



ACCESSIBLE TRANSPORTATION TECHNOLOGIES
RESEARCH INITIATIVE

ATTRI State of Practice, Innovation and Assessment of Research Webinar

February 2, 2016



U.S. Department of Transportation
Federal Transit Administration



U.S. Department of Transportation
Federal Highway Administration



U.S. Department of Transportation
Office of the Assistant Secretary for Research and Technology





Navigating Adobe Connect

Shortcuts for navigating pods, menus, and windows

Result	Windows	Mac OS
Toggle between notification window and meeting room	F8	F8
Display application menu bar for keyboard navigation	Ctrl+Space	Command+F2
Move focus to next / previous pod	Ctrl+F6 / Ctrl+Shift+F6	Command+F6 / Command+Shift+F6
Display pod menu for keyboard navigation	Ctrl+F8	Command+F8

Please refer to page 8 of the Adobe Connect User Guide for a complete list of shortcuts. The following link was sent to all registrants via email:

http://help.adobe.com/en_US/connect/9.0/using/connect_9_help.pdf

Introductions



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Ken Wood

NIDILRR

Program Specialist and Manager,
Switzer Research Fellowship
Program



Mohammed Yousuf

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Aaron Steinfeld, PhD

Associate Research Professor

Robotics Institute,
Carnegie Mellon University



Agenda

- **Welcome and Introductions**
 - Kunik Lee (FHWA)
- **ATTRI Program Overview and Status**
 - Mohammed Yousuf (FHWA)
- **Introduction to the ATTRI Technology Scan Task**
 - Ken Wood, ATTRI Team (NIDILRR)
- **ATTRI Technology Scan Findings**
 - Aaron Steinfeld (Carnegie Mellon University)
- **Q&A**
 - Kunik Lee (FHWA)



Welcome and Purpose

Webinar Purpose:

- Inform stakeholders on the progress of the ATTRI program
- Share the results of the ATTRI's program:
 - State of Practice Scan,
 - Innovation Scan, and
 - Assessment of Relevant Research Reports
- Present specific examples from accessible transportation or related fields of how the relevant methods, practices and technologies can meet the needs of transportation users of all abilities
- Provide recommendations regarding key opportunities on emerging technologies relative to accessible transportation
- Engage stakeholders





ATTRI Program Status



Mohammed Yousuf

ATTRI Program Manager

Office of Operations and Research Development,
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Accessible Transportation Technologies Research Initiative (ATTRI)



**Persons with
Disabilities**



**Veterans with
Disabilities**



Older Adults

- A U.S. DOT Multi-Year, Multimodal, Multi-Agency Research and Development Effort
- Identifying user needs of travelers with disabilities to develop new transformative applications to increase personal mobility
- Building collaborative research and deployment partnerships with other US and International research communities, both public and private
- Unique opportunity to develop and deploy novel applications for accessible transportation and extend those benefits to all travelers



The Challenge



Persons with Disabilities

- 56.7 million; 19% US population
- Unemployment Rate – 13.2 %; Income: \$38,400 (\$61,000)
- Poverty: 24.7% (9.0%)
- Rise in Autism: 1 in 150 (2000) to 1 in 68 (2010)
- Fed expenditures: \$226 B (2002); \$357 B (2008)



Veterans with Disabilities

- 21.4 million Americans are Veterans
- Disability claims: 104,819 (2006) vs. 634,743 (2012)
- 2.6 million deployed in 2012, 45% of eligible Veterans file claims for disability
- Spending: \$0.93 billion (2006) vs. \$5.95 billion (2012)



Older Adults

- Disability rates rise as people get older
- 43.1 million age 65 + in 2012 or 1 in 7 people
- 28% live alone
- Expected to reach 72.1 million by 2030

- WHO estimates that more than One Billion people in the world live with some form of disability
- The global GDP lost annually due to disability is estimated to be **\$1.37 trillion** to **\$1.94 trillion**
- Australian study: reducing the gap in workforce participation by **1/3** would result in a **\$43 billion** increase in GDP over **10 years**

Challenges & Opportunities



- 76% people with disabilities say adequate transportation is important to their job search
- 29% consider it a significant problem in accessing jobs

