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RESEARCH CONSORTIUM FOR CRASHWORTHINESS IN AUTOMATED DRIVING SYSTEMS — RCCADS —

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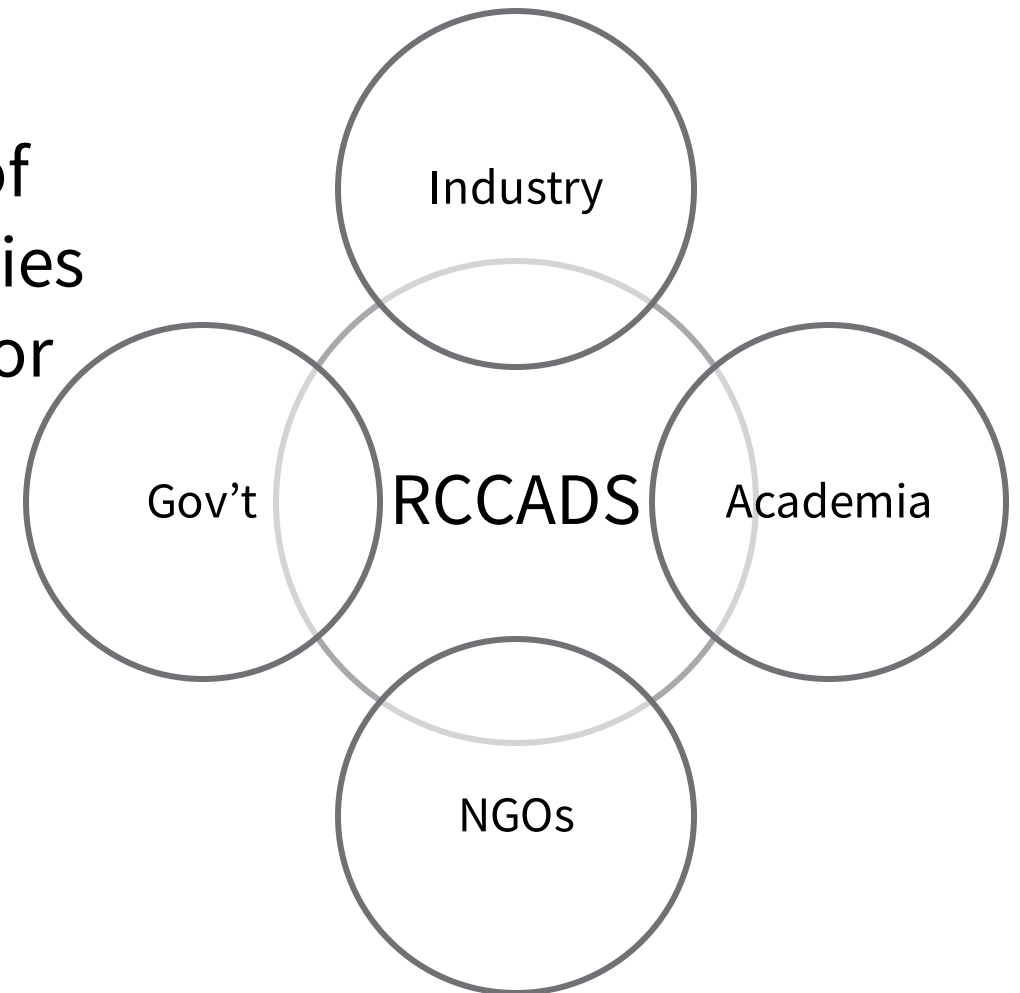
RCCADS Mission

