Senior Design Team 519: Secure Fit Football Undershirt

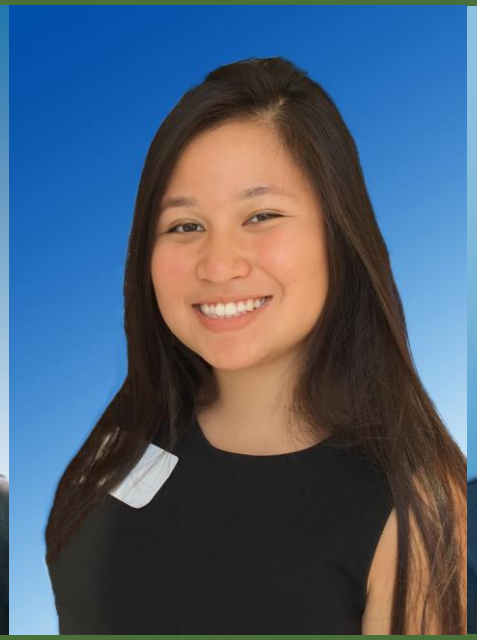
Paul Cunningham, Vivi Huynh, Sawyer O'Bryan,
Nicholas Palestrini, Morgan Sefcik

Morgan Sefcik

Team Introduction

Morgan Sefcik
Project Manager and Design Engineer

Paul Cunningham
Design and Materials Engineer



Vivi Huynh
Design and Manufacturing Engineer

Sawyer O'Bryan
Design and Materials Engineer

Nicholas Palestrini
Product Development and Data Engineer

Morgan Sefcik

Sponsor and Advisor

Sponsor
Mike Holloway
Survivor 30th Season Winner

Academic Advisor
Christian Hubicki, Ph.D.
Assistant Professor

Morgan Sefcik

Project Objective

The objective of this project is to reduce injuries of football players through the improvement of shoulder pads.

