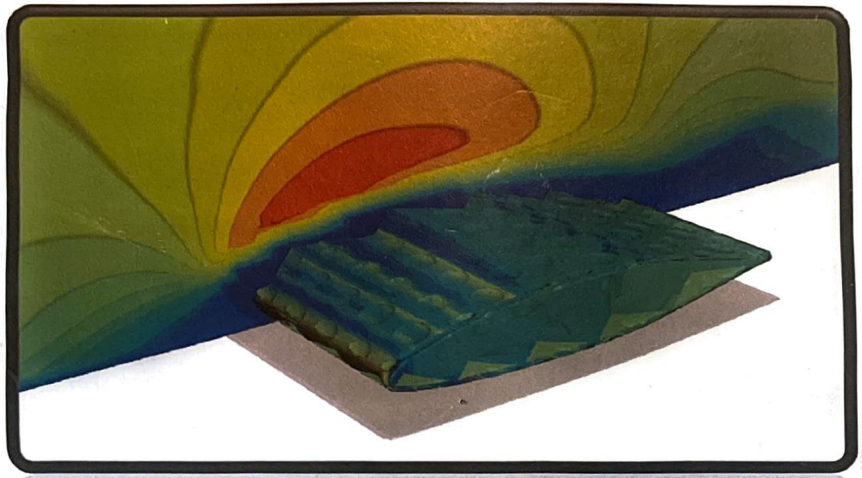


Drag Wrap

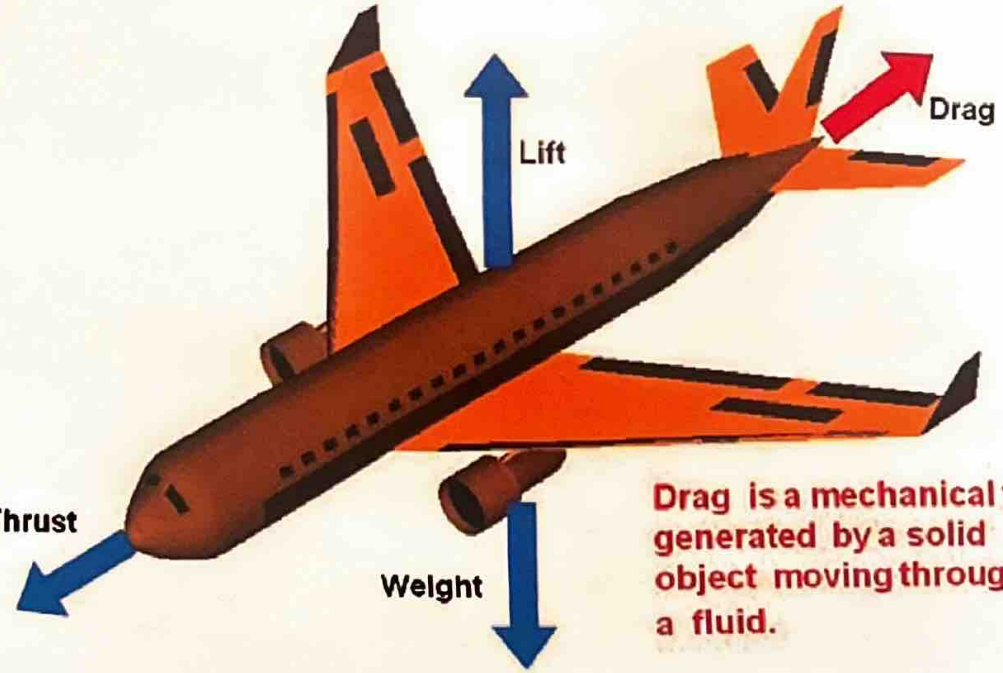
Ethan Collins

Inventor

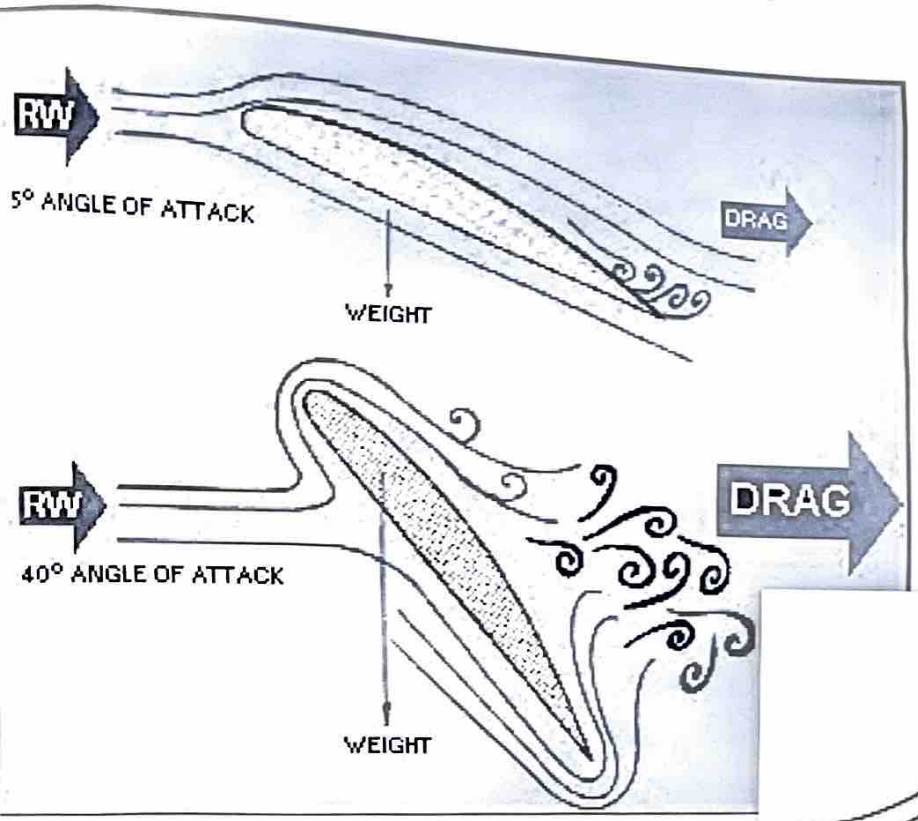
One of the greatest factors that influence flight is drag.