Targeted Populations



Persons with Disabilities



Veterans with Disabilities



Older Adults

Types of Disabilities



Vision



Mobility



Hearing



Cognitive

Enabling Technologies

ITS,
Wireless
& Sensors

Connected
Vehicles

Automated
Vehicles/ Personal
Mobility

Robotics,
Artificial
Intelligence

Accessible
Data

ATTRI Technology Research Areas



Wayfinding & Navigation Solutions

- Indoor/Outdoor navigation & orientation Apps
- Situational awareness and text recognition devices



ITS & Assistive Technologies

- Travel and emergency announcements with captioning and haptic/flashing alerts
- V2V, V2I and V2P apps for pedestrians



Automation & Robotics

- Personal mobility vehicles for first/last mile connections
- Virtual caregivers/concierge services with machine vision/AI, V2X



Data Integration

- Accessibility data and information systems
- Interoperability and data needs



Enhanced Human Services Transportation

- Real-time multimodal trip planning & services
- Inclusive one-fare payment application for all travelers



Strong Partnerships



Federal Partners

- NIDILRR
- US ARMY-TARDEC
- ICDR
- White House
- Access Board
- DOL-ODEP
- DHHS-ACL
- VA
- NASA
- NRI

U.S. DOT Research

- FHWA
- FTA
- ITS JPO
- OST

Research Institutions

- CMU – Robotics
- GA Tech – Apps for Older Adults
- CCNY, Auburn, TRX – EAR Program

International Collaboration

- Accessible Transportation Trilat SG
- E.U. City Mobil2
- Japan MLIT/SIP Tokyo 2020 Olympics

Private Industry

- General Motors
- Toyota
- IBM
- Qualcomm
- Intel
- Singapore GreenMan Plus

ATTRI Foundational Considerations



Standard Accessible Data Platform

- Data standardization and interoperability is critical in developing applications which aspire to enhance the personal mobility of those with the greatest needs.

Universal Design Standards

- Universal design standards incorporate a philosophy that promotes the applicability of a technical solution to the needs of all user groups.

Integrated Payment

- Interoperable electronic fare payment that can be utilized across various modes of transportation by all travelers including those with disability, at all times, and for multiple consumer purposes.



Leverage Existing Technologies

- Leverage existing technologies, including ITS, on-demand technologies, data standards, innovative smartphone and mobile technology, and transportation and other assistive and enabling technologies.

Developing Accessible Transportation Solutions



Foundational Considerations

**Standard
Accessible
Data Platform**

**Universal
Design
Standards**

**Integrated
Payment**

**Leverage
Existing
Technologies**



Smart Wayfinding & Navigation Systems

- Smartphone-based navigation systems for indoor & outdoor use
- Wearable technologies
- Community navigators



Pre-Trip Concierge & Virtualization

- Pre-trip and in-route traveler information
- Crowd-sourcing
- Virtual caregiver help for pre-trip planning and on route support



Shared Use, Automation & Robotics

- Automated Robotic Characterization of Pedestrian Zones
- Machine and robotic cross-walk assistant
- Slow-speed automatic vehicles