Key Goals

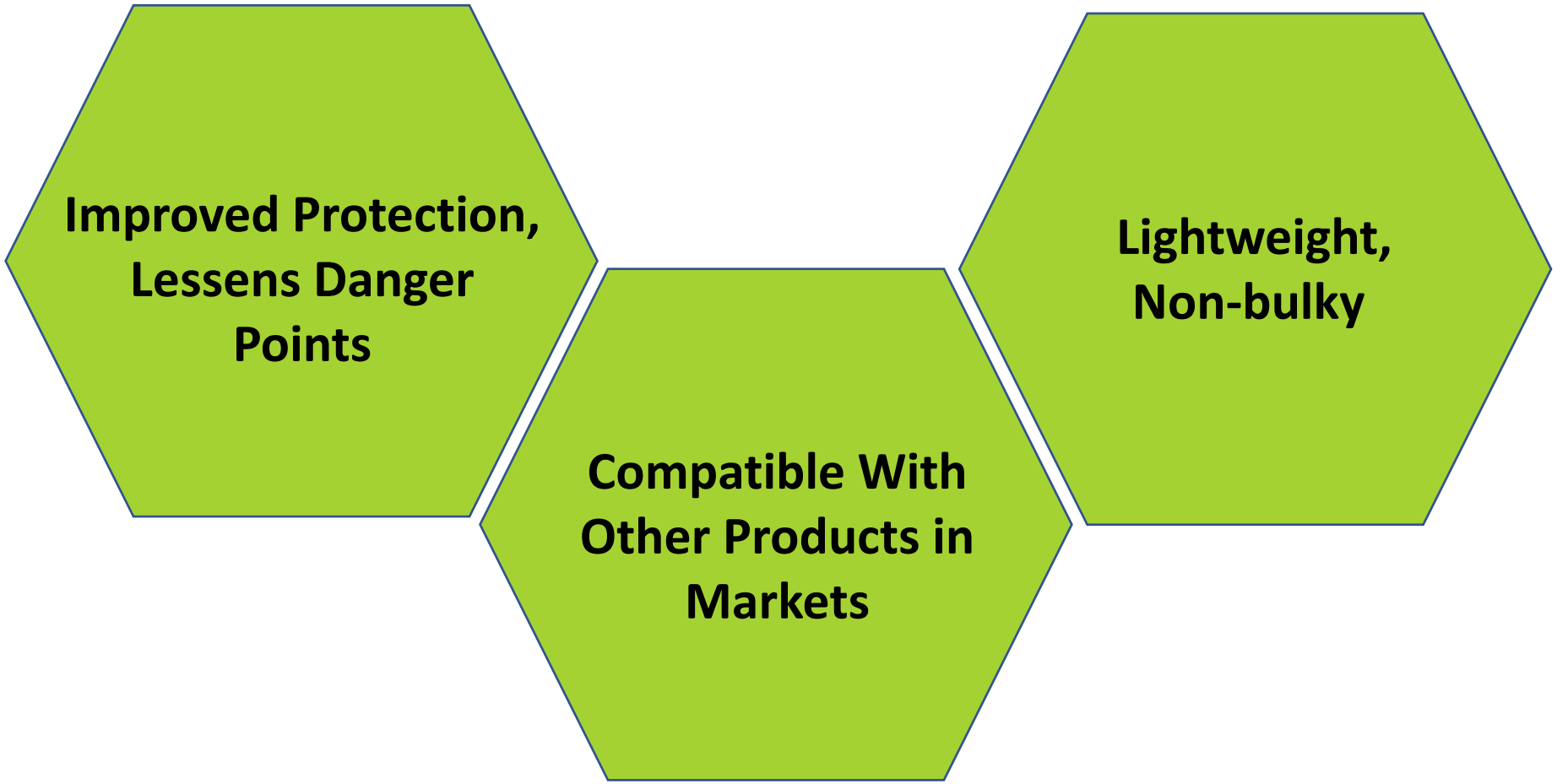
Optimal Fit

Lifespan and Durability

Prevent Restrictions of Movement

Morgan Sefcik

Fundamental Needs



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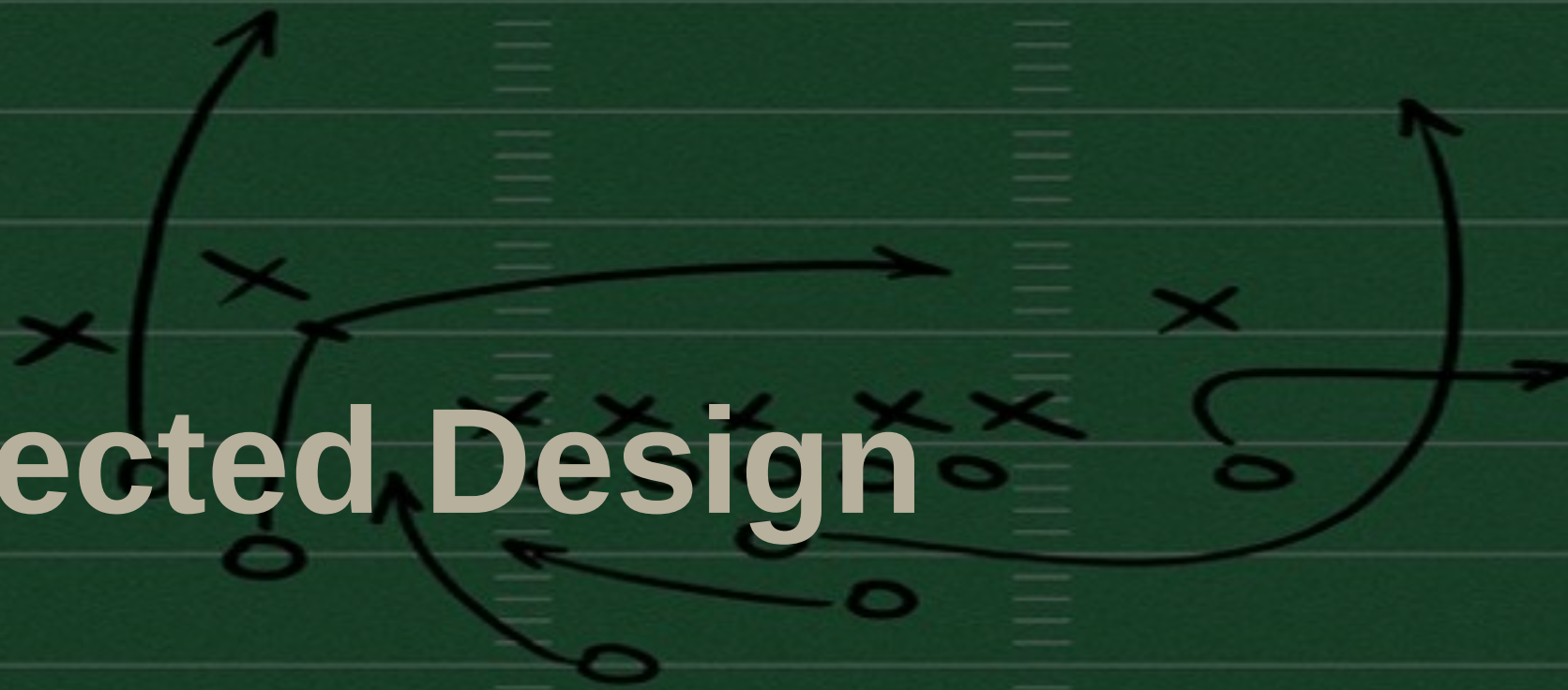
Selected Design