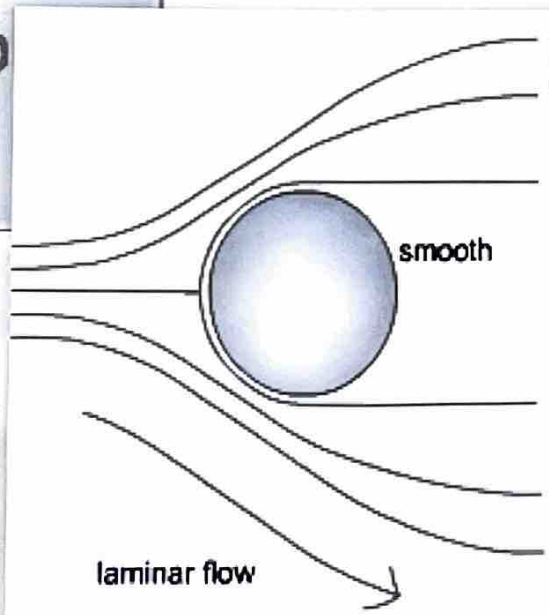
National Aeronautics and Space Administration

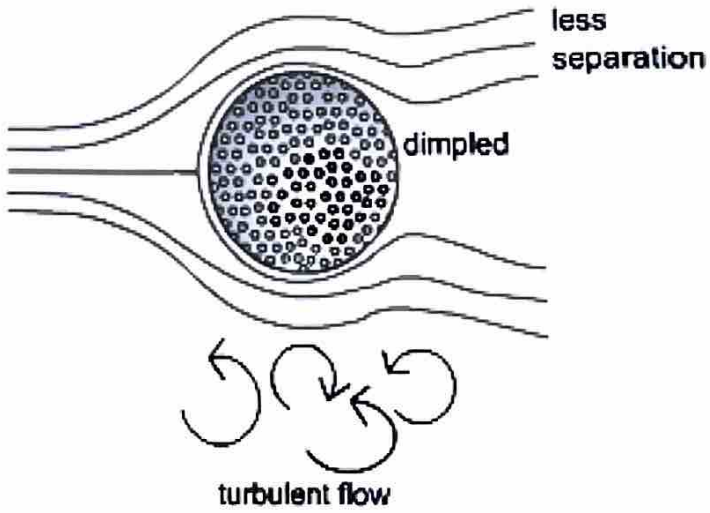
What is Drag ?



Drag is a mechanical force generated by a solid object moving through a fluid.


RW
5° ANGLE OF ATTACK
DRAG
WEIGHT
RW
40° ANGLE OF ATTACK
DRAG
WEIGHT


large amount of
separation
smooth
laminar flow


less
separation
dimpled
turbulent flow

Drag reduction methods

Design

- Swept Wings
- Winglets
- Vortex Generators
- Composite Aircraft Construction

Problems with design

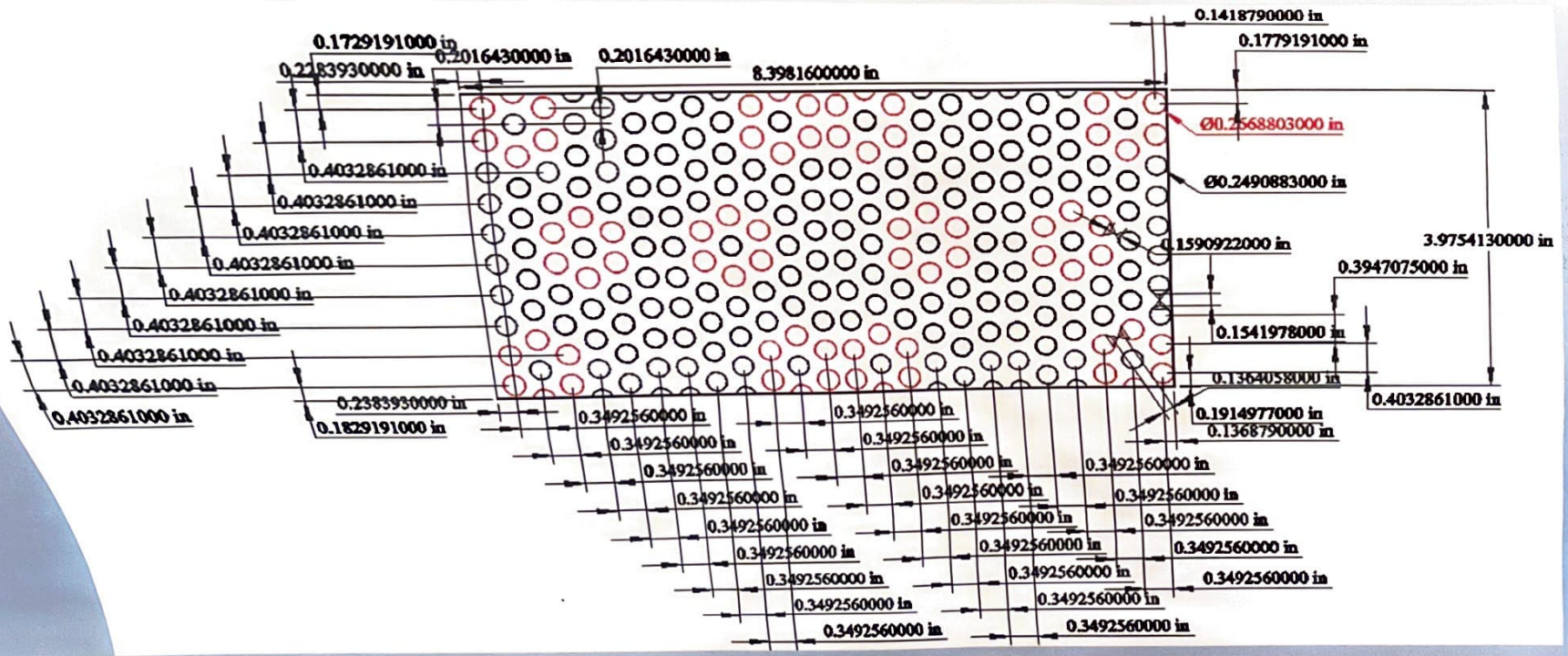
- Swept wings are only efficient at high airspeeds.
- Winglets are expensive and are only on large aircraft.
- Vortex generators are easily broken off.
- Composite aircraft are expensive and provide no conversion option for older aluminum aircraft.

What if the drag reducer:

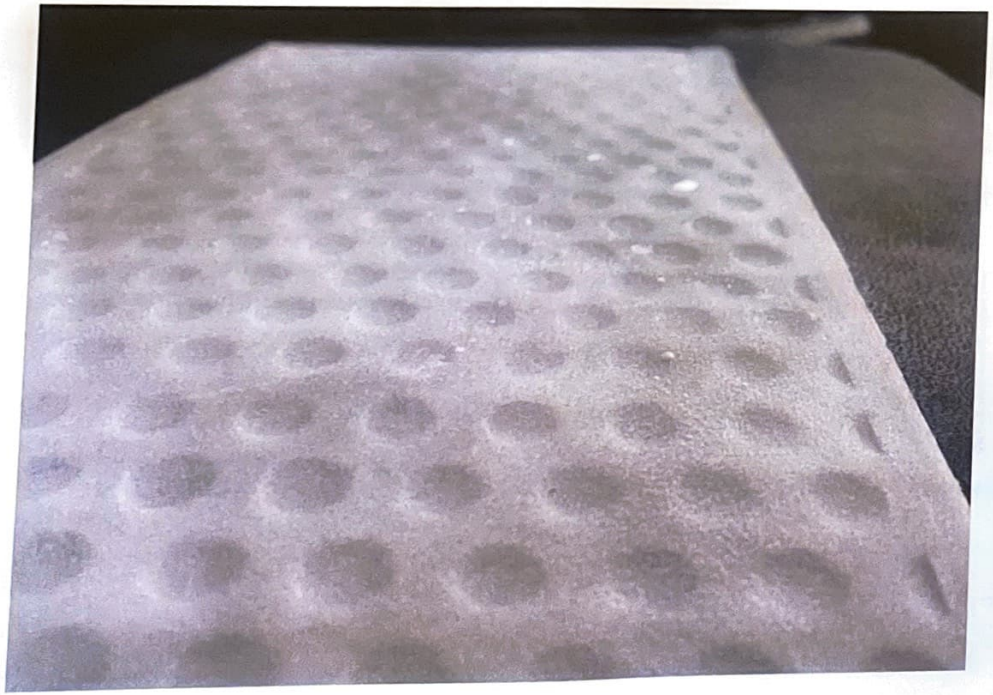
- Could be mass produced?
- Was inexpensive?
- Could be placed on from trains to planes?
- Could be applied and removed easily?
- Was not susceptible to damage?

