# Proceedings

# Interagency Committee on Disability Research Roundtable
on
# Accessible Transportation Technologies Research

**Friday, June 26, 2015**

**Washington, DC**

# Contents

# Abbreviations

| | |
|---|---|
| ACL | Administration for Community Living |
| AI | Artificial Intelligence |
| ARIBO | Applied Robotics for Installations and Base Operations |
| ATTRI | Accessible Transportation Technologies Research Initiative |
| CDC | Centers for Disease Control and Prevention |
| DoD | U.S. Department of Defense |
| DOL | U.S. Department of Labor |
| DOS | U.S. Department of State |
| DSRC | Dedicated Short Range Communication |
| FCC | Federal Communications Commission |
| FHWA | Federal Highway Administration |
| FTA | Federal Transit Administration |
| GIS | Geographic Information System |
| GPS | Global Positioning System |
| HHS | U.S. Department of Health and Human Services |
| ICDR | Interagency Committee on Disability Research |
| IOM | Institute of Medicine |
| IoP | Interoperability Profiles |
| IoT | Internet of Things |
| ITS | Intelligent Transportation Systems |
| ITS-JPO | Intelligent Transportation Systems Joint Program Office |
| JIT | Just-In-Time Information |
| NASA | National Aeronautics Space Administration |
| NBS | National Beneficiary Survey |
| NCHS | National Center for Health Statistics |
| NCMRR | National Center for Medical Rehabilitation Research |
| NICHHD | National Institute of Child Health and Human Development |
| NIDILRR | National Institute of Disability, Independent Living, and Rehabilitation Research |
| NIH | National Institutes of Health |
| OBSRR | Office of Behavioral and Social Sciences Research |
| ODEP | Office of Disability Employment Policy |
| ODP | Office of Disability Policy |
| OESP | Office of Employment Support Programs |
| PEAT | Partnership on Employment & Accessible Technology |
| POI | Points of Interest |
| R&D | Research and Development |
| ROS | Robotic Operating System |
| SBIR | Small Business Innovation Research |
| SLAM | Simultaneous Localization and Mapping |
| SSA | Social Security Administration |
| SSDI | Social Security Disability Insurance |
| SSI | Supplemental Security Income |
| TARDEC | U.S. Army Tank Automotive Research Development and Engineering Center |
| TTW | Ticket to Work |
| UGV | Unmanned Ground Vehicles |
| USDOT | U.S. Department of Transportation |
| V2I | Vehicle to infrastructure |
| V2P | Vehicle to pedestrian |
| V2V | Vehicle to vehicle |

# Executive Summary

The ICDR hosted a roundtable on Accessible Transportation Technologies Research, on June 26, 2015, at the request of the Accessible Transportation Technologies Research Initiative (ATTRI) of the U.S. Department of Transportation (USDOT). ICDR has actively supported ATTRI since its conceptualization and has linked USDOT with a number of federal partners. The purpose of the roundtable was to share scholarly and experiential knowledge related to accessible technology and transportation, and to identify further partnership opportunities to spur innovation and increase transportation and mobility options for travelers with disabilities.

The objectives of the roundtable were to:

- Share advances in scholarly and experiential knowledge in accessible transportation technologies research.
- Explore ways that research and priorities at other federal agencies might align with the ATTRI priorities identified through several stages of public input.
- Engage in a dialogue about shared interests, priorities, strengths, and resources that can spur further advancement in accessible transportation technologies.

ATTRI is a multi-modal multi-agency USDOT joint research and development (R&D) initiative co-led by the Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) with support from the Intelligent Transportation Systems Joint Program Office (ITS-JPO) and other federal agencies such as the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR). During the first part of the meeting, ATTRI shared its work to date including a state-of-the-practice/innovation scan and a stakeholder engagement/user needs assessment to identify promising technologies for development and user needs of travelers with disabilities. ATTRI is currently looking to leverage technologies and innovations from different federal intelligent transportation systems, and related disability R&D activities. The roundtable was an opportunity to share other federal initiatives that might help ATTRI move forward with developing transformative applications and improve travel for all travelers, including people with disabilities.