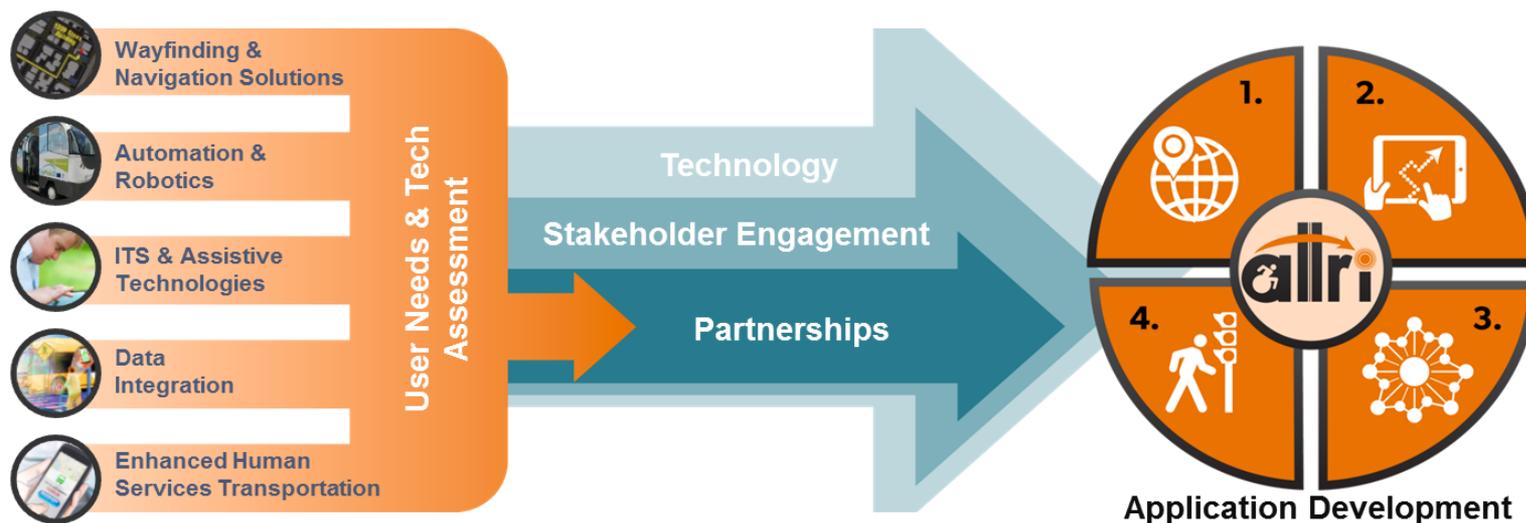
Safe Intersection Crossing

- Automated intersection crossing assistance
- Pedestrians interface with traffic signal and vehicles receive alerts
- Multiple communication formats (visual, audible, haptic)