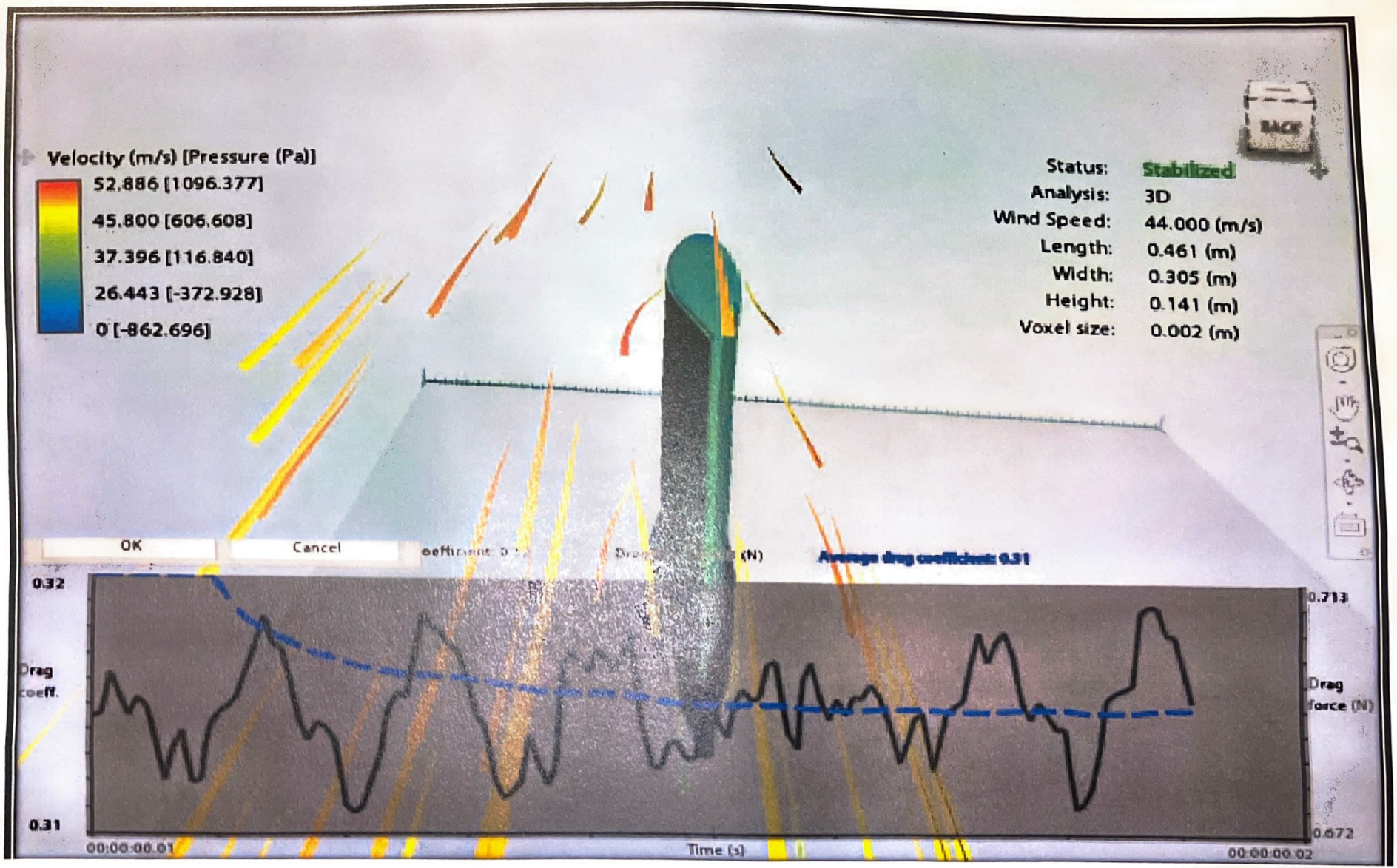
Say hello to Drag Reducing Film for Vehicles: (aka Drag Wrap)

