

# Aircraft Seat Dimensions

## Evaluation of the Effects of Seat Pitch and Width on Transport Category Airplane Egress

Presented to: CAMI Evacuation Project SAS/REDAC Update

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**Federal Aviation  
Administration**

# Introduction

- **Stacey L. Zinke-McKee, Branch Manager**
  - Human Protection and Survival Research Laboratory
- **Rick DeWeese, Section Manager**
  - Engineering Sciences
- **David Weed – Primary Investigator**
  - Team Coordinator, Cabin Safety Research Team
- **Melissa Beben – Co-Investigator**
  - Human Factors Research Specialist



# Background

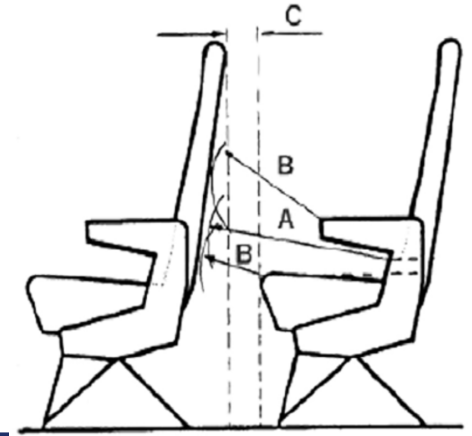
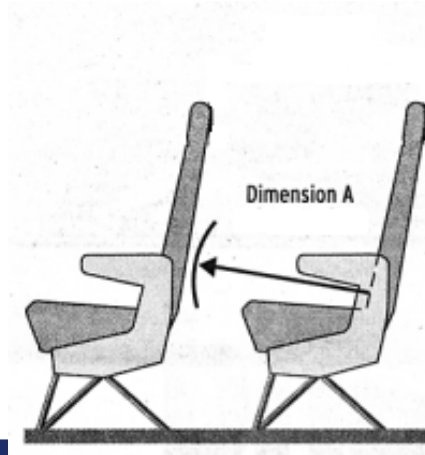
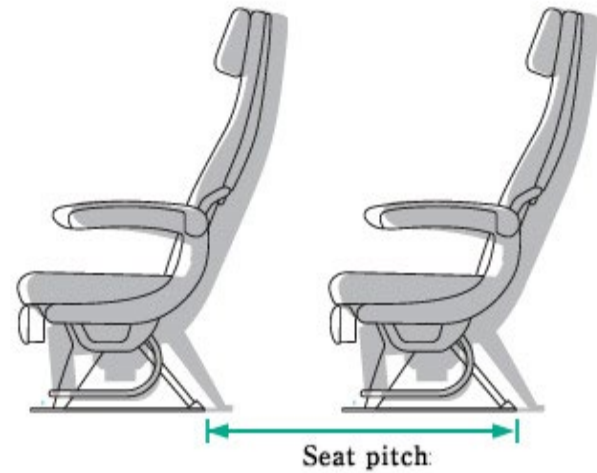
- **FAA Reauthorization Act of 2018**
  - Section 337 – Aircraft Cabin Evacuation Procedures
  - Section 577 – Minimum Dimensions for Passenger Seats
  - CAMI to conduct study to provide data for requirements



# More Background

- **Definitions and Disclaimer**

- Seat Width
- Seat Pitch
- UK CAA AN64:
  - “Dimension A”
  - “Dimension B”
  - “Dimension C”



# Study Design

- **Research Questions:**
  - 3 topics of interest:
    - Anthropometry of current population
    - Body types able to utilize seats
    - Effect of seat spacing/dimensions on egress



# Study Description

- **Variables tested:**
  - Seat Pitch<sup>1,2</sup>
    - 28 inches, 32 inches (control), 34 inches
    - Narrowest flying, Average flying, Average “Economy Plus”
  - Seat Width
    - 18 inches, 16 inches



# Study Description

- **Methodology**

- Motivation

- First 70% out each evacuation received 25% bonus.\*
    - Flight attendants shouting evacuation commands

- Anthropometrics collected

- Height, Weight, Girth, Shoulder Width, Hip Breadth, Buttock-to-knee, Knee-to-floor

- Experimental seating mock-up



# Study Description

- **Methodology cont.**
  - Comparative study
    - Effect of just seat pitch and width on evacuation times
  - Limited Variables/Safety of the subjects
    - No slides, baggage, children, pets, disabled persons, etc.
  - Evacuations
    - 12 days of testing, 4 evacuations per testing day
    - Counterbalanced run order





# Study Description

- **Methodology Conc.**
  - All groups experienced changes in Seat Width.
  - 2 distinct Seat Pitch comparison groups
    - A: (Average vs. Narrow) Test Days 1-8
    - B: (Average vs. Econ. Plus) Test Days 9-12



# Preliminary Data

- **Number of Subjects**

- Anthropometric data collected from 775 participants
  - 368 (47.5%) Male / 407 (52.5%) Female
  - Ages ranged from 18-64 (Avg. 35.7 years old)
    - 18-30 (293), 31-40 (213), 41-50 (160), 51-60 (105), 60+ (4)
- Averaged comparison of study evacuees (719) to general population data\*
  - Height (+2.57cm), Weight (+6.07kg), Girth (+2.51cm)



# Preliminary Data

- **Number of Subject cont.**
  - Evacuation data collected from 719 participants
    - 335 (46.6%) Male / 384 (53.4%) Female
- **Number of incidents**
  - 14 total IRB reportable incidents
    - 9 injuries requiring evaluation/treatment
      - 8 treated on-site/minor
      - 1 required medical transport



# Preliminary Data

- **General Trends:**
  - Groups mostly adhered to previous observations
    - First evacuation generally slowest, Subsequent evacuations tended to speed up
    - Lots of variance based on individuals
  - “Advanced Egress Techniques”
    - Emergent behaviors: Monkey see, monkey do.
    - Climbing, Seatback Walking, “Swimming”



# Research Plan

- **Data Breakdown**

- Paper Data

- Demographics, Anthropometry, Self-reports

- Video Data

- 48 Group Evacuation Times
    - ~2832 Individual Egress Times

# Current Status

- **Planning Phase: Complete**
- **Data Collection: Complete**
- **Data Analysis: Ongoing**
  - ~600 hours of video data (4tb)
  - 32.4kg (71.4lbs) of paper data
- **Report: Pending, est. 4Q20**



# Example Pictures



# Example Pictures





# Example Pictures



# Acknowledgements

- 47 FTE's
- CAMI iZone
- CAMI Clinic
- OKC ARFF
- 6 FA's
- MMAC Security
- Many More



# Conclusion

- **Questions?**