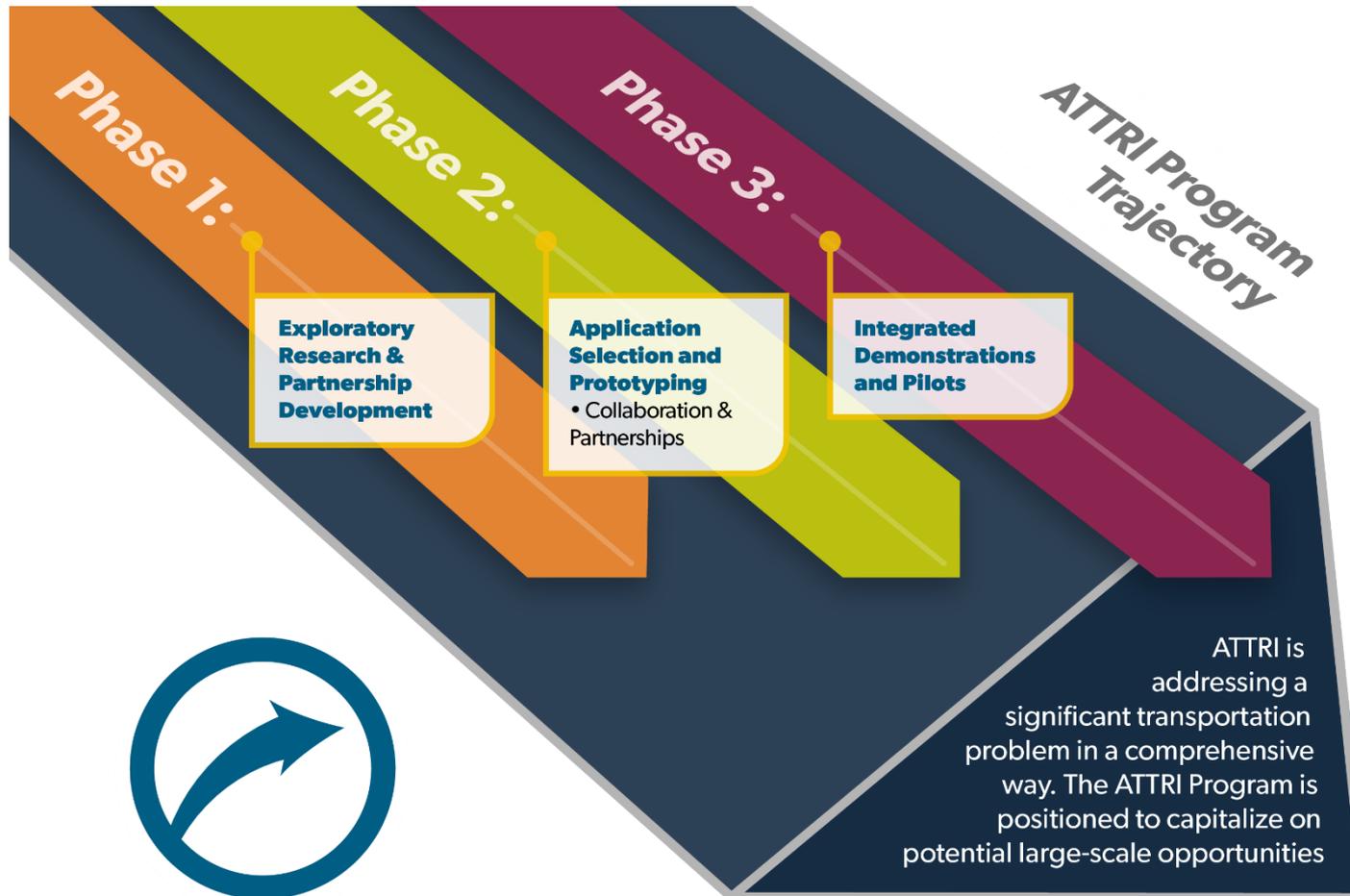
Next Steps



- Continue Stakeholder Outreach:
 - ATTRI Session at SxSW 2016
 - ATTRI Session at 2016 Annual International Technology and Persons with Disabilities Conference
 - ATTRI USDOT/Department of Labor Online Dialogues
- Publish User Needs Report and Technology Scan Reports – Early Spring 2016
- Application ConOps and System Requirements Procurements – To be released in Spring 2016



ATTRI Program Trajectory





ATTRI Technology Scans



Ken Wood

NIDILRR

Program Specialist and Manager,
Switzer Research Fellowship Program



NIDILRR Partnership



- Joint project in coordination with National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR) within US Department of Health and Human Services (HHS) and Federal Highway Administration (FHWA)
- **NIDILRR Mission:**
 - Generating new knowledge and promoting its effective use in improving the ability of persons with disabilities to perform activities of their choice in the community, and
 - Expanding society's capacity to provide full opportunities and accommodations for its citizens with disabilities.
- Technology Scan research being conducted by Carnegie Mellon and Rehabilitation Engineering Research Center on Accessible Public Transportation (RERC-APT)



ATTRI Technology Scans



- The Technology Scans have two purposes:
 - Determine the state of the practice and innovations in accessible transportation or related fields.
 - Gain a clear understanding of relevant research in the area of accessible transportation and travelers with disabilities to determine how these might impact the development and eventual deployment of ATTRI.
- The project was divided into three reports:
 - State of the Practice Scan
 - Innovation Scan
 - Assessment of Relevant Research

Three Technology Scans



State of the Practice Scan

- Identify current practices in accessible transportation, assistive technologies, applications and systems for travelers with disabilities

Innovation Scan

- Identify other research or demonstrations currently being conducted which offer innovation in the field of transportation

Assessment of Relevant Research

- Gain a clear understanding of current relevant research and development activities in the area of accessible transportation and travelers with disabilities to determine how these might impact the development and eventual deployment of ATTRI



ATTRI Technology Scans



- The Technology Scans are targeting technologies assisting:
 - Persons with disabilities, veterans with disabilities and older adults.
 - Vision, Mobility, Hearing, and Cognitive disabilities.
 - Across the 5 ATTRI technology areas.

