



## Welcome to the 2024 RCCADS Public Workshop!

The workshop will begin at 8:30am (EDT)

Please mute your microphone and turn off your video.

The chat function can be used for any questions.

# Event Logistics

- Microsoft Teams:
  - Please stay muted and leave your video off, unless you're speaking or presenting
  - Chat feature can be used at any time and is viewable by everyone in the meeting
  - Q&A: use chat feature or hand raise feature in Teams
- Workshop materials:
  - Some slides will be available after the workshop
  - Workshop will **not** be recorded
- In case of issues or questions about the event: chat or email [kendera@trcpg.com](mailto:kendera@trcpg.com) or [watkinsl@trcpg.com](mailto:watkinsl@trcpg.com)



**TRC**next

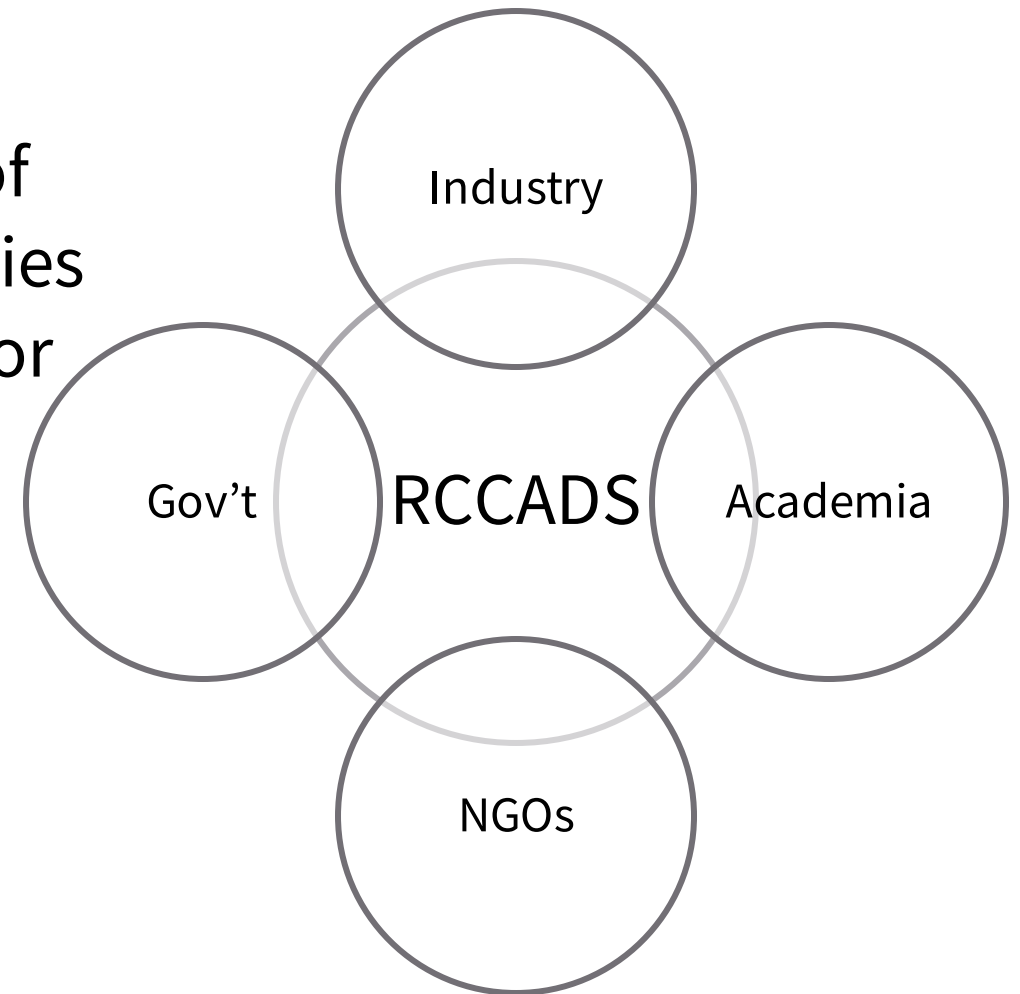
  
RESEARCH CONSORTIUM FOR  
CRASHWORTHINESS IN AUTOMATED  
DRIVING SYSTEMS  
— **RCCADS** —

# Research Consortium for Crashworthiness in Automated Driving Systems (RCCADS)

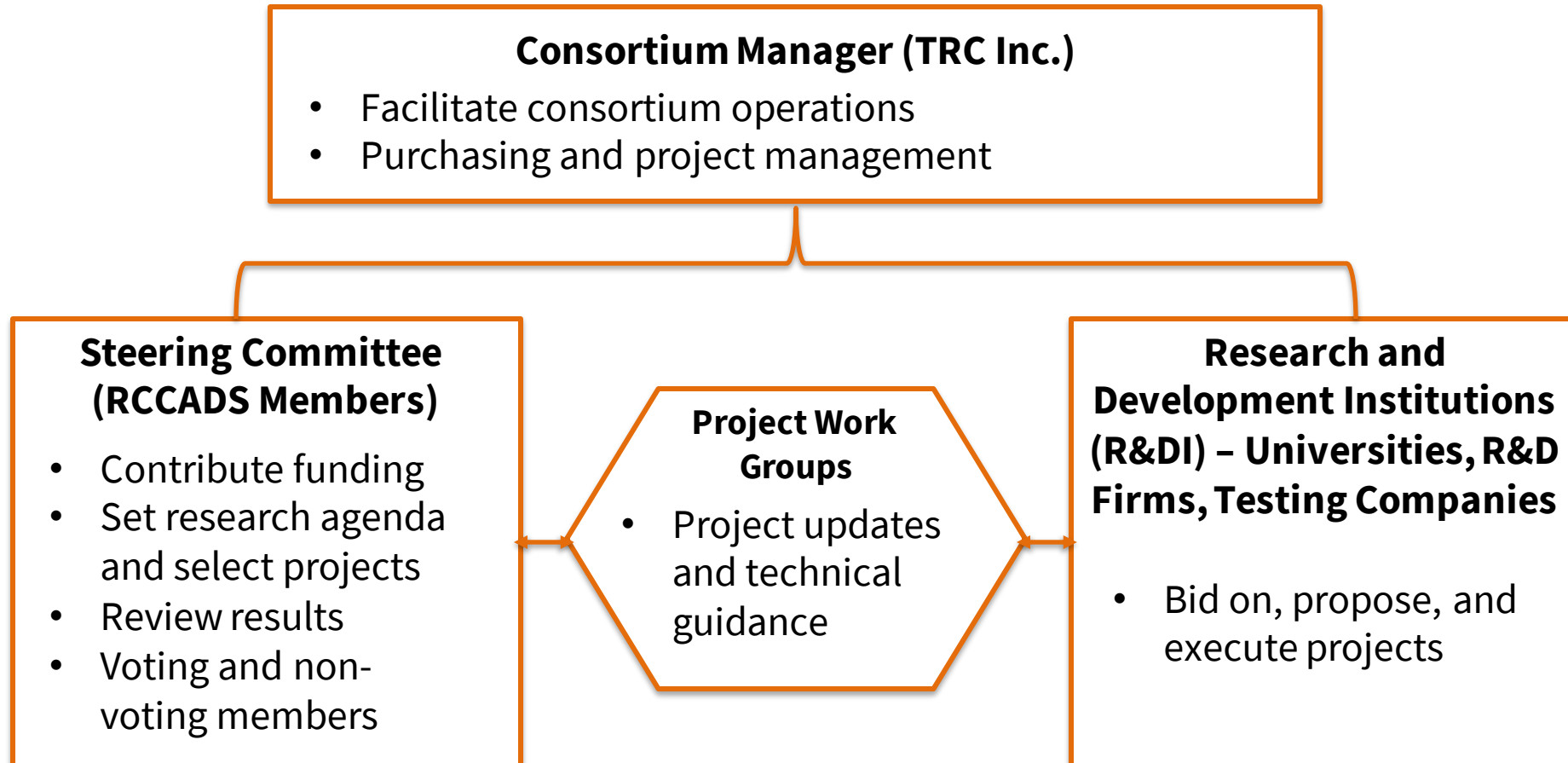
# RCCADS Mission

To collaboratively develop a foundation of information that will inform interested parties who seek to develop validation methods for automated driving systems.

The mission is to be accomplished through pre-competitive research engaging industry, trade associations, NGOs, government, and academia.