Patent# ~~513111387~~ Pending

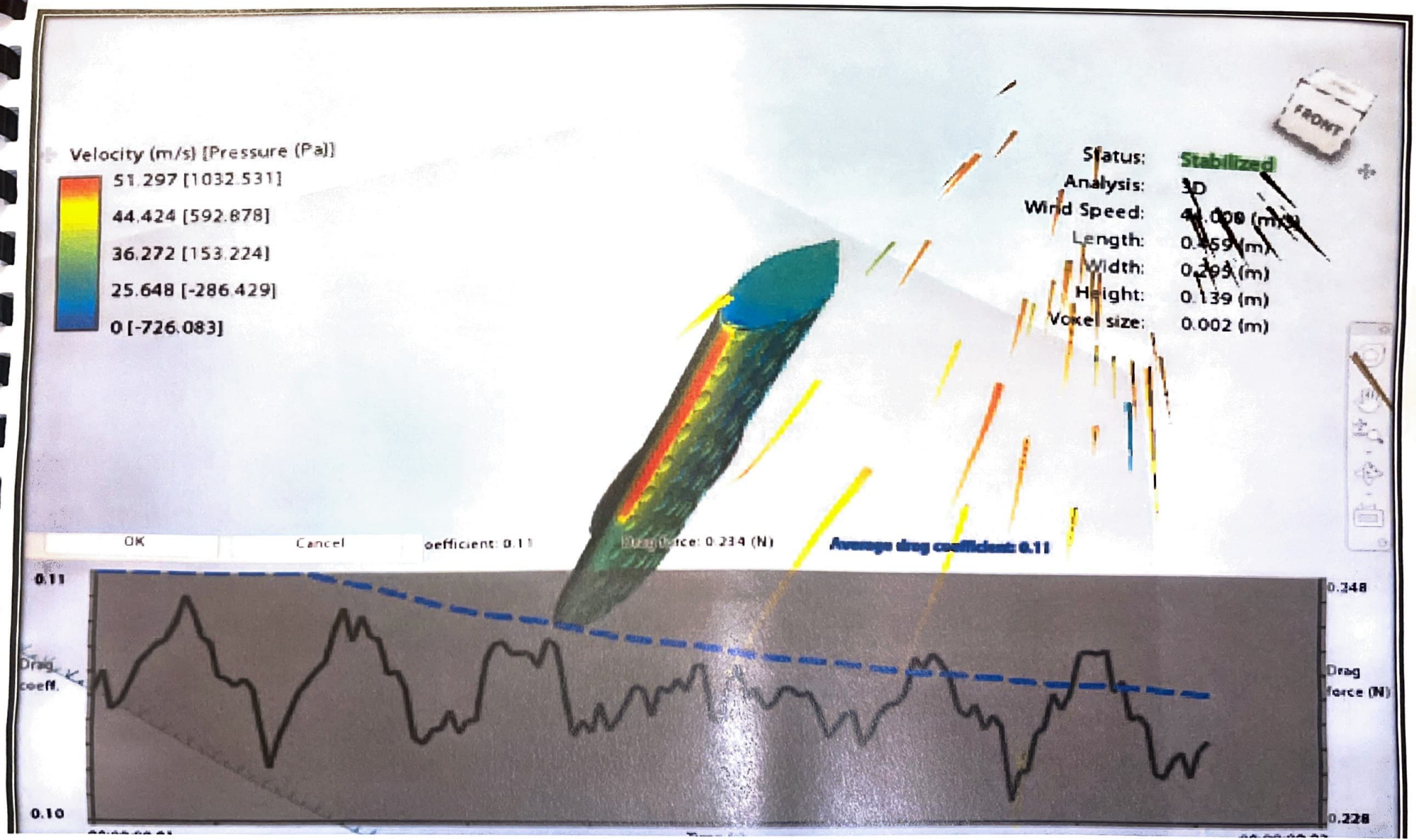

0.1729191000 in
0.2016430000 in
0.2016430000 in
0.2283930000 in
8.3981600000 in
0.1418790000 in
0.1779191000 in
Ø0.2568803000 in
Ø0.2490883000 in
0.4032861000 in
0.4032861000 in
0.4032861000 in
0.4032861000 in
0.4032861000 in
0.4032861000 in
0.4032861000 in
0.4032861000 in
0.1590922000 in
3.9754130000 in
0.3947075000 in
0.1541978000 in
0.1364058000 in
0.4032861000 in
0.1914977000 in
0.1368790000 in
0.2383930000 in
0.1829191000 in
0.3492560000 in

Prototype product

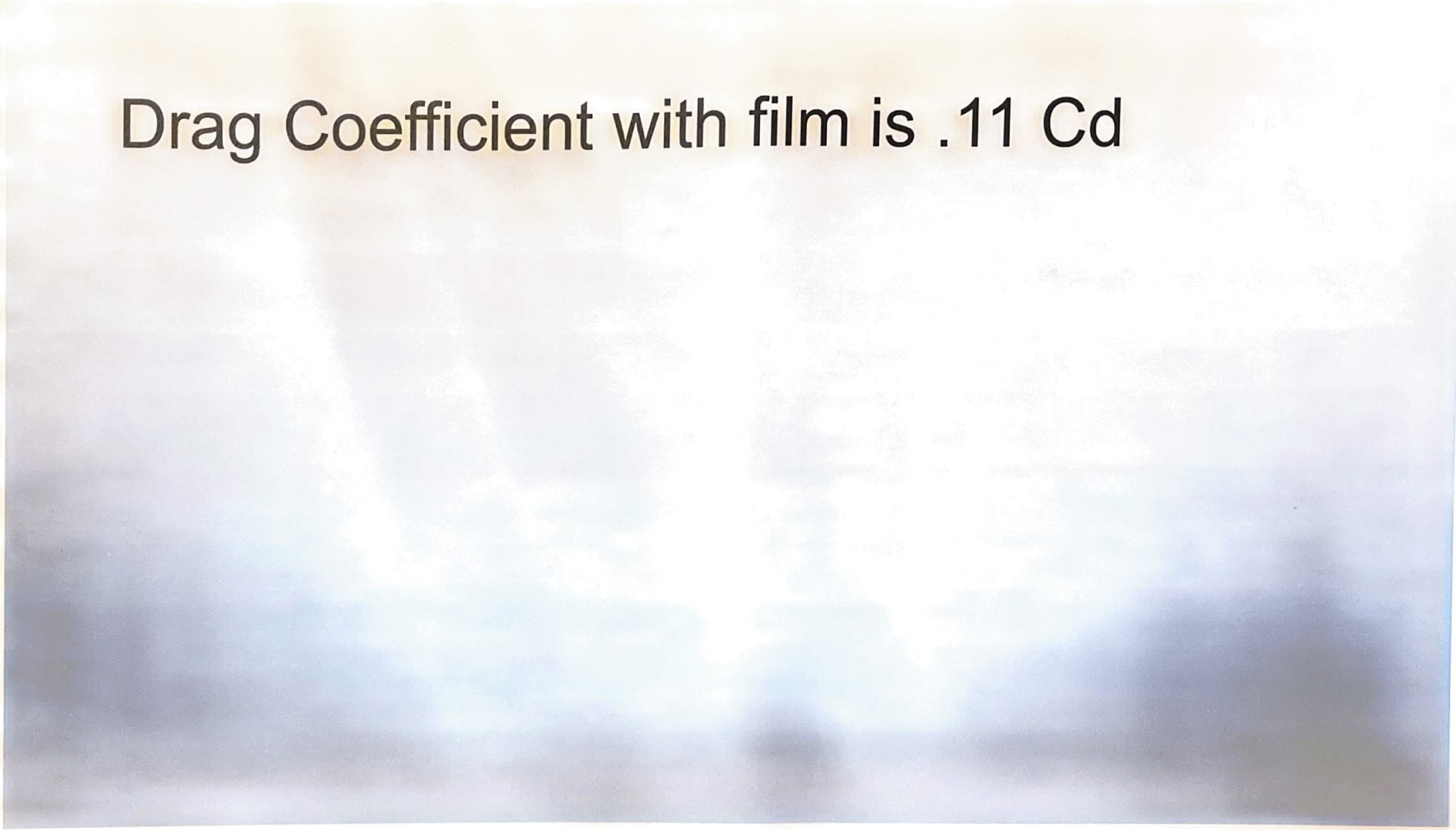



Velocity (m/s) [Pressure (Pa)]
52.886 [1096.377]
45.800 [606.608]
37.396 [116.840]
26.443 [-372.928]
0 [-862.696]
Status: Stabilized
Analysis: 3D
Wind Speed: 44.000 (m/s)
Length: 0.461 (m)
Width: 0.305 (m)
Height: 0.141 (m)
Voxel size: 0.002 (m)
OK
Cancel
Average drag coefficient: 0.31
0.32
0.31
Drag coeff.
0.713
0.672
Drag force (N)
00:00:00.01
Time (s)
00:00:00.02