Targeted Populations



Persons with Disabilities



Veterans with Disabilities



Older Adults

Types of Disabilities



Vision



Mobility



Hearing



Cognitive

ATTRI Technology Areas



Wayfinding and Navigation



ITS and Assistive Technologies



Robotics and Automation



Data Integration



Enhanced Human Service Transportation



ATTRI Technology Scans



Aaron Steinfeld
Carnegie Mellon University
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Funded by FWHA via NIDILRR
Rehabilitation Engineering Research Center on Accessible Public Transportation (RERC-APT)
Grant No. HHS 90RE5011-01-00 (formerly ED H133E130004-14)

Technology Inclusion Criteria



- State of the Practice
 - Used commonly around the United States
 - Well established elsewhere
- Innovation Scan
 - Novel and limited public use in United States
 - Novel technologies from elsewhere
- Assessment of Relevant Research
 - Technology research projects
 - Early pilot testing

ATTRI Technology Research Areas



- Wayfinding and Navigation
- Assistive Technologies
- Automation and Robotics
- Data Integration
- Enhanced Human Service Transportation

- All transportation modes
 - Emphasis on travel within community
 - Daily life

- Each document has numerous examples of technologies
 - Three examples in this talk

State of the Practice: Coordinated Fare Systems



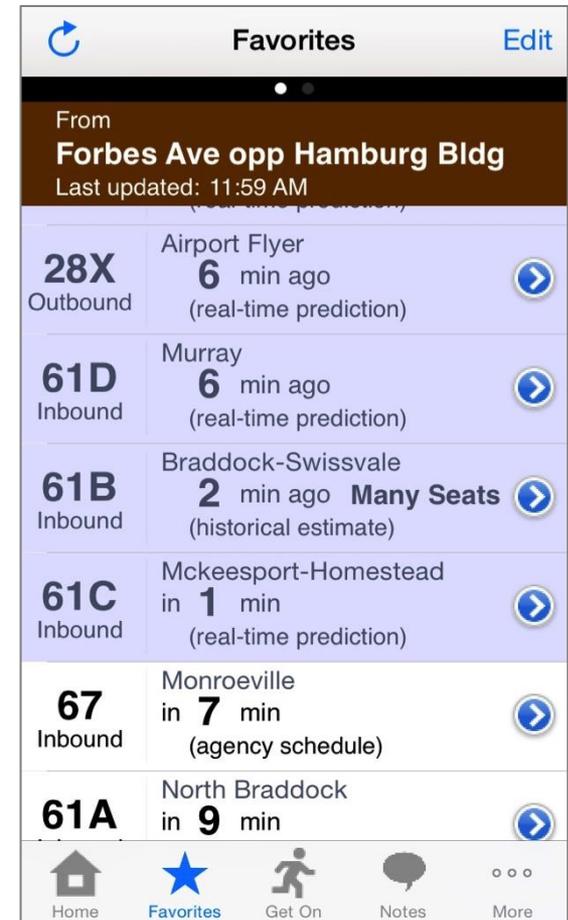
- *Enhanced Human Service Transportation*
- Regional smartcards
 - Multi-modal fare payment (e.g., San Francisco Bay Clipper Card)
 - Support for other purchases through partnerships (e.g., some university ID cards, Korea T-Money)
- Reduces confusion and effort from multiple cards
 - Multiple balances (Cognition)
 - Selecting (Fine motor control)
 - Determining which card (Vision)



Innovation: Tiramisu Transit



- *Data Integration*
- Crowdsource real-time accessibility information
- Merges agency-supplied data with transit rider observations
- Current and future travel
- Universal design
 - Supports multiple disabilities
 - People without disabilities contribute most of the data



Assessment of Relevant Research: Driver Interfaces for the Blind



- *Wayfinding & Navigation*
- Vehicle interfaces for blind drivers
 - Converts visual information into other modes
 - Tactile gloves and seat back vibrations



Image source: Virginia Tech



Recommendations for Future ATTRI Work



- *Disclaimers*
 - Based on our technology assessment effort
 - Integrate with needs identified by ATTRI stakeholders
 - Example images are for illustration purposes only and not necessarily the recommended approach
 - Not an endorsement or the official opinion of DOT and other ATTRI government partners

Recommendation: Wayfinding & Navigation (1)



- Integration of Map Data from Various Sources
 - Regular digital map data
 - Methods for easily merging data from other sources
 - Available for third party developers via open data and open service models
 - Improve existing map data, rather than rebuild digital maps



Recommendation: Wayfinding & Navigation (2)



- Infrastructure Descriptions
 - Common encoding methods
 - Sharing gathered details
 - E.g., stairs, sidewalk quality, etc.
 - Data collected in one system is usable by others
 - Design for worldwide scale