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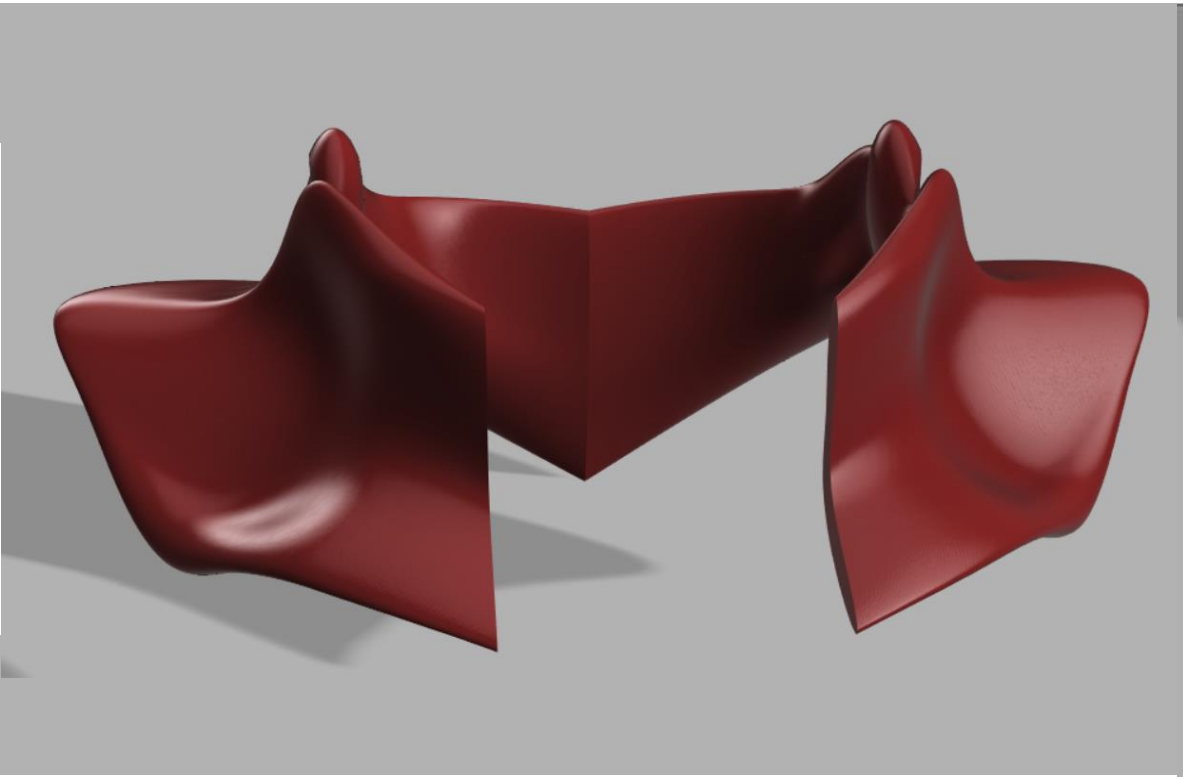
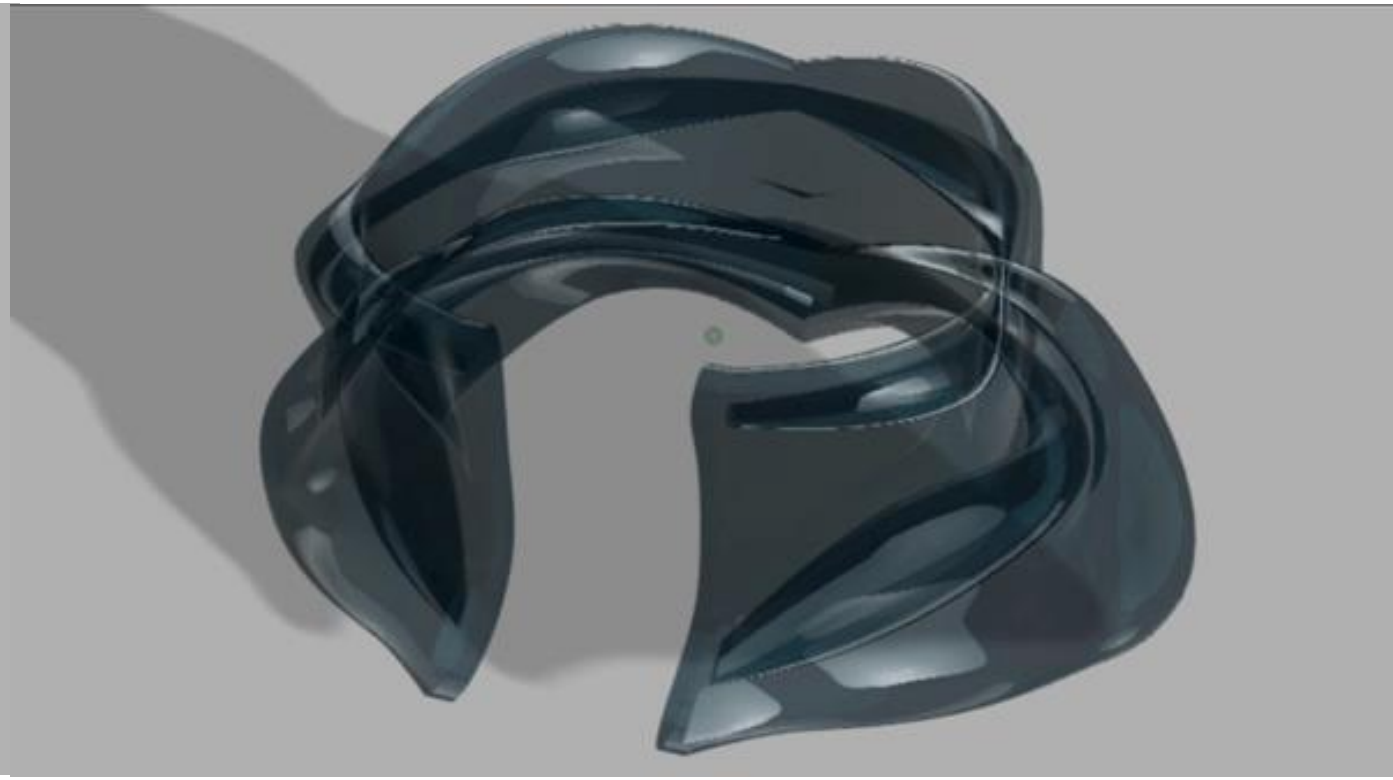
Undershirt Design

Morgan Sefcik

Collar Designs





Morgan Sefcik

Methods of Validation: Undershirt

Sawyer O'Bryan

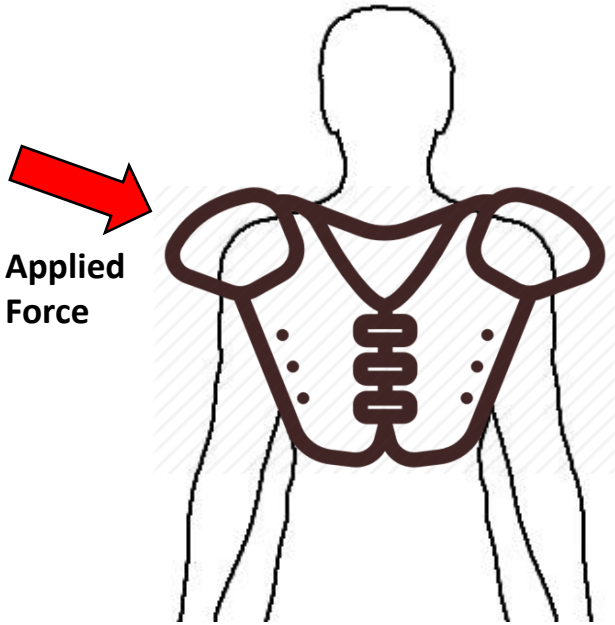
Fit Optimization: Shoulder Mold

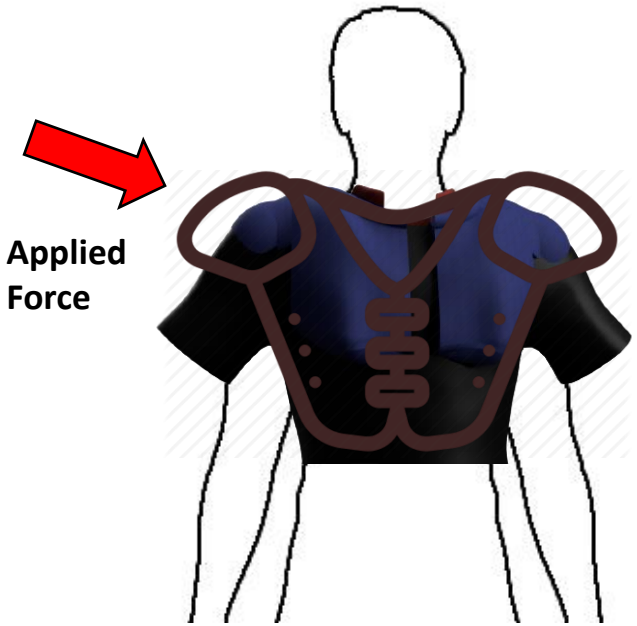
Measurement: Dimensions (m) and Volume (m^3) of mold

