.46	8.593	5.339
3	2.132	10.60	7.675	4.769
Average	2.237	10.12	8.055	5.005

My place in the class competition (both classes)
_____9__ out of ___12____ CO2 Dragsters

Rendered BlackBird Video

- Rotation Video

https://www.youtube.com/watch?v=MAcmDFDfWlI&feature=youtu.be

- Assembly Video

https://www.youtube.com/watch?v=6bhxcRbuNgE&feature=youtu.be

- Flow Design Video

https://www.youtube.com/watch?v=fTaw_uM57Kg&feature=youtu.be