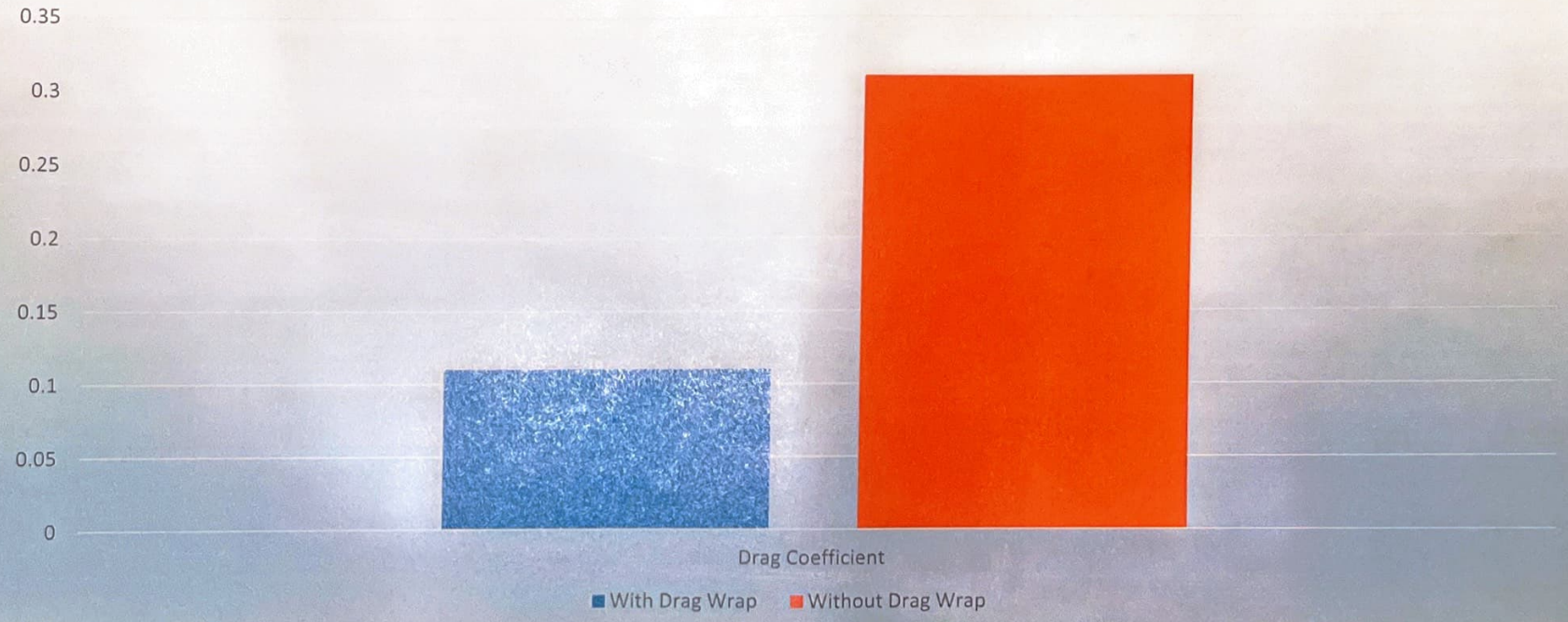
Drag Coefficient without film is .31 Cd


Velocity (m/s) [Pressure (Pa)]
51.297 [1032.531]
44.424 [592.878]
36.272 [153.224]
25.648 [-286.429]
0 [-726.083]
FRONT
Status: Stabilized
Analysis: 3D
Wind Speed:
Length:
Width:
Height: 0.139 (m)
Voxel size: 0.002 (m)
OK
Cancel
Average drag coefficient: 0.11
0.11
0.10
0.248
0.228
Drag coeff.
Drag force (N)

Drag Coefficient with film is .11 Cd



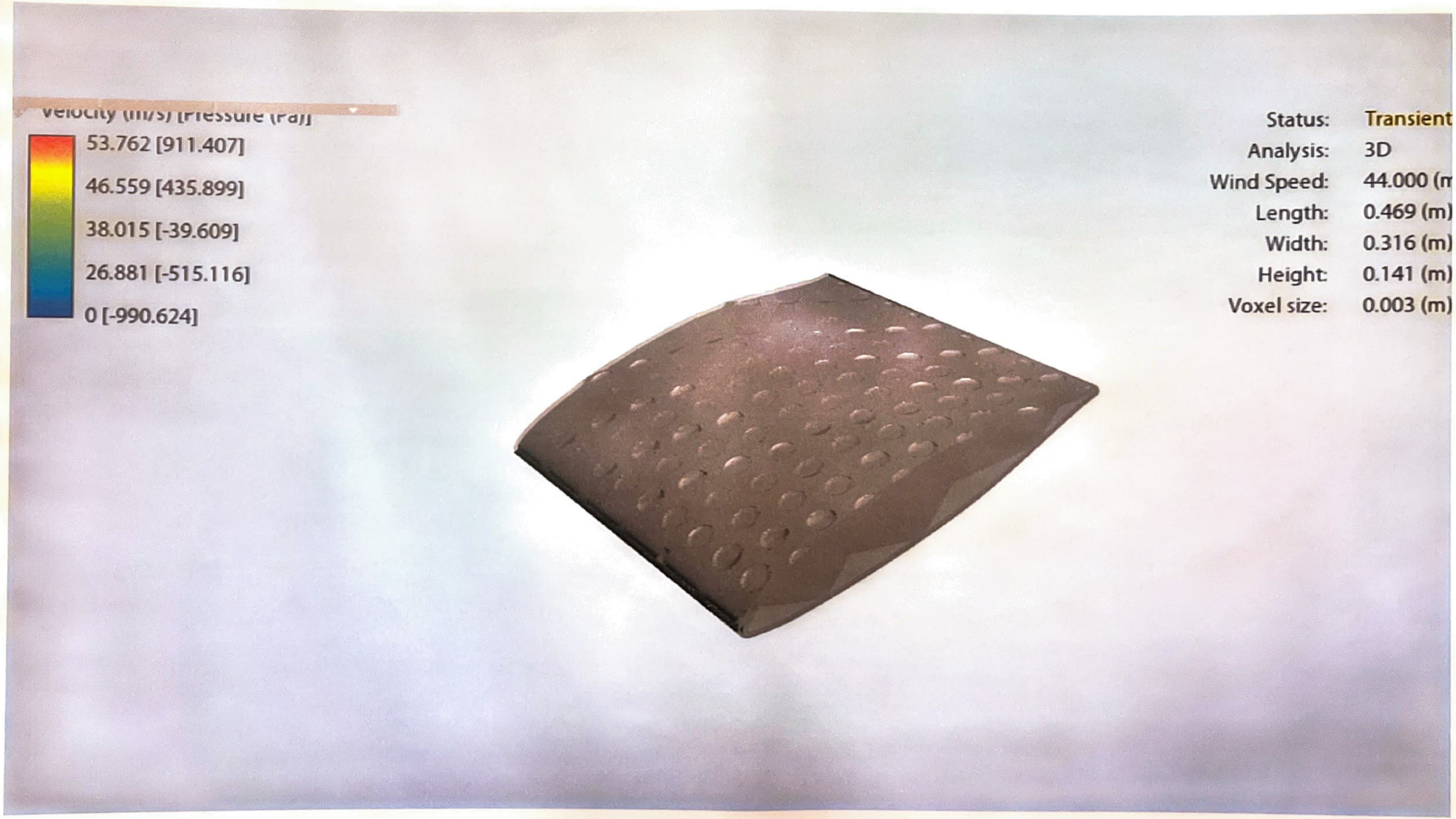
Drag Comparison



So what is the big deal about Drag Wrap?

- Drag Wrap reduces drag by ~~25-55%~~ 35%
- Requires no modification of the wing structure
- Can be removed easily if needed but remains secure over high speeds
- Transparent and stylish
- Protects existing paint job at high pressure areas
- Can be OEM or applied to existing vehicles

Weight?