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

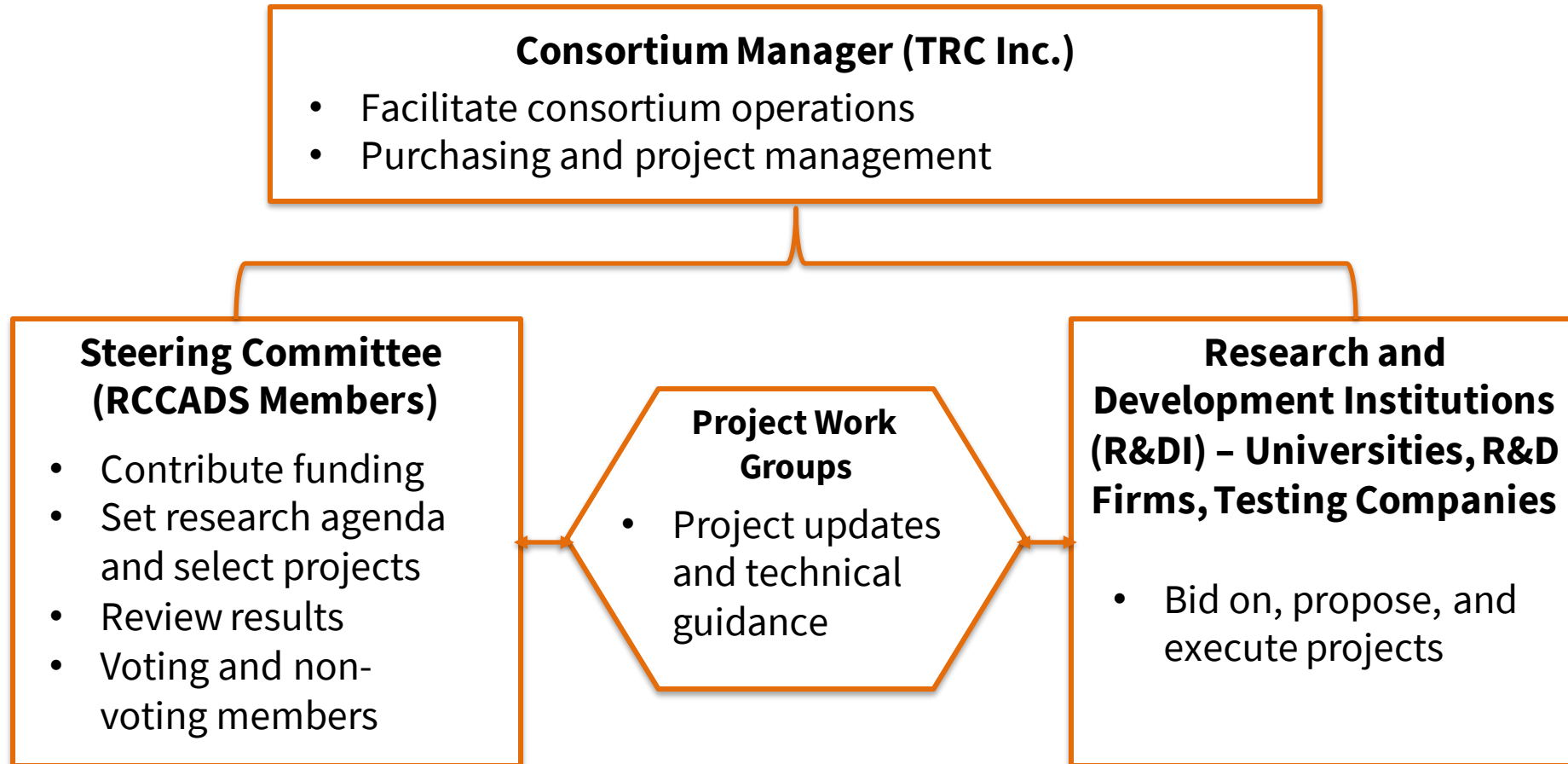New seating layouts → broader range of occupant postures → implications for occupant protection

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.

Industry

Gov't

RCCADS

Academia

NGOs

Consortium Structure

Consortium Manager (TRC Inc.)
- Facilitate consortium operations
- Purchasing and project management

Steering Committee (RCCADS Members)
- Contribute funding
- Set research agenda and select projects
- Review results
- Voting and non-voting members

Project Work Groups
- Project updates and technical guidance

Research and Development Institutions (R&DI) – Universities, R&D Firms, Testing Companies
- Bid on, propose, and execute projects

Research Areas

- Future crash modes

- Non-standard seating and restraints

- Biomechanical data
    - Define injury risk
    - Evaluate, update, & develop tools

- Research & literature review

From *Östling et al., 2019*

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

Research Areas

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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 49th 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 49th 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)

<u>Validation of FE Model during Ramping up in Rear-Loading Conditions</u>

PI: Costin Untaroiu, PhD | Virginia Tech

- Aim to improve and validate a 50th male THUMS model in postero-anterior loading in reclined postures.

- Presented at 2021 RCCADS Public Workshop (Methodology only)

- Presented at 2022 RCCADS Public Workshop

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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.

- Ongoing

- Presenting 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

- Presenting at 2023 RCCADS Public Workshop

RCCADS Project Status Year 4 (2022-2023)

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

- 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.

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

- Scan volunteers in supine, upright, and reclined postures to better understand the effects of body shape variability on skeletal posture and belt fit.

Submarining and Rib Fracture Prediction Thresholds

- 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.

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RCCADS Project Next Steps (2023-2024)

- Project proposal and selection process will begin in June

  - Application to be added as an RCCADS R&DI Due: **May 31, 2023**

  - Request for letters of intent: **June 12, 2023**

  - Letters of intent due: **June 23, 2023**

- For more information, contact **Laura Watkins: <u>watkinsl@trcpg.com</u>**