Sawyer O'Bryan

Slip Test

Measurement: Displacement (m)

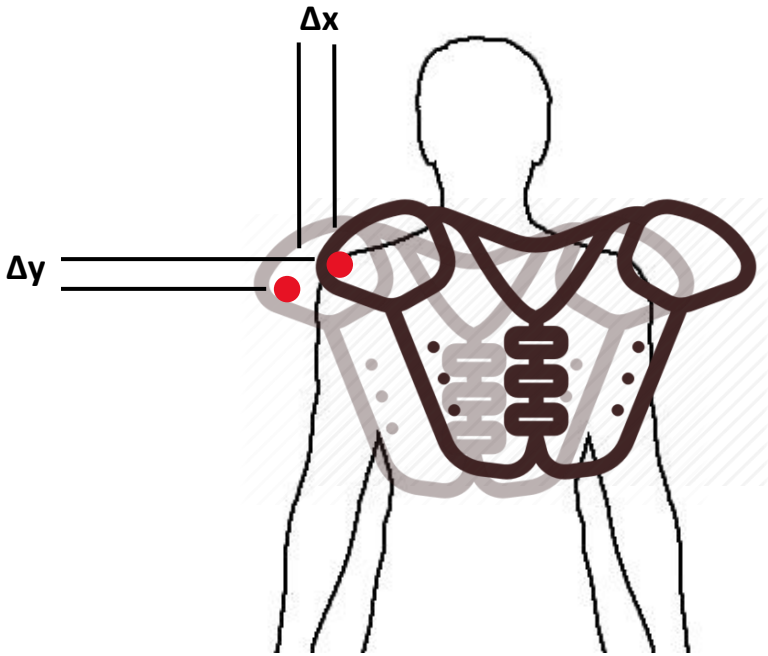


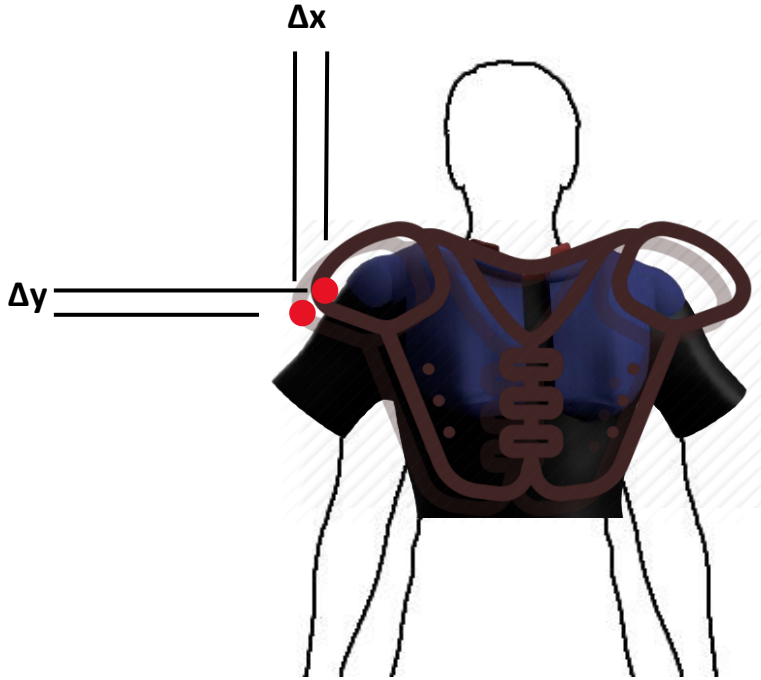


Sawyer O'Bryan

Slip Test

Measurement: Displacement (m)

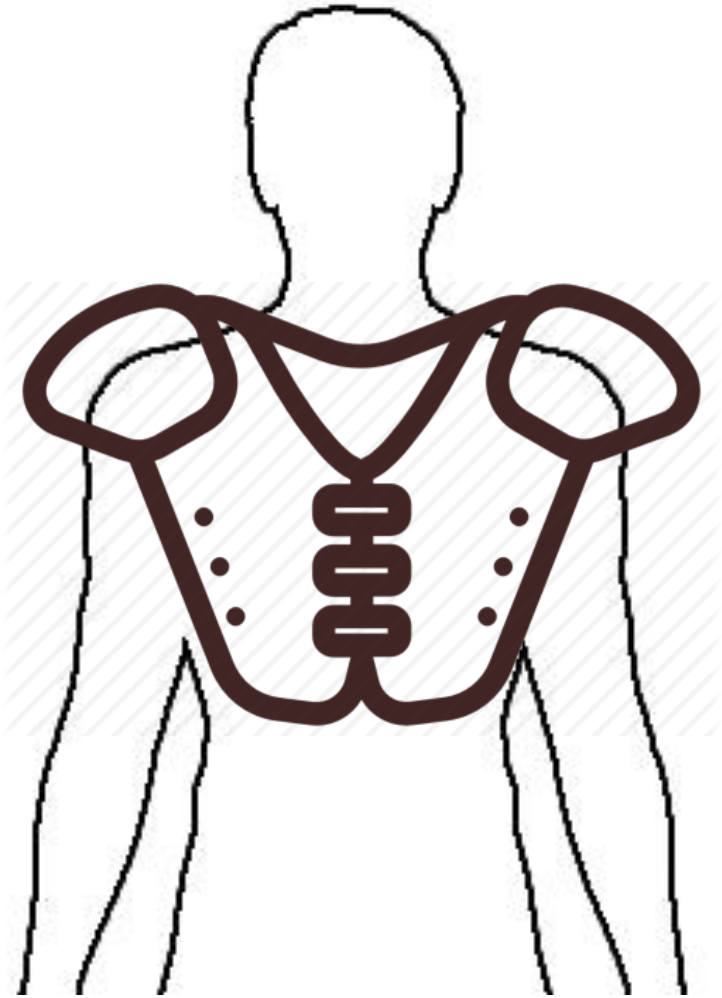


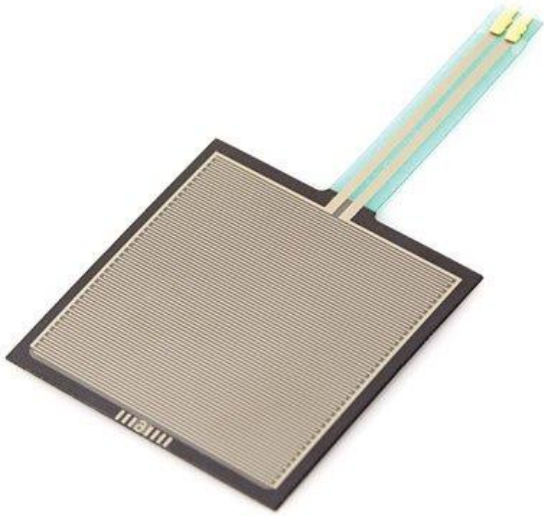


Sawyer O'Bryan

Impact Test

Measurement: Force (N)