# Consortium Structure



# Research Areas

- Future crash modes
- Non-standard seating and restraints
- Biomechanical data
  - Define injury risk
  - Evaluate, update, & develop tools



From Östling et al., 2019



From *Automated Driving Systems 2.0: A Vision for Safety*



# RCCADS Project Status Year 1 (2019-2020)

## Supporting the Development of Pelvis Injury Criteria

PI: Jason Kerrigan, PhD | University of Virginia

- Aim to provide the first step in understanding how the lap belt loads the pelvis, replicates loading scenarios that caused fracture in sled tests in static belt load on 2 PMHS
- Presented at 2021 RCCADS Public Workshop
- Published at IRCOBI IRC-21-36  
A Methodology to Replicate Lap Belt Loading Conditions from a Sled Impact Test in a Non-Impact Dynamic Environment on Whole-Body Postmortem Human Subjects  
Moreau, D., Donlon, J.P., Chebbi, A., Jayathirtha, M., Sochor, S., Overby, B., Richardson, R., Gepner, B., Forman, J., Östling, M. and Kerrigan, J.



# RCCADS Project Status Year 2 (2020-2021)

## Evaluating Biofidelity of THOR-50M in a Reclined Frontal-Crash Sled Tests

PI: Jason Kerrigan, PhD | University of Virginia

- Perform a detailed biofidelity evaluation of the THOR-50M ATD in a reclined frontal crash environment
- Presented at 2021 RCCADS Public Workshop (Methodology only)
- Presented at 2022 RCCADS Public Workshop
- Presented at 49<sup>th</sup> NHTSA Workshop on Human Subjects for Biomechanical Research
- Published at IRCOBI IRC 22-48

Biofidelity Evaluation of the Hybrid-III 50th Male and the THOR-50M in Reclined Frontal Impact Sled Tests. Shin, J., Donlon, JP., Richardson, R., & Gepner, B., Forman, J., Östling, M., & Kerrigan, J.



# RCCADS Project Status Year 2 (2020-2021)

## Characterization of Subcutaneous Pelvic Adipose Tissue for Enhancement of Human Surrogate Model

PI: Scott Gayzik, PhD | Wake Forest University

- Analyze subcutaneous adipose tissue (SAT) in medical imaging scans to develop relationships between subject characteristics and quantitative measures of SAT
- Presented at 2021 RCCADS Public Workshop
- Presented at 49<sup>th</sup> NHTSA Workshop on Human Subjects for Biomechanical Research
- Published in November 2022 Traffic Injury Prevention 23(sup1):1-3

Characterization of subcutaneous pelvic adipose tissue morphology and composition at the plane of the ASIS: A retrospective study of living subjects. Moore, A. M., Efobi, S. M., Aira, J., Weaver, A. A., Lenchik, L., Hsu, F. C., & Gayzik, F. S.

# RCCADS Project Status Year 2 (2020-2021)

## Validation of FE Model during Ramping up in Rear-Loading Conditions

PI: Costin Untaroiu, PhD | Virginia Tech

- Aim to improve and validate a 50<sup>th</sup> male THUMS model in postero-anterior loading in reclined postures.
- Presented at 2021 RCCADS Public Workshop (Methodology only)
- Presented at 2022 RCCADS Public Workshop

# RCCADS Project Status Year 3 (2021-2022)

## Critical Factors Influencing Pelvis Motion and Lap-Belt to Pelvis Interaction for Occupants of Automated Vehicles

PI: Jason Forman, PhD | University of Virginia

- Investigate the effects of intrinsic occupant factors and extrinsic factors on pelvis motion and belt-to-pelvis interaction using multiple occupant models in order to assess relative sensitivities and identify which factors have a universal effect.
- Presented at 2022 RCCADS Public Workshop

# RCCADS Project Status Year 3 (2021-2022)

## Lumbar Spine Mechanical Response to Combined Flexion/Compression: PMHS and THOR

PI: Jason Kerrigan, PhD | University of Virginia

- Investigate the mechanical response of the lumbar spine to combined loading using female and male specimens, and a THOR-50M lumbar spine.
- Presented at 2023 RCCADS Public Workshop

# RCCADS Project Status Year 3 (2021-2022)

## PMHS Responses and Injuries in a Continuous Rear-Facing Seat Condition at a High-Speed Frontal Impact

PI: Yun-Seok Kang, PhD | Ohio State University

- Investigate biomechanical responses and injuries of PMHS seated in a continuous seat back during high-speed, rear-facing frontal impact
- Presented at 2023 RCCADS Public Workshop
- Presenting at 2024 AAAM
  - To be published in Accident Analysis & Prevention