Tags

```
information=tactile_map  
information=tactile_model  
ramp=yes/no  
tactile_paving=yes/no/...  
traffic_signals:arrow=yes/no  
traffic_signals:minimap=yes/no  
traffic_signals:sound=yes/no/...  
traffic_signals:vibration=yes/no  
traffic_signals:floor_vibration=yes/no  
wheelchair=yes/no/...  
wheelchair:description:en=*  
blind:description:en=*  
deaf:description:en=*
```

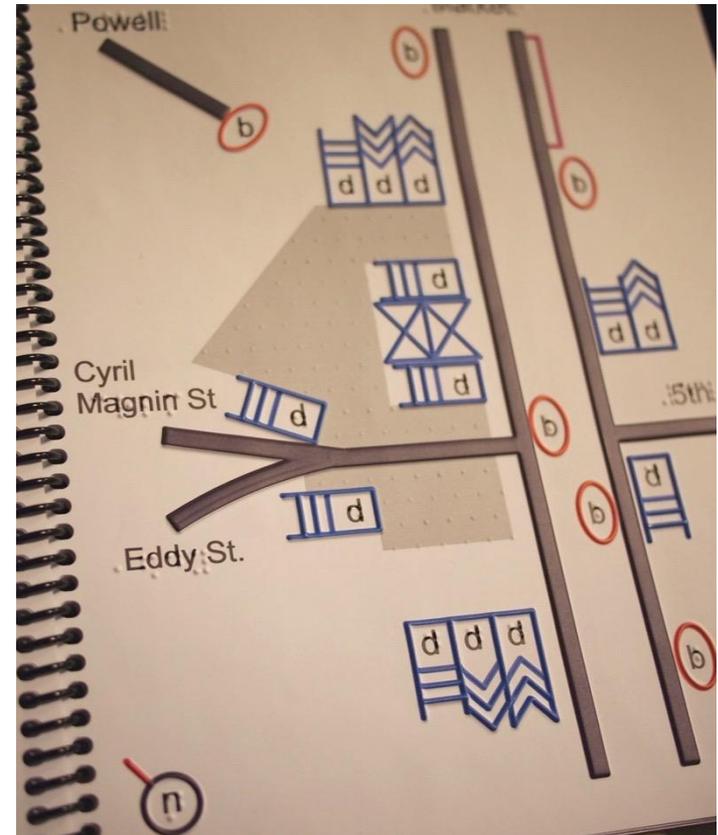
Image source: OpenStreetMap.org



Recommendation: Wayfinding & Navigation (3)



- ATTRI Specific Data
 - Accessibility details beyond just basic points of interest
 - E.g., entry door locations, accessible entry, presence of accessible bathroom, etc.
 - Contact information for venue so users can call ahead if needed



Lighthouse for the Blind and Visually Impaired



Recommendation: ITS & Assistive Technologies (1)



- Modernized Maintenance and Asset Management
 - Apply ITS approaches to AT maintenance and asset management
 - Have the right equipment and assistance at the right time
 - E.g., lift and elevator maintenance, pre-positioning the correct AT equipment during air travel, etc.