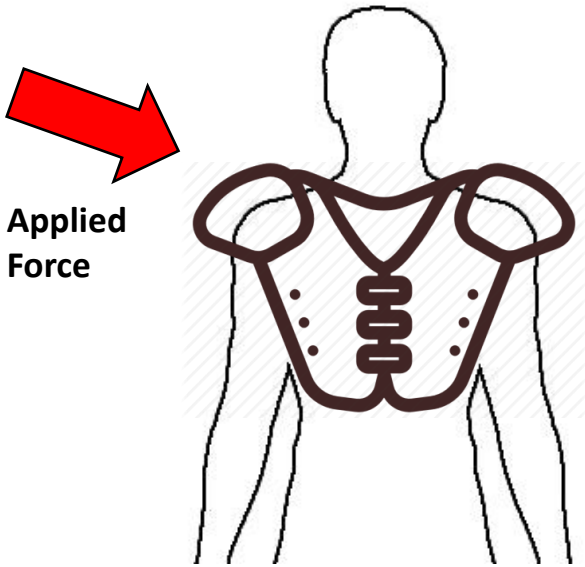


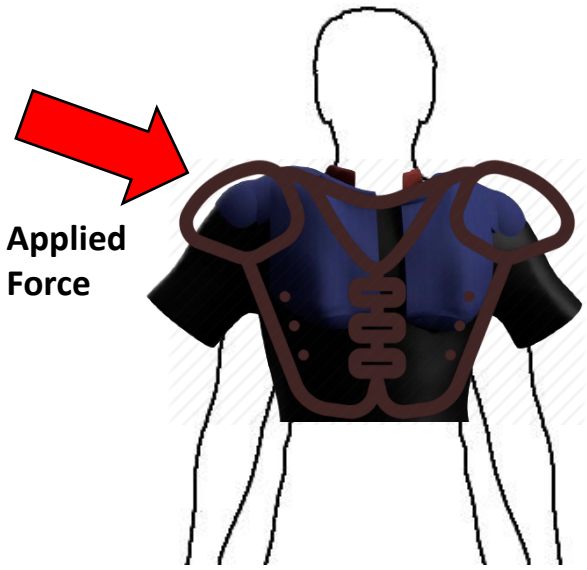
Force Sensor

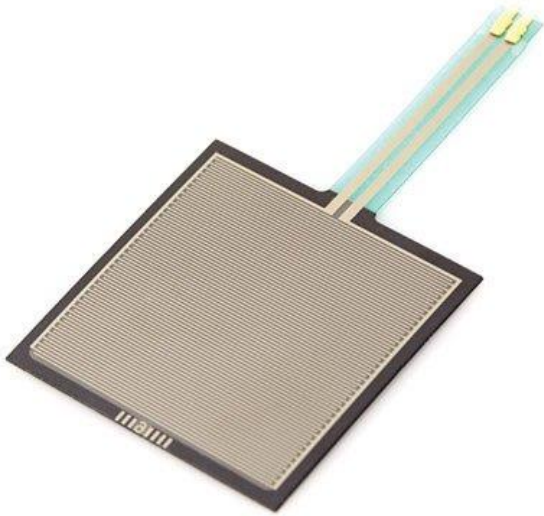
Sawyer O'Bryan

Impact Test

Measurement: Force (N)