Velocity (m/s) [Pressure (Pa)]
53.762 [911.407]
46.559 [435.899]
38.015 [-39.609]
26.881 [-515.116]
0 [-990.624]
Status: Transient
Analysis: 3D
Wind Speed: 44.000 (m
Length: 0.469 (m)
Width: 0.316 (m)
Height: 0.141 (m)
Voxel size: 0.003 (m)

Money is needed to produce Drag Wrap

As all new inventions require, Drag Wrap needs money to pay for legal counsel, government regulation adherence, engineers, research and development, prototypes, test pilots, marketing, manufacturing agreements and administration.

2014-2015 Budget

- Manufacture: $523
- Materials: $100
- Labor: $160
- Legal Costs: $654
- Engineering: $859

2016-2017 Budget

- Manufacture: $460,000
- Materials: $80,000
- Labor: $120,000
- Legal: $560,000
- Engineering: $740,000

Cost to install on Boeing 737 series aircraft

- Upper surface area of wings: 975.5 sq ft 140,472 sq in
- Tile size: ~~3 sq ft~~ $36 in^2$
- Tile cost per: $22
- Total required tiles: ~~325~~ 3902
- Total cost for tiles: ~~$7,154~~ 85,844
- Total cost for installation: $35,000
- Total fuel savings of United Airline's 737, 757 and 767 fleet: $1.1 B

How much money will Drag Wrap make?

Average fuel cost savings per year with scimitar winglet installed

######## ######## Fleet savings per year @350 737,757, 767

Cost of installing Split Scimitar winglet

$575,000 ######## Fleet Outfit Cost

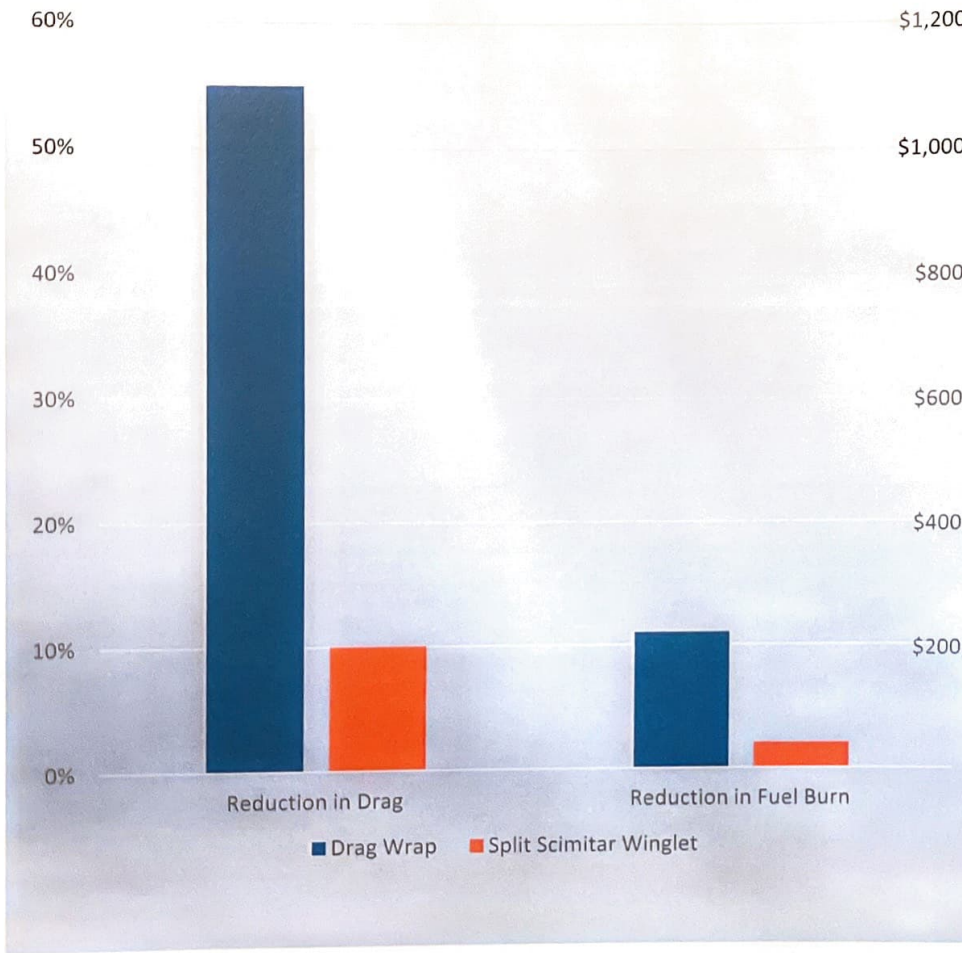
Average fuel cost savings per year with Drag Wrap

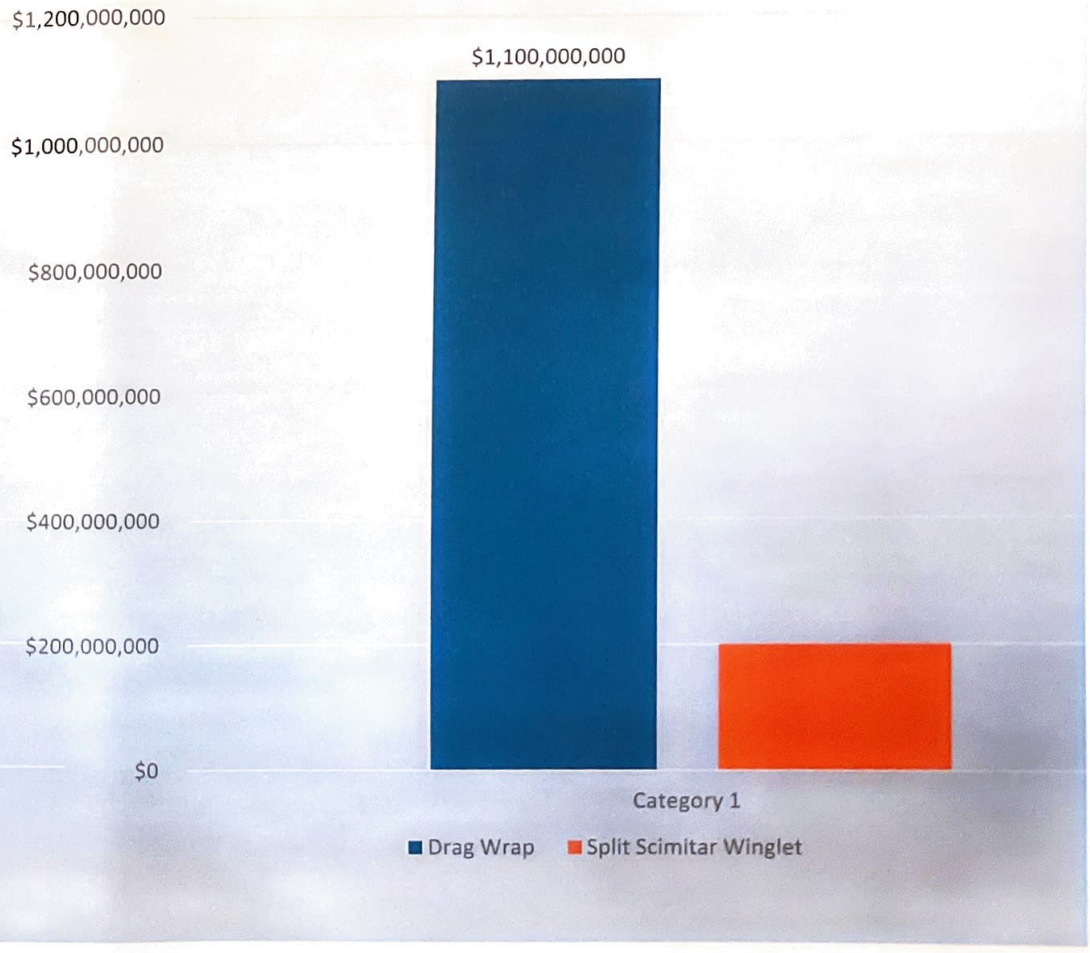
######## ######## Fleet savings per year @350 737,757,767

