Virtual Design Review 1

Flight Simulator Egress System

Marco Karay
Daniel Swope
Andrew Filiault

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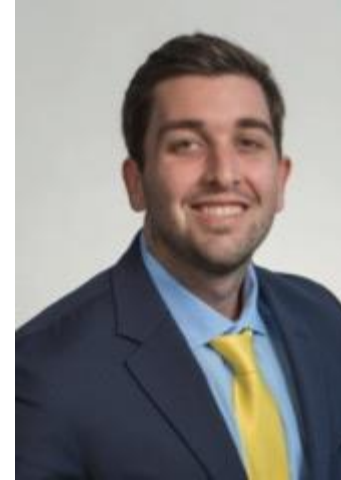
Introduction

| **Team Leader** | **Design Engineer** | **Research Engineer** | **Financial Advisor** | **Historian** |
| Frank Cullen | Andrew Filiault | Andrew Porter | Daniel Swope | Marco Karay |

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Project Background

➢ Sponsor: Lockheed Martin

➢ The purpose of this project is to support pilot training through the design of a system to improve the way pilots get in and out of F-16 cockpit simulators.

Figure 1: A Lockheed Martin F-16 in flight. (Lockheed Martin, n.d)

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Project Summary

➢Design a modular system that allows training seat to move in and out of cockpit dome

➢Research best method of movement and operation

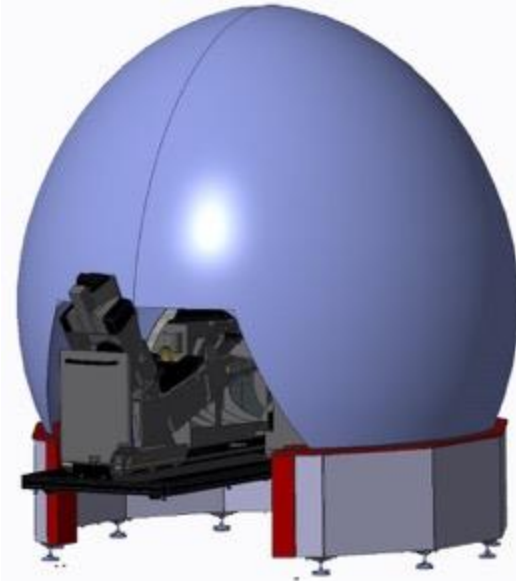➢Perform FEA analysis on structural components and initial prototyping

Figure 2: Existing cockpit dome design.

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Background Research

➢ Investigate best method of motion

➢ Investigate best method of operation

➢ Must conform to military standards

  ▪ Mil Spec 1472 (Human Engineering)

Arm Strength in Newtons (pounds of force)													
(1)	(2)		(3)		(4)		(5)		(6)		(7)	
Degree of shoulder flexion/extension	Pull		Push		Up		Down		Out		In	
	L	R	L	R	L	R	L	R	L	R	L	R
90 deg (flexion)	222 (50)	231 (52)	187 (42)	222 (50)	40 (9.0)	62 (14)	58 (13)	76 (17)	36 (8.0)	62 (14)	58 (13)	89 (20)

Figure 3: MIL Spec 1472 standard arm strength values for degrees of flexion. (U.S. DoD, 2012)

Project Scope

➢ Increase ease of use of F-16 flight simulator

➢ Decrease risk of damage to cockpit

➢ Create a system that will be easily implemented into current flight simulators

Figure 4: Example of a dome style cockpit simulator. (DePietro, 2011)

