

COE CST Seventh Annual Technical Meeting

Task 310: Assessment of Methods, Procedures, and Technologies Available for the Protection of SFPs in Commercial Spaceflight Vehicles

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**Center of Excellence for
Commercial Space Transportation**



Agenda

- Team Members
- Task Description
- Schedule
- Goals
- Results
- Conclusions and Future Work

Team Members

- Principal Investigator: Charles Mathers, MD, MPH
- Co-Investigators: James M. Vanderploeg, MD, MPH; Rebecca Blue, MD, MPH; Tarah Castleberry, DO, MPH; Leigh Speicher, MD, MPH
- Students: Alejandro Garbino, MD, PhD

Organizations

- University of Texas Medical Branch
- The Mayo Clinic, Jacksonville

Task Description

- To evaluate methods to enhance the safety of the cabin environment, space vehicle crashworthiness, individual restraint systems, emergency evacuation systems, and survival equipment

Schedule

- 2016-2017: Literature review regarding restraint system design and impact vulnerability of varied populations
- Identify best-practices regarding restraint design and safety for cabin designs

Goals

- Optimization of crew and passenger compartments to promote the survival of occupants during human spaceflight operations
- Dedicated efforts towards enhancing safety methods and advanced crashworthiness of spaceflight vehicles to improve the safety of spaceflight endeavors

Results

- Data are lacking regarding potential commercial spaceflight impact forces
 - Analog studies: motor vehicle impacts, aviation mishaps, previous spaceflight mishaps
- Restraint Design:
 - Superior performance of harness designs that include bilateral shoulder restraint and negative-G belts to limit torso movement
- Injury Patterns:
 - Anthropometric variations – varied risk by sex, age, body morphology
 - Obese and elderly at increased vulnerability for high morbidity/mortality – improved outcomes with more rigorous restraint design

Future Work

- Presentation and publication of significant findings
 - Submitted, in review, Aerospace Medicine and Human Performance
 - Presentation anticipated at Aerospace Medical Association Annual Scientific Meeting 2018

TASK 310. ASSESSMENT OF METHODS, PROCEDURES, AND TECHNOLOGIES AVAILABLE FOR THE PROTECTION OF SFPs IN COMMERCIAL SPACEFLIGHT VEHICLES

PROJECT AT-A-GLANCE

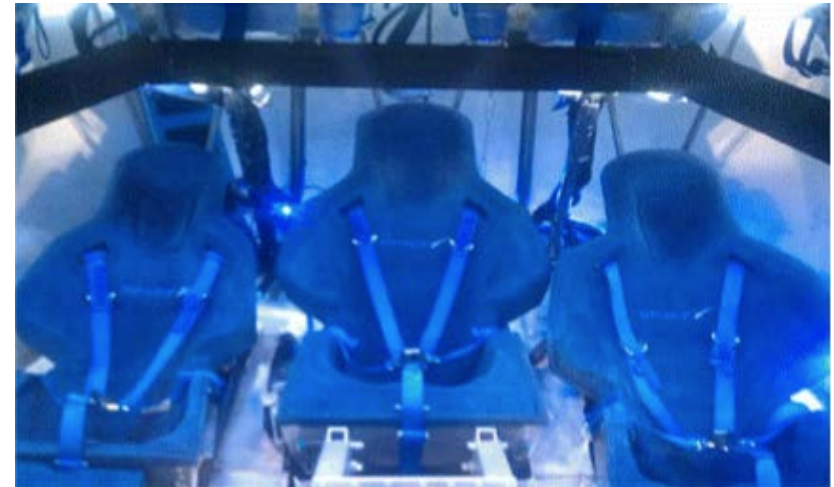
- University: The University of Texas Medical Branch
- Principal Investigator: Charles H. Mathers, MD, MPH
- Co-Investigators: James M. Vanderploeg, MD, MPH; Rebecca Blue, MD, MPH; Tarah Castleberry, DO, MPH; Leigh Speicher, MD, MPH
- Residents: Alejandro Garbino, MD, PhD

RELEVANCE TO COMMERCIAL SPACE INDUSTRY

- Dedicated efforts towards the enhanced safety in spaceflight vehicles will improve the success of commercial space endeavors
- Direct applicability to design phase of commercial spaceflight vehicles, integration of medical efforts with cabin engineering

STATEMENT OF WORK

- Identify injury patterns associated with various restraint designs
- Identify injury patterns and relative risks of anthropometrically and demographically varied populations, including factors such as sex, obesity, advanced age
- Identify any best practices for restraint design in commercial spaceflight vehicles



STATUS

- Literature review and analysis completed 2017
- Abstract submitted for Aerospace Medical Association Annual Scientific Meeting presentation, 2018
- Manuscript submitted to Aerospace Medicine and Human Performance Journal; in review

FUTURE WORK

- Presentation and publication of significant findings – publication anticipated 2018, presentation expected at Aerospace Medical Association Annual Scientific Meeting 2018