Force Sensor

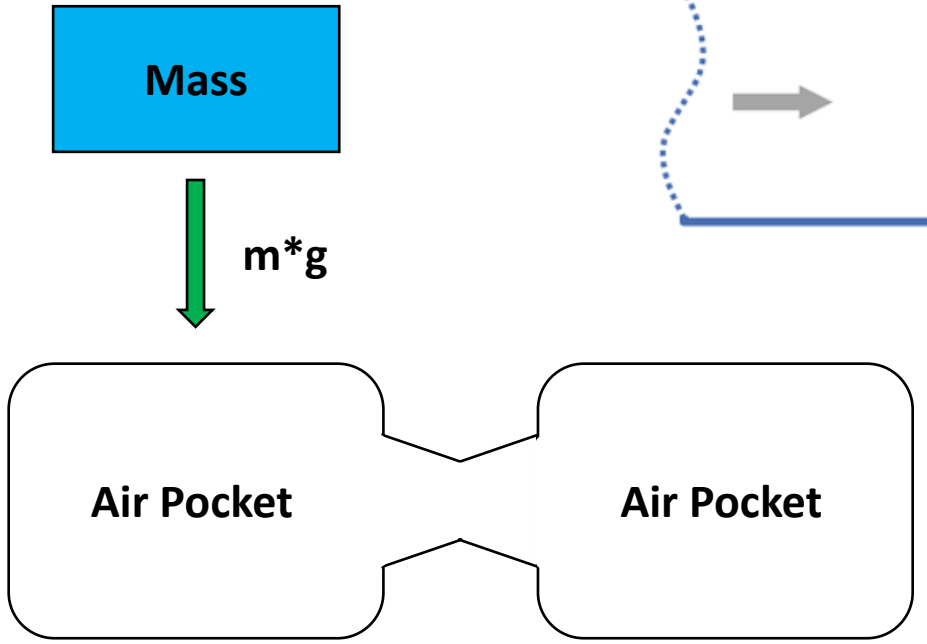
Sawyer O'Bryan

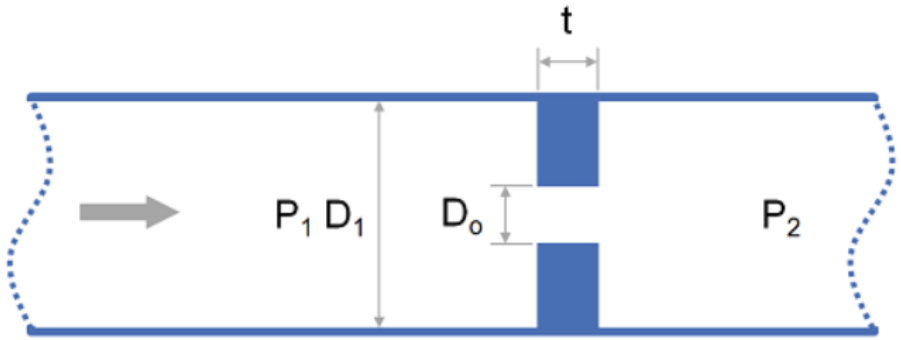
Methods of Validation: Air Pockets

Nicholas Palestrini

Air Damping: Drop Test

Measurement: Amplitude of Oscillations, time to return to equilibrium (s)





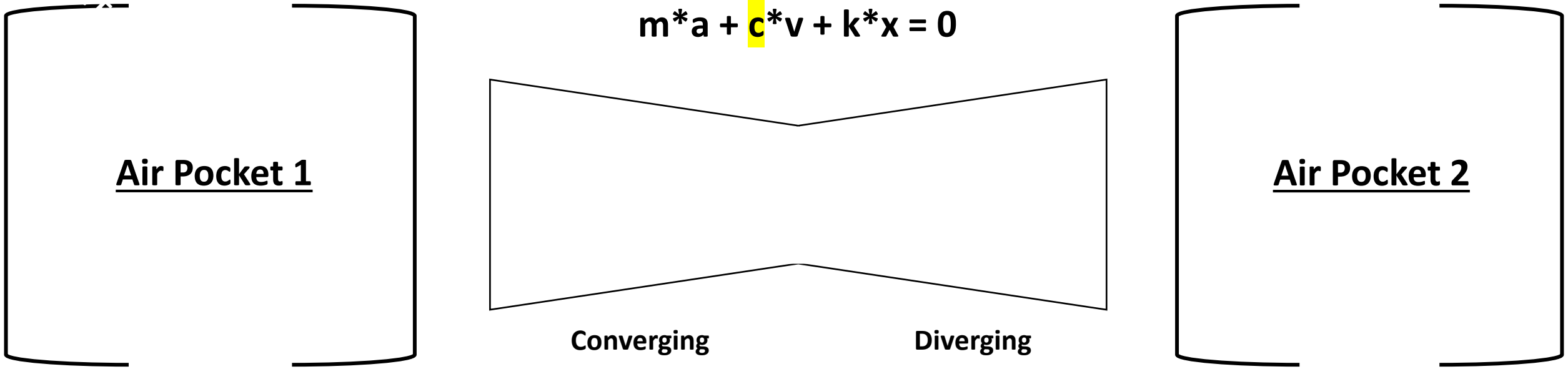
Nicholas Palestrini

Air Damping: Nozzle Model Problem

Measurement: Velocity (m/s)

Motion Equation

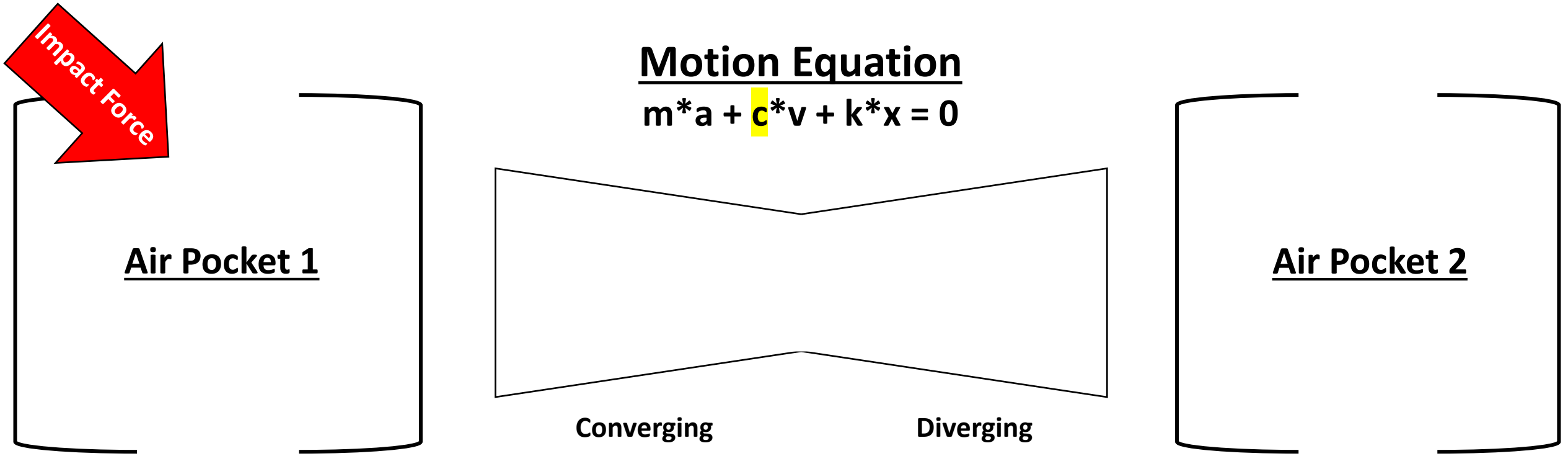
$$m*a + c*v + k*x = 0$$



Nicholas Palestrini

Air Damping: Nozzle Model Problem

Measurement: Velocity (m/s)