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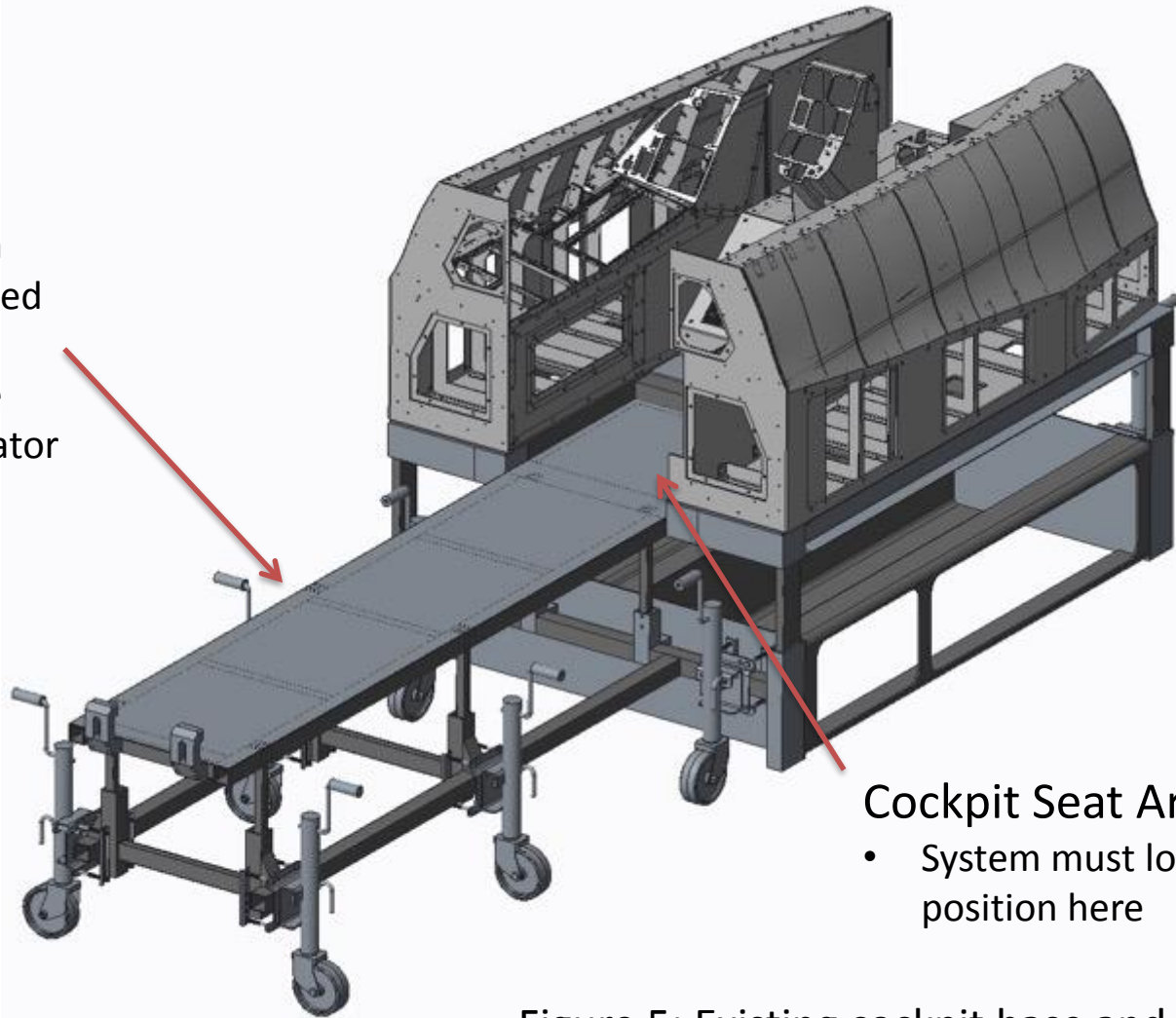MECHANICAL ENGINEERING

Customer Needs

➤ Design a track system that can mount to the gurney

➤ Seat must move fully in and out of simulator dome

➤ Allow for ingress and egress of 95th percentile male

Customer Needs (cont'd)