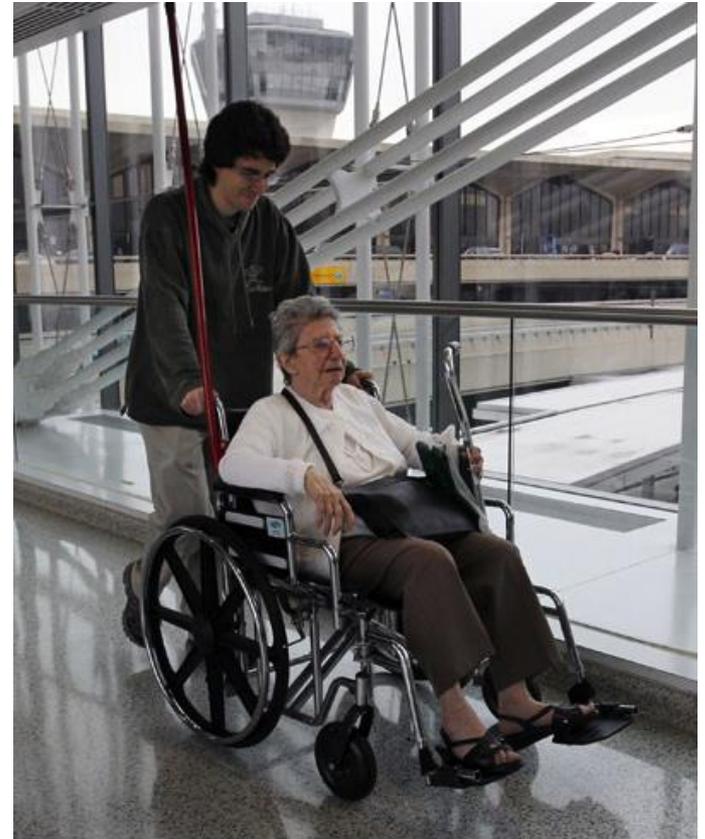


Image source: U.S. Department of State

Recommendation: ITS & Assistive Technologies (2)



- Remote assistance
 - Remote control of local AT and infrastructure
 - Beyond just voice help calls
 - E.g., unlocking gates



Seoul Metropolitan Subway



Recommendation: ITS & Assistive Technologies (3)



- Barrier Traversal
 - Better AT for crossing curb and sidewalk barriers
 - Opportunities for collaboration
 - Veterans Affairs prototype wheelchair that can drive over curbs and single steps
 - Off road military robots

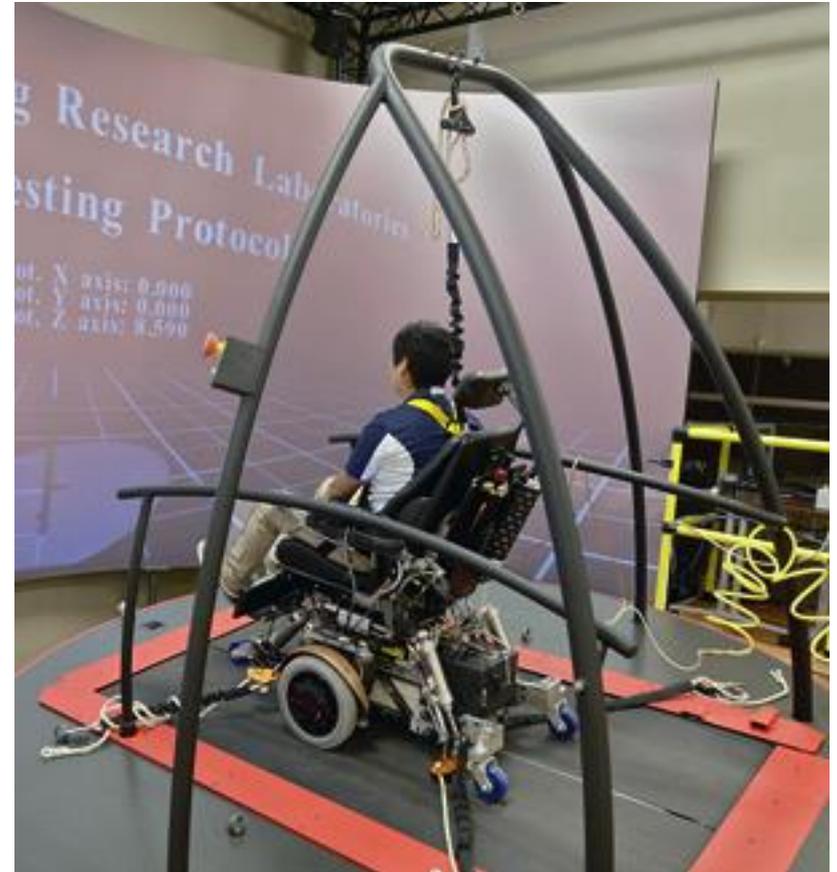


Image source: Human Engineering Research Laboratories, VA



Recommendation: Automation & Robotics (1)



- Shared Neighborhood Autonomous Vehicles
 - ARIBO and CityMobil2 are good starts
 - More in this space is needed
 - Solutions that do not require a driver's license are necessary



Image source: U.S. Army TARDEC

Recommendation: Automation & Robotics (2)