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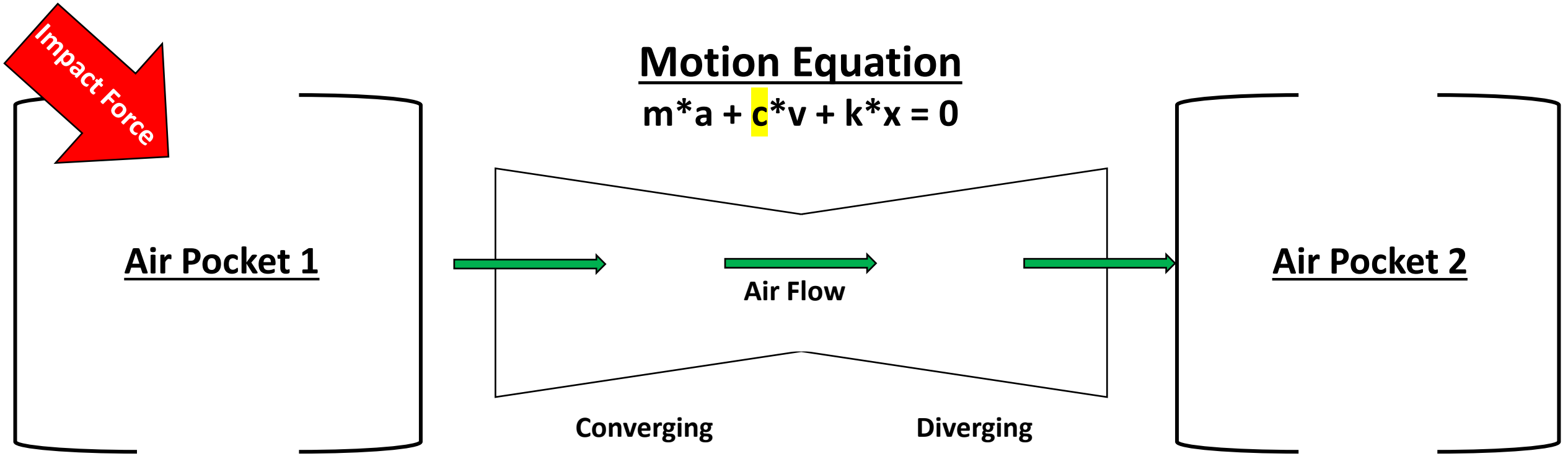

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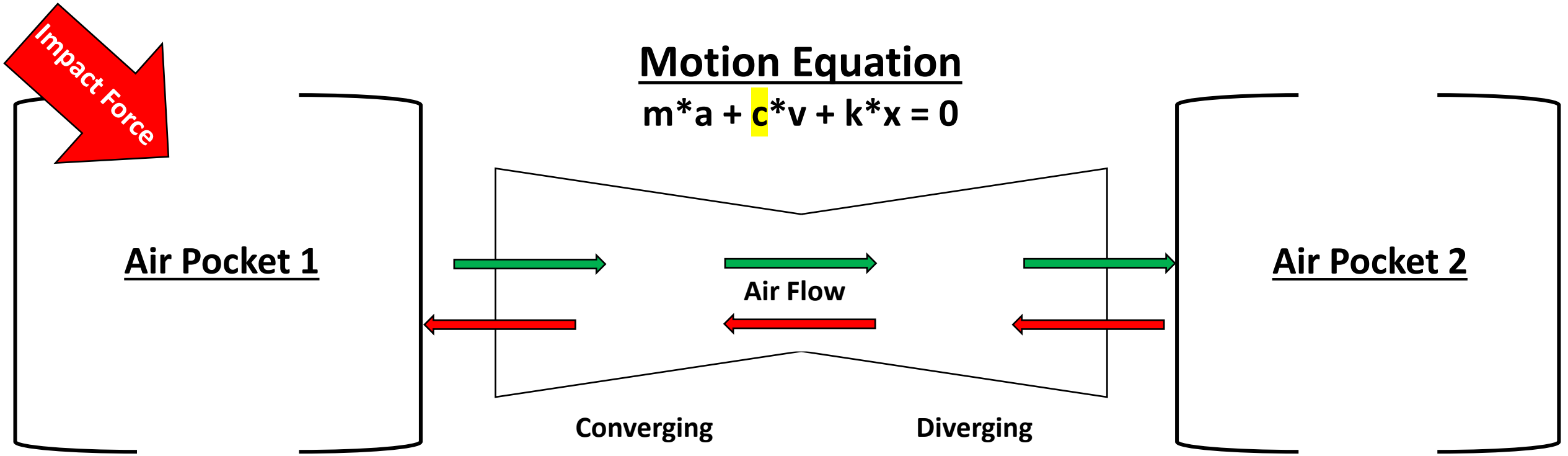
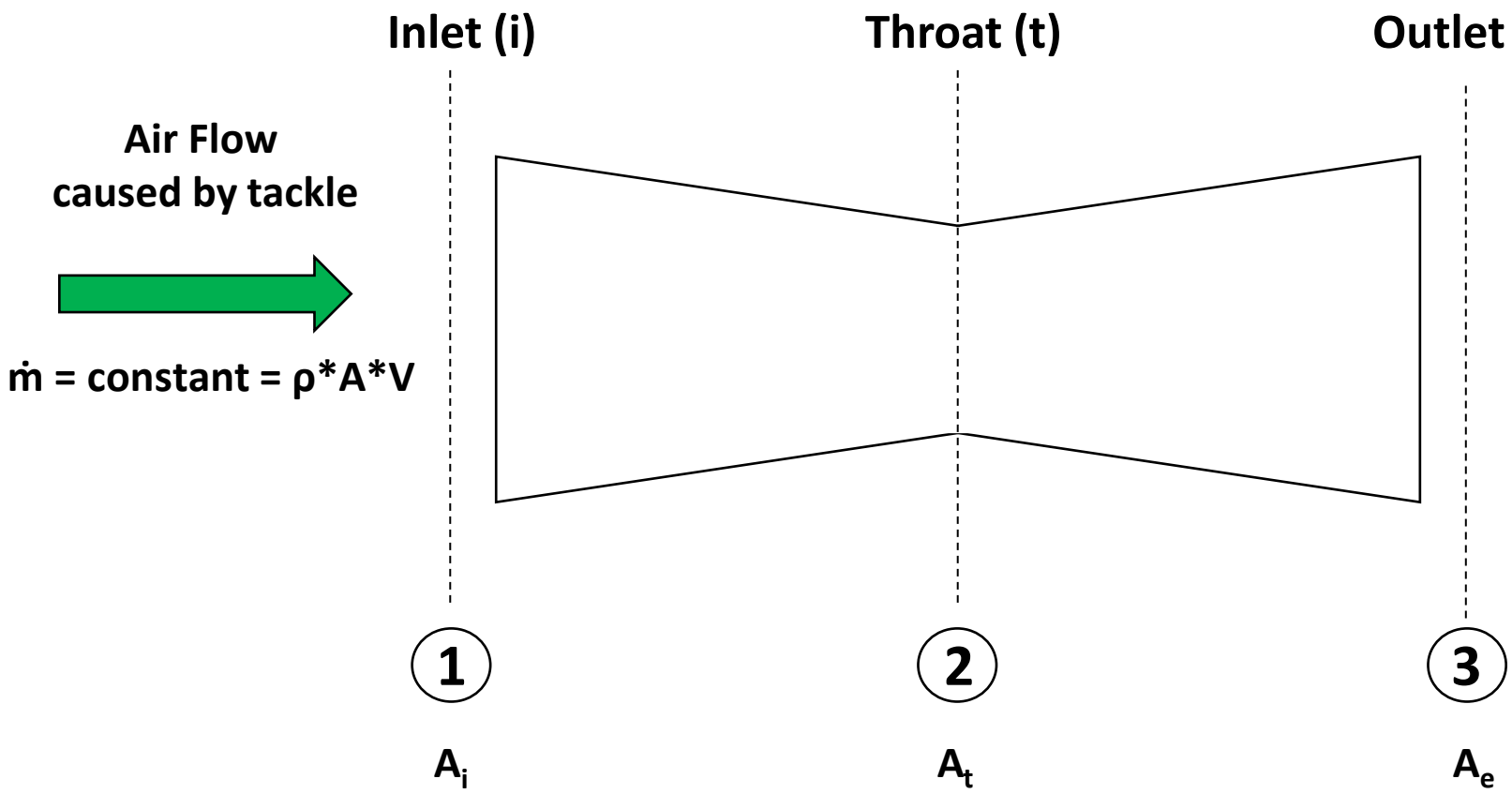
Measurement: Velocity (m/s)