Gurney
- Egress system will be mounted on gurney
- Locks into the cockpit simulator
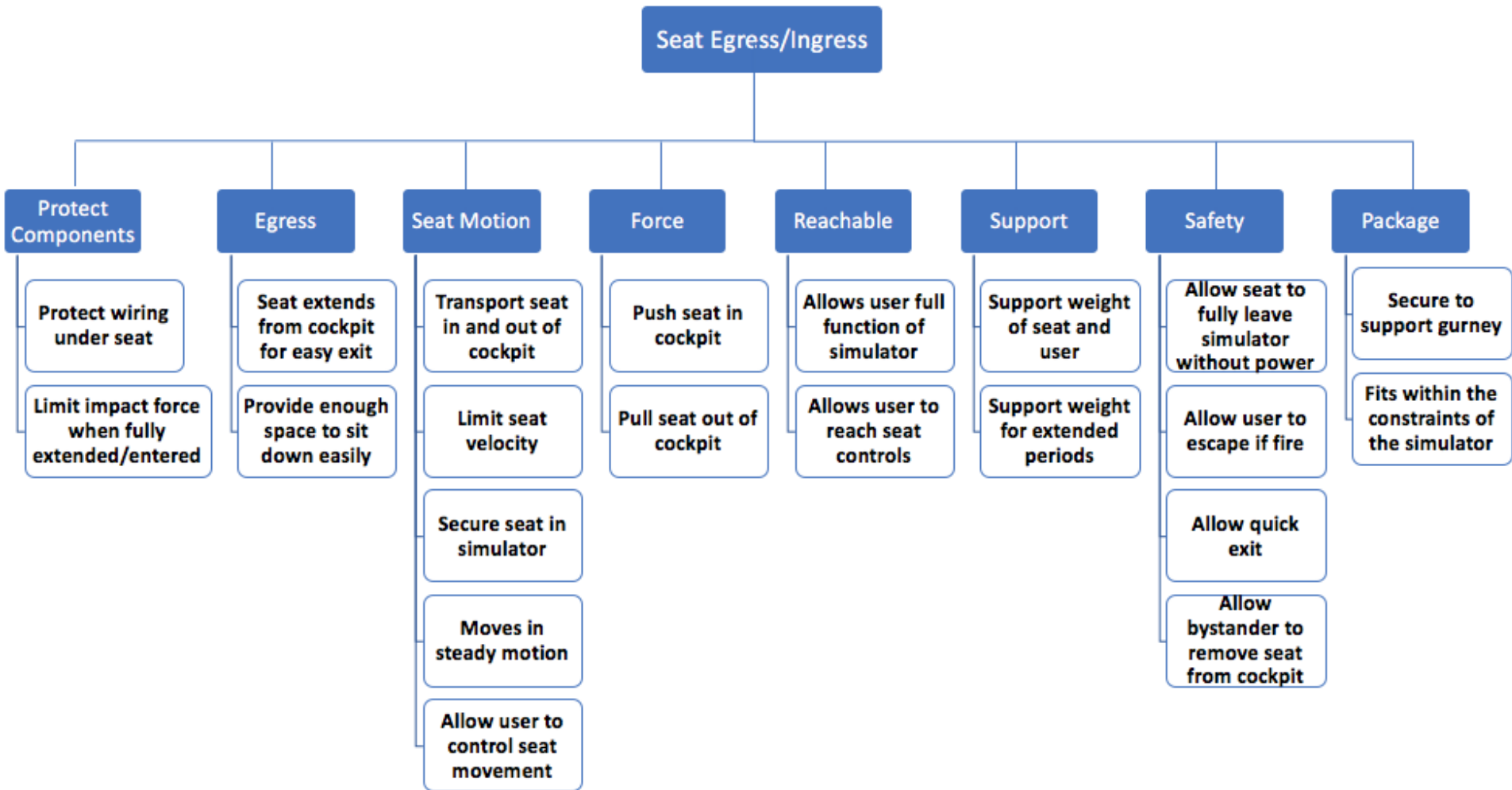
Cockpit Seat Area
- System must lock seat position here

Figure 5: Existing cockpit base and gurney system.

Functional Decomposition

Functional Decomposition (cont'd)

