



Virtual Design Review 4

Flight Simulator Egress System

LOCKHEED MARTIN



FAMU-FSU COLLEGE OF ENGINEERING
MECHANICAL ENGINEERING

Introduction



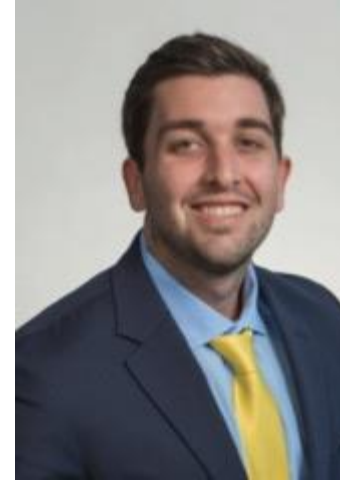
Team Leader
Frank Cullen



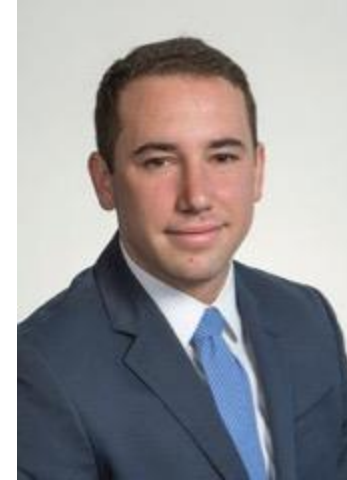
Design Engineer
Andrew Filiault



Research Engineer
Andrew Porter



Financial Advisor
Daniel Swope



Historian
Marco Karay

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.



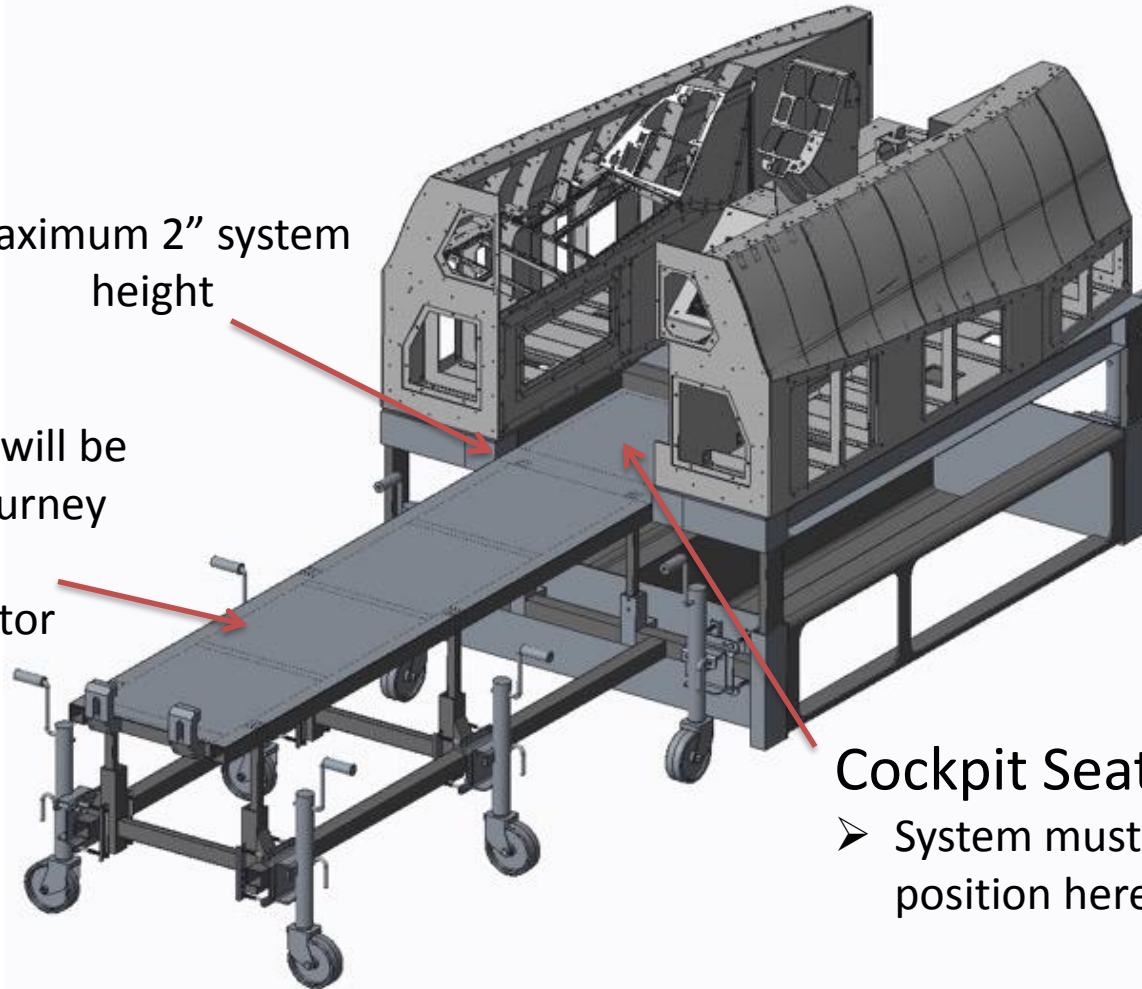
Figure 1: A Lockheed Martin F-16 in flight. (Lockheed Martin, n.d)