Nicholas Palestrini

Air Damping: Nozzle Model Problem



Nicholas Palestrini

References

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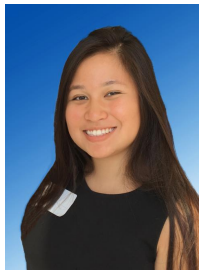

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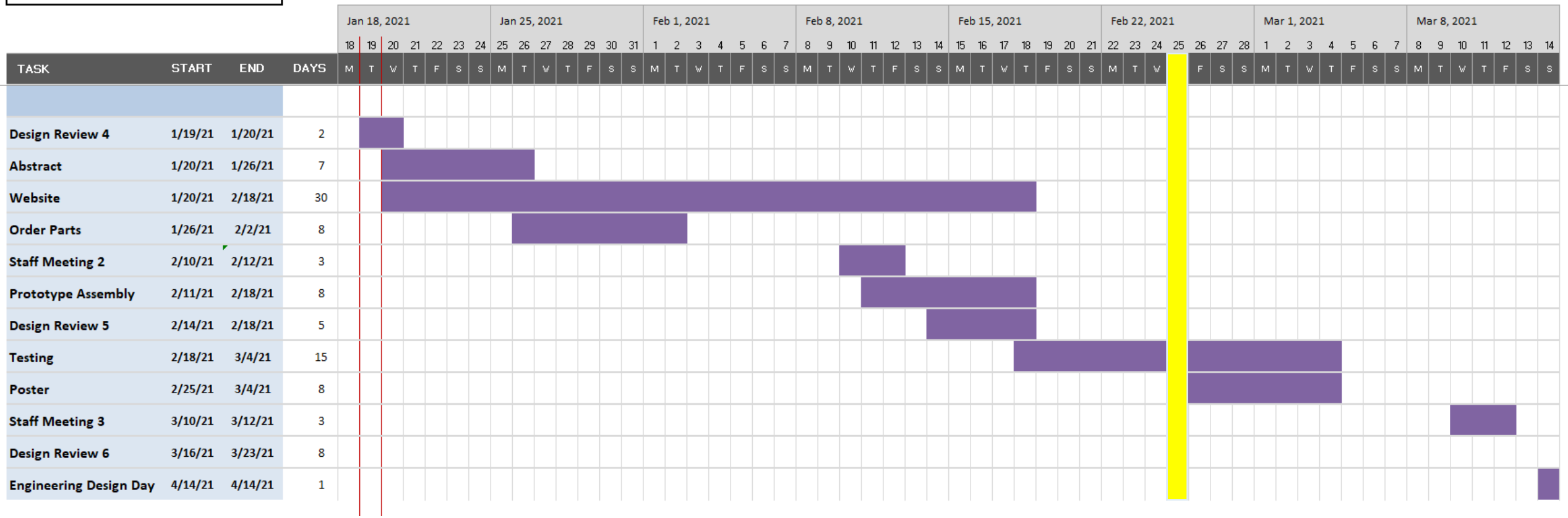
Nicholas Palestrini

Secure Fit Football Undershirt

GANTT CHART

Start Date Tue, 1/19/2021



TASK	START	END	DAYS
Design Review 4	1/19/21	1/20/21	2
Abstract	1/20/21	1/26/21	7
Website	1/20/21	2/18/21	30
Order Parts	1/26/21	2/2/21	8
Staff Meeting 2	2/10/21	2/12/21	3
Prototype Assembly	2/11/21	2/18/21	8
Design Review 5	2/14/21	2/18/21	5
Testing	2/18/21	3/4/21	15
Poster	2/25/21	3/4/21	8
Staff Meeting 3	3/10/21	3/12/21	3
Design Review 6	3/16/21	3/23/21	8
Engineering Design Day	4/14/21	4/14/21	1

Nicholas Palestrini

Consistency Check		
{Ws}	{W}	Cons
3.78	0.502	7.54
1.19	0.168	7.09
0.67	0.104	6.45
0.91	0.143	6.40
0.25	0.041	6.18
0.27	0.043	6.35
Average (λ)		6.67

Consistency Comparison	
λ - n	0.67
n - 1	5
Consistency index	0.133
RI Value	1.35
Consistency Ratio	0.099