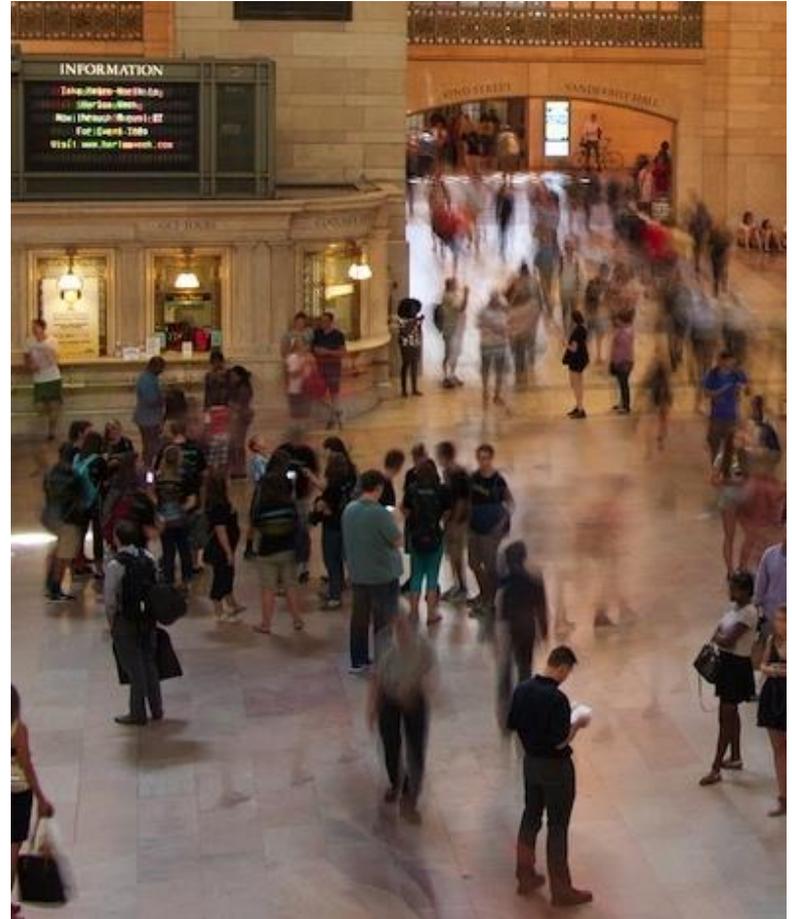
- Accessible Vehicles
 - Modification is costly and rare
 - New and better vehicle designs
 - Entering and existing shared and autonomous vehicles
 - Transportation network company (TNC) and taxi vehicles



Recommendation: Automation & Robotics (3)



- Look Ahead Functions
 - Predict how path ahead of user will change
 - Navigate by looking more than 5 feet ahead
 - Any travel mode



Recommendation: Data Integration (1)



- Open Data and Open Services
 - Important for accelerating development of novel systems
- Community Generated Data
 - New methods for gathering and distributing data
 - Crowdsourced or from local community
 - Generalizable approaches



Recommendation: Data Integration (2)



- Machine Readable Personal Information
 - User preferences on how service and technology used
 - Support flexible preferences
 - Preserve privacy
- Service Matchmaking
 - Methods for finding the right options for specific users
 - E.g., senior discounts, military transportation, etc.



Recommendation: Enhanced Human Service Transportation (1)



- TNCs and Ridesharing
 - Improvements on providing travel independence
 - Ensure equal access for stakeholders
 - Prevent service-related barriers
 - Likely a mix of technology and service design



Recommendation: Enhanced Human Service Transportation (2)

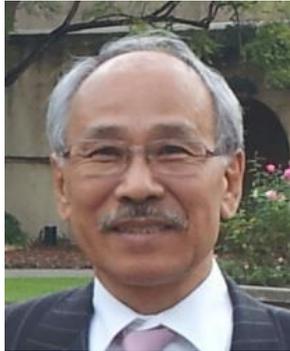


- Mode Shifting
 - Seniors will increasingly be transitioning out of driving
 - Coach users in unfamiliar transportation settings
 - Inform users of options in easy to understand ways
 - Guardian angel to detect and warn before a mistake
 - Caregiver tools for remote support





Webinar Q&A



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Thank You!



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