➤ Move seat inside and outside of cockpit dome

➤ Allow variety of cockpit occupants

➤ Attach to existing cockpit components

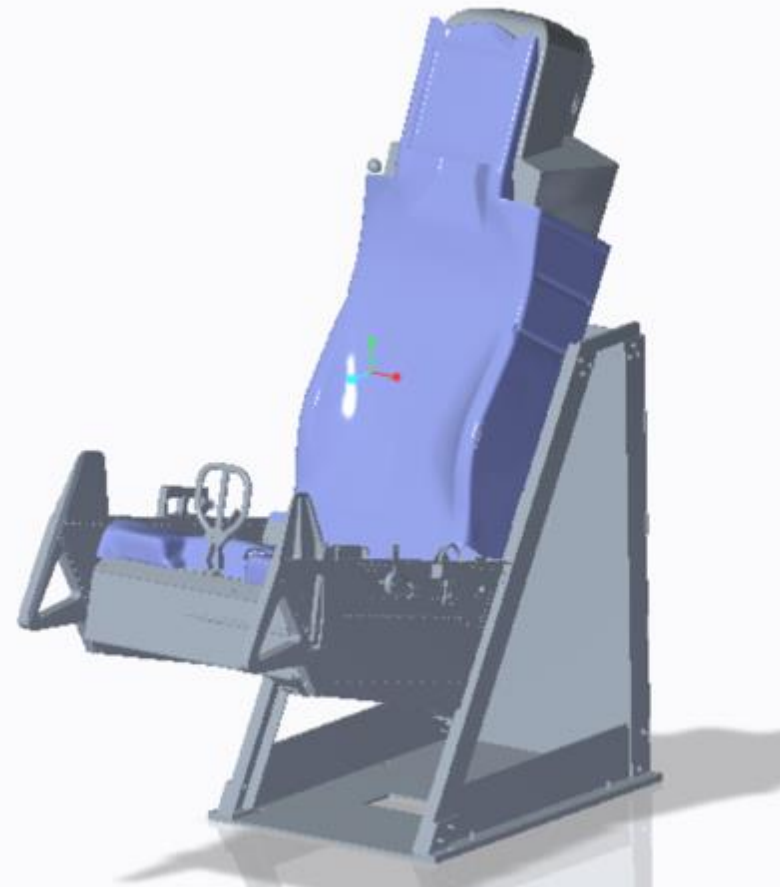➤ Operate in emergency situations

  ▪ Fire

  ▪ Loss of power

Figure 6: Current cockpit seat system.

Gantt Chart

	Major Tasks	Project Completed By: May 01, 2018										
		Oct 1st	Oct 15th	Nov 1st	Nov 15th	Dec 1st	Dec 15th	Jan 15th	Feb 1st	Feb 15th	Mar 1st	Mar 15th
1	Get design requirements from sponsor	■										
2	Define working paramenters		▣									
3	Evaluate current egress system	■										
4	Research existing systems	■	▣									
5	Determine mode of motion for cockpit seat	▣	▣									
6	Research user control mechanisms		☐	☐								
7	Design working CAD model of prototype			☐	☐							
8	Send CAD model to Lockheed				☐							
9	Revise CAD model				☐							
10	Cost analysis for bought parts vs. self made				☐							
11	Order parts and hardware					☐						
12	Analyze clearances between proposed design and existing base		☐									
13	Perform preliminary stress analysis for material thickness			☐								
14	Design initial prototype					☐	☐					
15	Proof of concept to Lockheed							☐				
16	Perform final stress analysis							☐	☐			
17	Revise and finalize design								☐	☐		
18	Produce functional design									☐	☐	☐
19	Validate design for integration											☐

Moving Forward

- ➢ Target Catalogue
- ➢ Target Summary
- ➢ Concept Generation
- ➢ Concept Selection
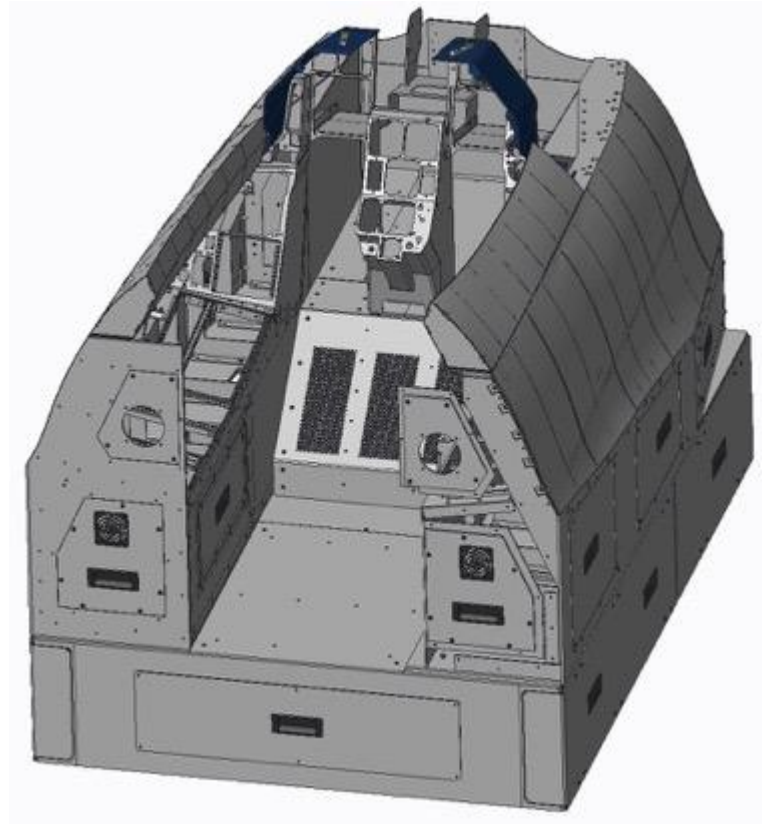- ➢ Simulator base mockup

Figure 7: Cockpit simulator base.

Acknowledgments

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➢ Thank you to Dr. Hollis for his expertise on our project

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