Design Constraints

Maximum 2" system height

Gurney

- Egress system will be mounted on gurney
- Locks into the cockpit simulator



Cockpit Seat Area

- System must lock seat position here

Project Scope

- System must move 5th and 95th percentile users in and out of cockpit dome
- Must position user in exact orientation of current fixed cockpit seat
- Allows user to egress in case emergency
- Produce functional prototype in under \$2000

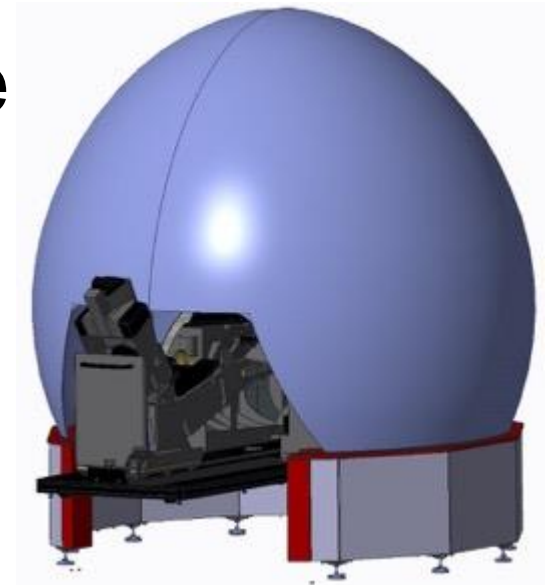


Figure 3: Existing cockpit dome design.

Up to Date Milestones

- Began Prototyping a wooden mockup of our cockpit base and gurney
- Chose our locking mechanism
- Requested quotes from outside vendors for our rail system and locking mechanism
- Created CAD Models

Transition to a Manual System

- Factors that influenced this transition
 - Cost
 - Outside of our Project Scope
 - Convenience w/ Emergency Situations
- Main components of our human powered system:
 - Linear Rail System w/ Mounting Carriages
 - Locking System

Frank Cullen

Part Selection



Carrier Selection

➤ Contact Slide Carrier

- No moving parts
- High noise level under load



Fig 4: PBC Linear contact slide carrier and rail.

➤ Recirculating Ball Carrier

- 30x lower frictional resistance
- Approximately same price point as contact slide

Carrier Selection Cont.

- Selected CPC ball-type linear guide system
 - Price: \$780
 - (39% of budget)
 - Lead Time: 1 Week



Fig 5: CPC linear ball carrier and rail.

Locking Mechanism Dilemma

Challenges

- Limited space proved difficult to design under seat
- Emergency situation's require immediate response

Solutions

- AC electromagnet mounted to cockpit base outside of seat track
- Calibrate “break away” force without need to actually break the lock

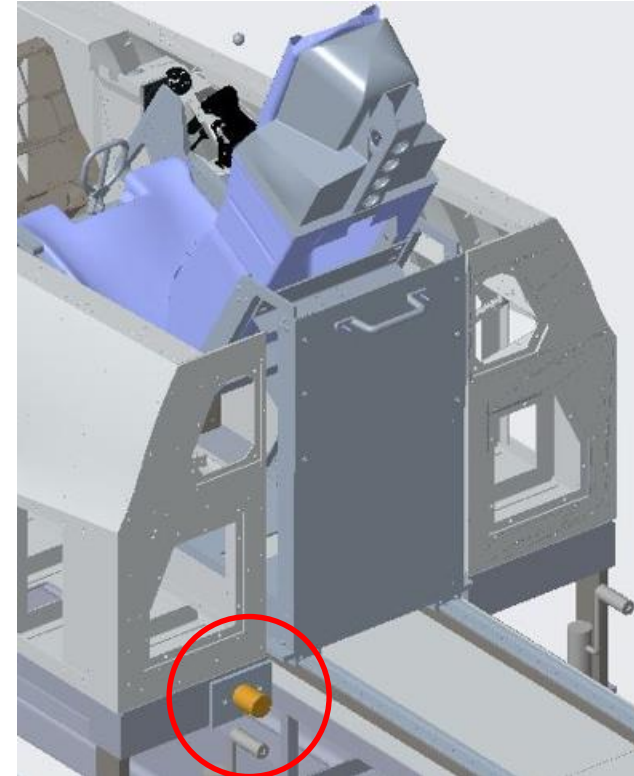


Fig 6: Electromagnet position with seat in fully extended position.