Cost of installing Drag Wrap

$35,000-$500,000 ######## ######## Fleet Outfit Cost

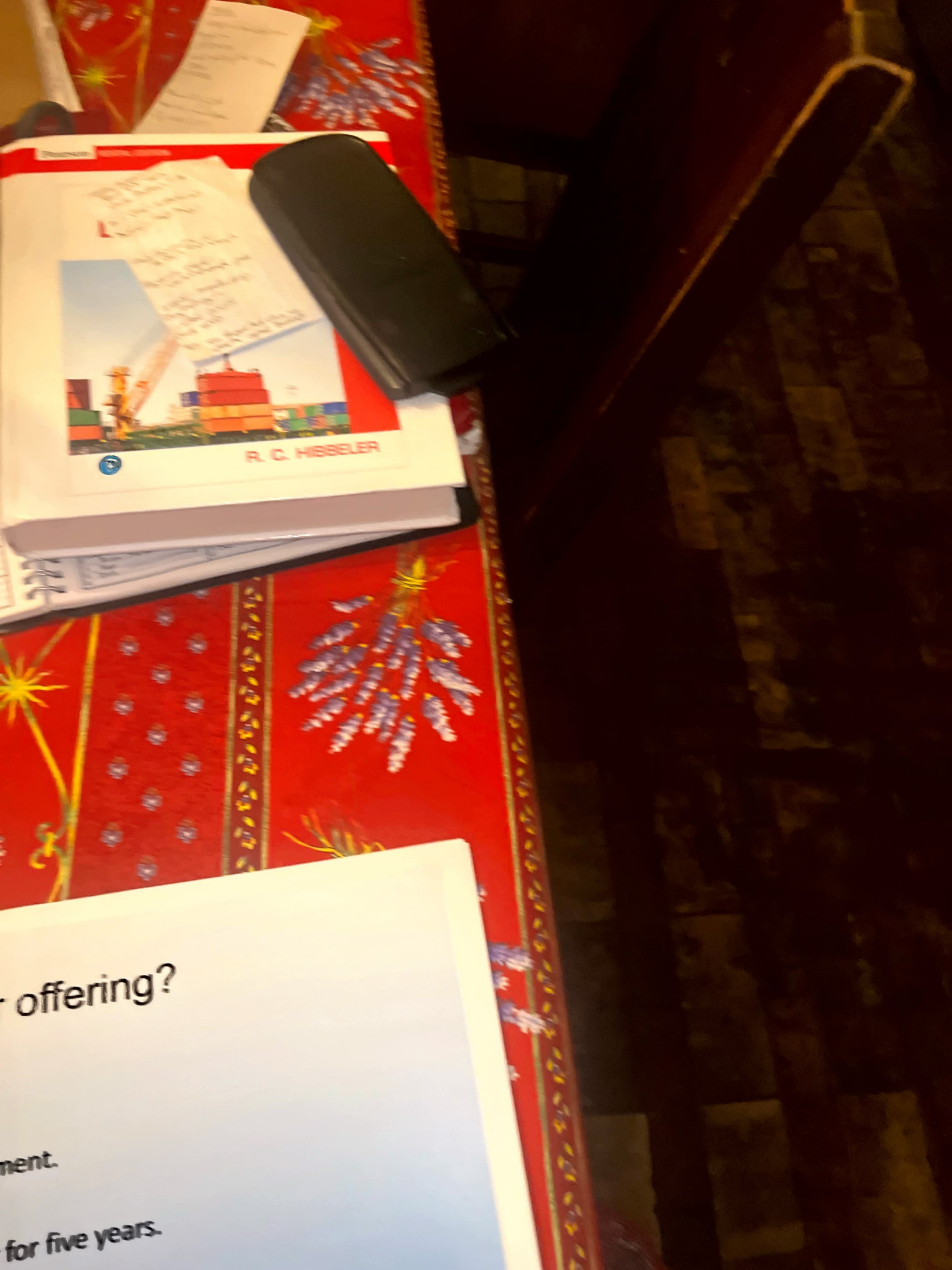
	LO	HI	LO	HI
	Per Aircraft		Per Fleet	350 ct
Price	36582	522600	12803700	1.83E+08
Net Profit	1500	22600	553700	7910000
Royalty	150	2260	55370	791000
Remain	1350	20340	498330	7119000


60%
50%
40%
30%
20%
10%
0%
Reduction in Drag
Reduction in Fuel Burn
Drag Wrap
Split Scimitar Winglet