# RCCADS Project Status Year 4 (2022-2023)

## Continuing Refinement of THOR for Reclined Postures – Testing to Evaluate Prototype Pelvis Modifications

PI: Jason Forman, PhD | University of Virginia

- Test the modified THOR-50M dummy to quantify the effects of these changes on the kinematic and kinetic biofidelity of the dummy in the Richardson et al. (2020c) reclined test condition.
- Presented at 2023 RCCADS Public Workshop
- Presenting at 2024 RCCADS Public Workshop

# RCCADS Project Status Year 4 (2022-2023)

## The effects of sex, body shape, posture, and belt tension on belt fit relative to the skeleton – continuing volunteer data collection with Open MRI

PI: Peter Cripton, PhD | University of British Columbia

- Scan volunteers in supine, upright, and reclined postures to better understand the effects of body shape variability on skeletal posture and belt fit.
- Presented at 2023 RCCADS Public Workshop
- Presenting at 2024 RCCADS Public Workshop



# RCCADS Project Status Year 4 (2022-2023)

## Submarining and Rib Fracture Prediction Thresholds

PI: Devon Albert, PhD | Virginia Tech

- Identify and demonstrate effective techniques for predicting the occurrence of both submarining and rib fractures. Concomitant objectives are to establish corresponding thresholds for seatbelt-related abdominal injuries and rib fractures.
- Presented at 2023 RCCADS Public Workshop
- Presented at 2024 Government/Industry Meeting
- Presenting at 2024 RCCADS Public Workshop
- Presenting at 2024 IRCOBI
- Presenting at 2024 AAAM

# RCCADS Project Status Year 5 (2023-2024)

## Understanding of Non-Standard Seating Loadcases – TU Graz

- Investigate the impact of initial seating posture (upright vs 0G) on kinematics, muscle activation, and peak excursions during a braking maneuver to validate and calibrate active Human Body Models (HBMs) using data from 20 volunteers. Simulate the influence of varied pre-crash postures on injury criteria, including age-related factors, to enhance understanding of occupant safety in different seating scenarios.

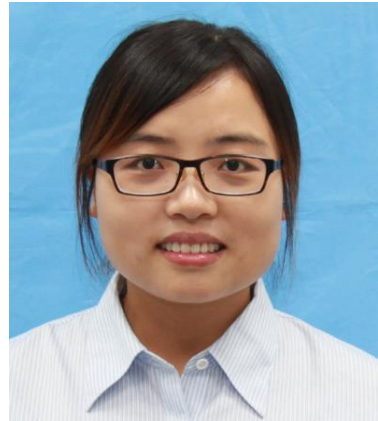
## Tensile and Compressive Material Properties of Human Pelvic Cortical Bone – VT and OSU

- Investigate the correlation between pelvic cortical bone material properties and microstructure by quantifying material properties and characterizing microstructure through imaging, aiming to produce preliminary mappings for future studies and methodology development.

# RCCADS Project Next Steps (2024-2025)

- Project proposal and selection process will begin in June
  - Application to be added as an RCCADS R&DI Due: **June 10, 2024**
  - Request for letters of intent: **June 17, 2024**
  - Letters of intent due: **June 28, 2024**
- For more information, contact **Laura Watkins: [watkinsl@trcpg.com](mailto:watkinsl@trcpg.com)**

# Session 1: ADS and Alternative Seating Positions



Andrew Kemper  
NHTSA

Jing Fei  
CAERI

Corina Klug and  
Gregor Gstrein  
TU Graz

John-Paul  
Donlon  
UVA

Eamon  
Campolettano  
Waymo

*Moderator*

*Speaker*

*Speaker*

*Speaker*

*Speaker*



## RCCADS Public Workshop

Break: 10:30-10:40am EDT

Please mute your microphone and turn off your video.

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# Session 2: Influence of Restraint Systems



Nick White  
Nick White Impact  
Biomechanics LLC

*Moderator*



Da Wang  
Autoliv

*Speaker*



Devon Albert  
VT

*Speaker*



Paris Vakiel  
UBC

*Speaker*



Mutaz  
Shkoukani  
Joyson Safety  
Systems

*Speaker*

# Closing Remarks



# RCCADS Members include:



HUMANETICS

TOYOTA

# Thank You!

Thank you to today's speakers and moderators!

And, thank you for attending the 2024 RCCADS Public Workshop!

- We want to hear your feedback – survey link will be emailed next week
- If you have questions, or want to learn more about RCCADS, contact:
  - Laura Watkins: [watkinsl@trcpg.com](mailto:watkinsl@trcpg.com)
  - Allison Kender: [kendera@trcpg.com](mailto:kendera@trcpg.com)