

**Automated vehicle Services for People with disabilities –  
Involved Responsive Engineering  
(ASPIRE Center)**

**Quarterly Progress Report #5**

<b>Grant Number:</b>	69A3552047140
<b>Topic:</b>	Implications of Accessible Automated Vehicles and Mobility Services for People with Disabilities
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<b>Partner Universities:</b>	Uniformed Services University of Health Sciences The Catholic University of America
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<b>Prepared for:</b>	University Transportation Centers Program, Office of the Assistant Secretary for Research & Technology, U.S Department of Transportation

## 1. Accomplishments

**Aim 1: Systematic Review:** We will conduct a comprehensive review of the literature to more clearly understand the current trends and implications for future travel related to accessible automated vehicles and services.

- **Specific Objectives and Major Activities:**

Nothing to report this quarter as we have successfully completed Aim 1 as mentioned in Q4. Please refer to the below mentioned manuscript publication:

<https://doi.org/10.1016/j.neulet.2021.136103>

Dicianno, Brad E., Sivashankar Sivakanthan, S. Andrea Sundaram, Shantanu Satpute, Hailee Kulich, Elizabeth Powers, Nikitha Deepak, Rebecca Russell, Rosemarie Cooper, and Rory A. Cooper. "Systematic Review: Automated Vehicles and Services for People with Disabilities." *Neuroscience Letters* (2021): 136103.

**Aim 2: Understand the needs of Users and Providers:** We will conduct surveys, focus groups, and journey mapping of stakeholders, including individuals with disabilities, their travel companions and/or caregivers, designers, medical providers, and mobility service experts (e.g., vehicle manufacturers and modifiers, as well as adaptive driving training instructors). The survey will be refined using pilot surveys, focus groups and journey mapping and then distributed broadly to all key stakeholders.

- **Specific Objectives:**

1. Obtain IRB approval for focus groups & journey mapping
2. Plan, recruit and enroll study participants
3. Finalize interview script for focus group (designers, medical providers, and mobility service experts)
4. Draft survey questions
5. IRB protocol development for pilot/nationwide survey

- **Major Activities:**

This quarter, the study protocol was submitted to and subsequently approved by the University of Pittsburgh, Institutional Review Board.

**Study title:** Automated vehicle Services for People with disabilities – Involved Responsive Engineering (ASPIRE Center): Journey Mapping- Focus Group

**IRB #:** STUDY20090111

**Review Type:** Expedited - Approved

**Study Risk:** No greater than minimal risk

**Approval date:** 9/16/2021

**Journey Mapping-** An enrollment matrix was developed to ensure good representation of individuals with varying disabilities who use personal and public transportation.

**Planned Enrollment: Targeted number of Subjects = 15:**

<b>Disability Category</b>	<b>Driver, Personal Vehicle</b>	<b>Public Transportation User</b>
Blind/vision impaired		2
Hearing impaired	1	1
Mobility impaired – Ambulatory with use of assistive technology (e.g., walker, cane, etc.)	1	1
Mobility impaired – Requires use of a manual wheelchair full-time (>30 hours/week) *	1	1
Mobility impaired – Requires use of a power wheelchair full-time (>30 hours/week*	1	1
Cognitive impairment – (e.g., traumatic brain injury, intellectual disability)		1
Psychological (e.g., PTSD, anxiety)	1	1
Older adult (70+ years)	2	

\*Ideally including at least one person with combined upper and lower extremity impairments

Before enrolling participants for journey mapping, study logistics were taken care and mock trials were conducted to make sure the one-on-one sessions run smoothly. **To date, we have successfully completed three interviews and have four more scheduled.** We will be engaging Toyota Mobility Foundation (TMF) in the data analysis of the Journey Mapping. All study procedures with respect to recruitment, enrollment, data analysis, reimbursement, etc. are being followed as per approved IRB protocol.

- Recruitment: Referral sampling will be used for this study wherein initial participants will be asked to distribute recruitment materials to their own networks. Participants are being recruited through networks of Advisory Board members, investigators, consumer advocacy organizations, and in person at athletic events, advocacy meetings, and at meetings of veteran service organizations for veterans and people with disabilities.

**Focus Groups-** We have completed a draft of the AV focus group script for the 3<sup>rd</sup> cohort (*Transportation Provider, Expert or Designer- see below for more details*) pending final review. An IRB amendment will be submitted to include this to the existing protocol. In addition, we also plan to run the draft of the survey questions by the study participants to get their input.

- Accessible transportation service provider (e.g., driver rehabilitation specialists, adaptive driving instructors, paratransit, and ride-share operators)
- Education or referrals provider to individuals with disabilities for accessible transportation services (e.g., physicians, vocational rehabilitation counselors, social workers)
- Designer (e.g., vehicle manufacturers and modifiers, architects, engineers, designers, etc.)

**Survey development-** A preliminary draft of the 'Voice of the Consumer' survey questions has been completed pending review from the advisory board members. In parallel, we are also developing a 'Voice of the Provider' survey questions. These questions were designed mainly based on literature review however as we complete journey mapping and focus groups, we expect that we may be refining some of those national survey-based questions.