Electromagnet Lock Design

- Electromagnet will interface with ferritic steel plate
- Two variables control locking force
 - Distance from plate to magnet
 - Thickness of plate
- Awaiting final seat dimensions from sponsor before finalizing mounting bracket

Marco Karay

Looking Ahead

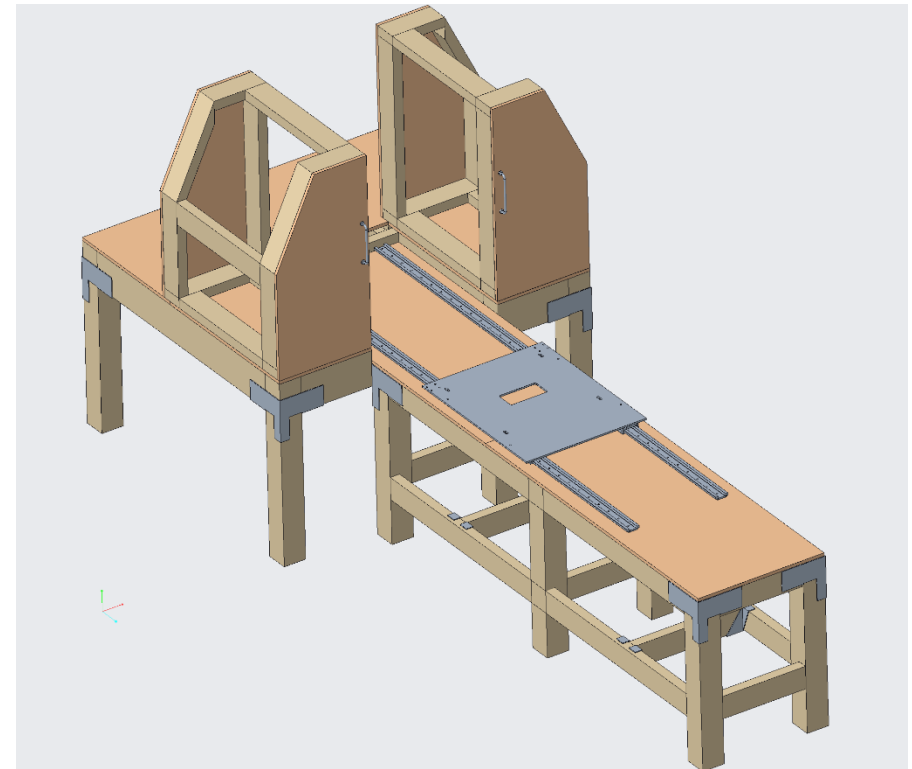


Future Work

- Selection and location of handles for pilot and operator
- Build wooden mockup of F-16 cockpit
- Assemble and install egress system

Final Deliverable

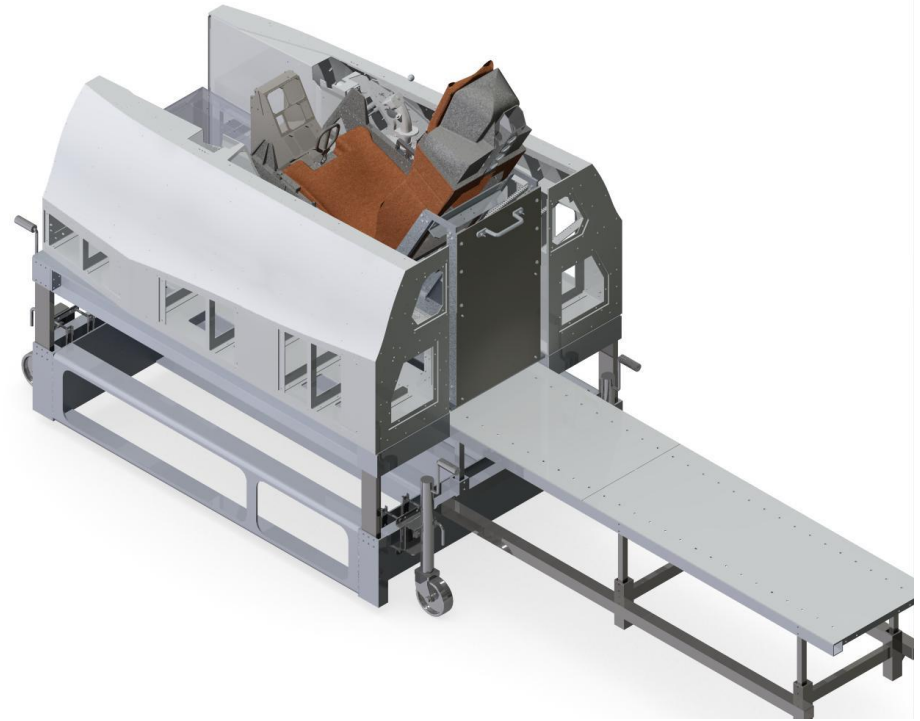
- Demonstrate proof of concept
 - Fully functional prototype with working guide and lock systems
 - Wooden mockup of F-16 simulator
 - Simulate pilot and chair with a 500lb payload



Final Deliverable

➤ Design for Lockheed Martin's System:

- Complete CAD assembly for Lockheed Martin's system
- Additional belt-driven design for future implementation by Lockheed Martin that was out of budget for the project



Acknowledgments

- Thank you to Lockheed Martin for their sponsorship
- Thank you to Jeff Payne, Robert Kenney, and Ken Clonts of Lockheed Martin for their guidance and direction
- Thank you to Dr. Hollis for his expertise on our project

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Questions?



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