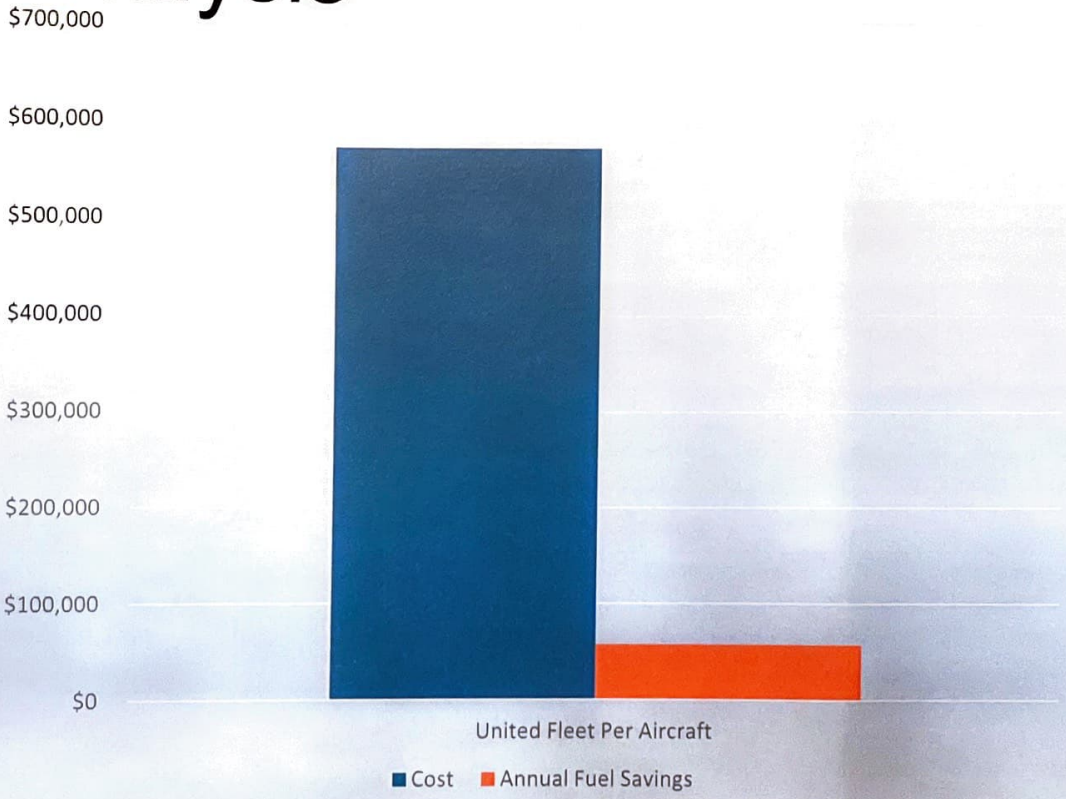

$1,200,000,000
$1,000,000,000
$800,000,000
$600,000,000
$400,000,000
$200,000,000
$0
$1,100,000,000
Category 1
Drag Wrap
Split Scimitar Winglet

Who will buy Drag Wrap?

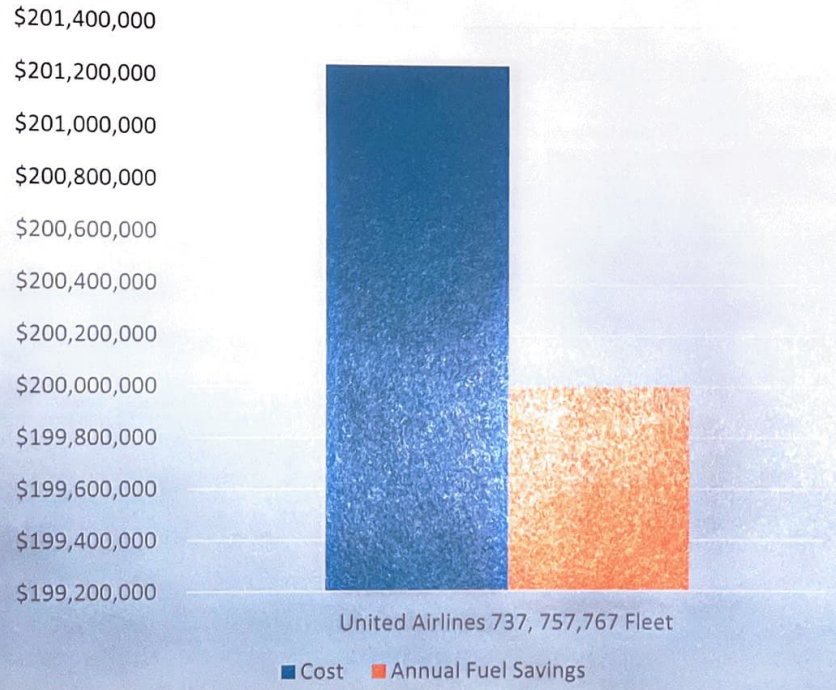
- United Airlines
- Aviation Partners Boeing
- BMW
- United Parcel Service
- Tesla Motor Company
- The United States military


R. C. HIBBELER
offering?
ment.
for five years.

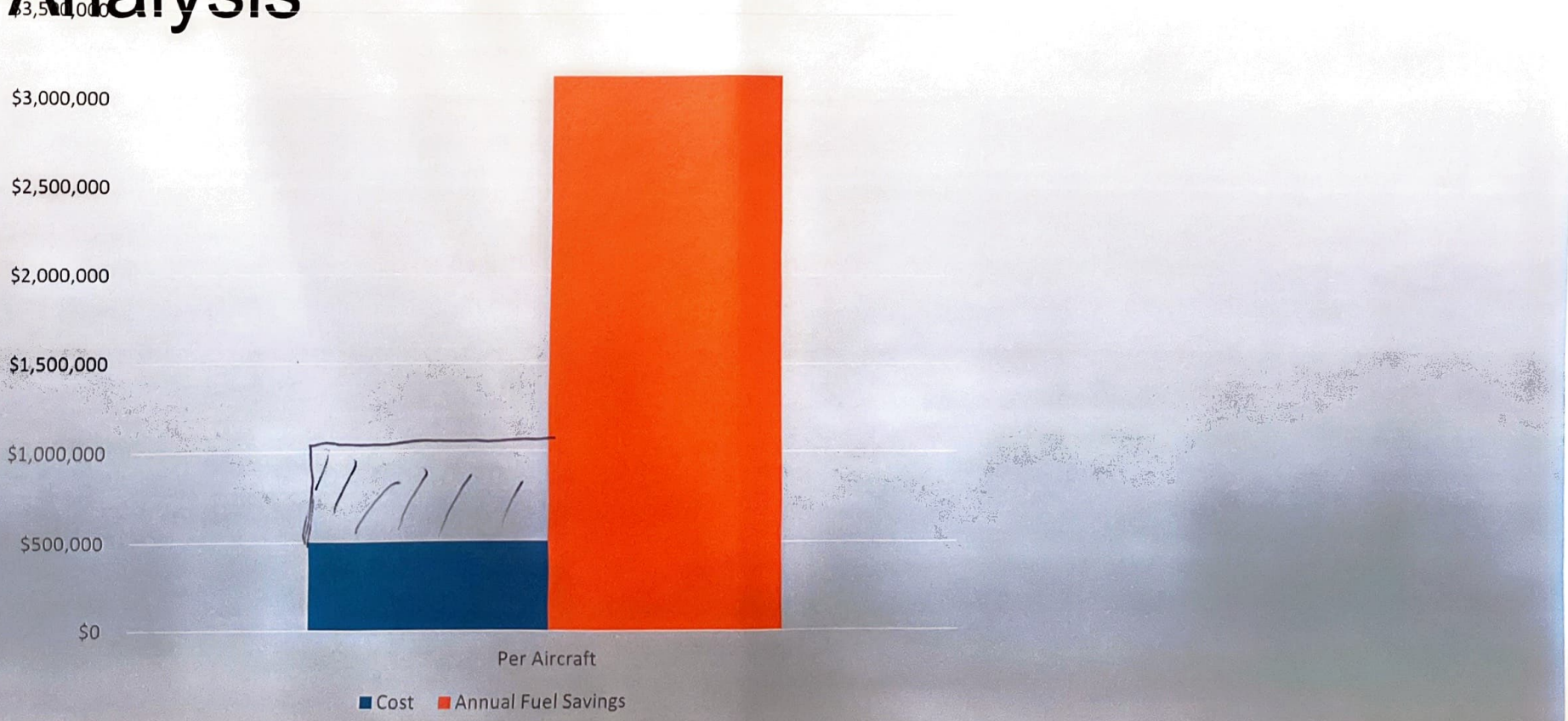
Split Scimitar Equipped Per Aircraft Analysis



Split Scimitar Fleet Expense Analysis



Drag Wrap Equipped Per Aircraft Analysis



Drag Wrap Equipped Fleet Analysis