As soon as the nationwide survey questions are finalized, they will be developed using a platform called REDCap. We will have two cohorts- Voice of Consumer (individuals with disabilities/older adults, travel partners like caregivers or spouse) & Voice of Provider (Transportation Provider, Expert or Designer). We will be implementing branching logics to the survey to capture the data accordingly.

Another Pitt IRB (STUDY20120052) related to the survey is currently under development and will be submitted for review soon.

**Aim 3: Data synthesis, extrapolation, analysis and modeling:** We will synthesize the data obtained to understand the current and future needs of potential stakeholders of accessible automated transportation and services. This will involve presenting summary survey findings, extrapolating findings to the greater population of potential automated vehicle users, combining our data with publicly available datasets to understand factors that influence travel, displaying clusters of users based on their characteristics and needs, and ideation and development of solid models that illustrate key features and parameters for implementing automated vehicles and mobility services.

- **Major Activities:**

We will have more updates as data start pouring in from the studies.

*New sub-project: Wheelchair Accessible Autonomous Vehicle Concept*

Prof. Fici-Pasquina (Catholic University of America) is starting to look at the literature review and develop conceptual graphical illustrations of the key findings. Dr. Grindle is putting together a team to design the model accessible vehicle. We are in the process of hiring a post-doc to assist with this project.

## 2. Changes/Problems

### a. Actual Problems or delays and actions to resolve them

Delays in obtaining Institutional Review Board approval and previous challenges related to COVID-19 restrictions put us behind on our timeline. A no-cost extension was requested and subsequently approved to extend the grant termination date to December 31, 2022.

[Grant No. 69A3552047140, Modification No. 1 (No Cost)]

This additional time will allow us to complete tasks, engage more students, expand & strengthen relationships with our partners to increase impact and likelihood of sustainability. In addition, we intend to improve the modeling portion (Aim 3) of the ASPIRE Center by designing and fabricating a prototype of an accessible autonomous personal vehicle system with students, staff, and stakeholders.

### b. Anticipated Problems/Issues

Nothing to Report.

## 3. Collaborations

The ASPIRE Center continues to attract more organizations to engage and partner. This quarter, Waymo LLC interviewed Drs. Cooper and Dicianno for a web article with their public education campaign, [Let's](#)

[Talk Autonomous Driving](#) about the project activities. Let's Talk Autonomous Driving is a Waymo-led initiative composed of diverse national and local partner organizations, such as National Safety Council and World Blind Union, that believe autonomous driving technology has the potential to save lives and improve mobility access and improve independence. The article is available in the below link:

[Engineers Point to Opportunities for Including People with Disabilities in Autonomous Driving Research and Development | Let's Talk Autonomous Driving \(Itad.com\)](#)

In addition, we have been continuously engaging advisory board members in project activities such as reviewing and guiding the focus group questions. Another DoT-ASPIRE Center Advisory Board meeting was held this quarter and we will continue to hold these bi-monthly meetings.

Over the quarter, Dr. Cooper and team have presented in the below virtual events:

- Cooper RA, Dicianno BE, [Accessible Autonomous Vehicles & Transportation: Initial Consumer Views](#), NMEDA Circuit Breaker, July-September 2021.
- 35th Anniversary Celebration of the Air Carrier Access Act
- LABS Conference, Semi-Autonomous Mobility (SAM)- moderated discussion with Sam Schmidt (Former Indy Car Racer), and now Indy Car Team partner with ARROW McLaren SP

For more information, please refer to the ASPIRE Center website:

[Tier 1 University Transportation Center \(UTC\) grant | Human Engineering Research Laboratories | University of Pittsburgh](#)

#### 4. Education and Workforce Development

In this quarter, we continued to engage PhD students in activities such as designing focus group, journey mapping and survey questions for Aim 2. We also reached out to both Swanson School of Engineering and also Bio-E department within the University of Pittsburgh with requests for Co Op students to work on Aim 3 activities in the next quarter. Additionally, we plan to engage students in our internship programs to perform research specifically tied into the grant. Having access to some quality engineering programs here at Pitt, and outside interest from the students in our summer program really allow for meaningful input and some quality research to be done on the project.

#### 5. Performance metrics

Peer-Reviewed Journal Publications

1. Satpute S, Cooper RM, Dicianno BE, Joseph J, Chi Y, Cooper RA, [Mini-Review: Rehabilitation Engineering: Research Priorities and Trends](#), **Neuroscience Letters**, 136207, Vol. 764, November 2021.
2. Dicianno BE, Sivakanthan S, Sundaram SA, Satpute S, Kulich H, Powers E, Deepak N, Russell R, Cooper RM, Cooper RA, [Systematic Review: Automated Vehicles and Services for People with Disabilities](#), **Neuroscience Letters**, 136103, Vol. 761, September 2021.
3. Greenhalgh M, Rigot S, Eckstein S, Joseph J, Cooper RM, Cooper RA, [A Consumer Assessment from Women Who Use Wheelchairs](#), **Journal of Military, Veteran and Family Health**, pp. 40-49, Vol. 7, No. 2, May 2021.
4. Quinby E, McKernan G, Eckstein S, Joseph J, Dicianno BE, Cooper RA, [The voice of the consumer: a survey of consumer priorities to inform knowledge translation among Veterans who use mobility assistive technology](#), **Journal of Military, Veteran and Family Health**, pp. 26-39, Vol. 7, No. 2, May 2021.