The second part of the meeting was to spur interagency dialogue. Representatives from the following agencies posed questions and shared related initiatives and priorities from their agencies that might contribute to this interagency initiative:

- Administration for Community Living (ACL)
- Centers for Disease Control and Prevention (CDC)
- National Institutes of Health (NIH)
- National Institute of Disability, Independent Living, and Rehabilitation Research (NIDILRR)
- Federal Communications Commission (FCC)
- Social Security Administration (SSA)
- U.S. Department of Transportation (USDOT)
- U.S. Access Board
- U.S. Army Tank Automotive Research Development and Engineering Center (TARDEC)
- U.S. Department of Health and Human Services (HHS)
- U.S. Department of Labor (DOL)
- U.S. Department of State (DOS)

Examples of existing partnership included:

- **NIDILRR**. Intellectual resources and funding.
- **TARDEC/Army**. Offer to pilot-test technologies developed through ATTRI on military bases.
- **Office of Disability Employment Policy (ODEP)/Department of Labor (DOL)**. Sponsoring an "app challenge," and co-sponsoring other efforts to develop employment-related transportation technologies.

A number of new collaboration opportunities emerged, including:

- **National Institutes of Health (NIH)**. Connection with relevant NIH-funded research in assistive technology devices including off-body robotics; and application of research outside the laboratory setting in the home, workplace, and community.
- **Social Security Administration (SSA)**. A potential source for research funding is the SSA Disability Research Consortium.
- **Administration for Community Living (ACL)** Funds programs in every state for aging, independent living, and assistive technology.

Other suggested future partnerships are described at the end of this report.

# About the Roundtable

## Purpose

The ICDR hosted a Roundtable on Accessible Technologies Transportation Research on June 26, 2015, at the request of the Accessible Transportation Technologies Research Initiative (ATTRI) of the U.S. Department of Transportation (USDOT). ATTRI was initially conceived during discussions within the Interagency Committee on Disability Research (ICDR). Since ATTRI's inception, the ICDR has been instrumental in connecting federal agencies with this initiative. The purpose of the roundtable was to share scholarly and experiential knowledge related to accessible technology and transportation and to identify partnership opportunities to spur innovation and increase transportation and mobility options for people with disabilities.

According to John Tschida, ICDR chair and Director of the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR), "We are not here to admire the problem, we are here to discuss possibilities and partnerships." Ken Leonard, Director of the Intelligent Transportation Systems Joint Program Office (ITO-JPO) shared the USDOT vision for the transformation of transportation to a single integrated system that is interoperable for anyone who uses it. He stressed the importance of this meeting stating that "As we build a smart, connected transportation system, we need to make sure we design in intelligent capabilities that remove barriers and make our systems accessible to all."

This roundtable engaged representatives within the USDOT and other federal agencies in an exchange of information, ideas, and priorities for providing wider access to transportation options for people with disabilities.

## Objectives

- Share advances in scholarly and experiential knowledge in accessible transportation technologies research.
- Explore ways that research and priorities at other federal agencies might align with the ATTRI priorities identified through several stages of public input.
- Engage in a dialogue about shared interests, priorities, strengths, and resources that can spur further advancement in accessible transportation technologies.

## Background

ATTRI is a multi-modal multi-agency USDOT joint research and development (R&D) initiative co-led by the Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) with support from the Intelligent Transportation Systems Joint Program Office (ITS-JPO) and other federal agencies such as NIDILRR.  The diverse needs of travelers with disabilities requires a diverse set of technology solutions. A synergistic approach is needed to find emerging technology solutions in assistive technologies and pair them with the recent advances of Intelligent Transportation Systems (ITS) to create transformative accessible transportation solutions to address such needs.

The USDOT recognizes the interdisciplinary nature of accessible transportation research and actively seeks opportunities to leverage resources, accomplishments, and technological advances both within and outside of USDOT. ATTRI has established collaborations with key federal partners and other

organizations such as the ICDR; Office of Disability Employment Policy, Department of Labor (ODEP/DOL); the U.S. Army Tank Automotive Research, Development and Engineering Center (TARDEC); National Aeronautics Space Administration (NASA); the U.S. Access Board; and other public and private organizations. Such partnerships can leverage technologies and innovations from federal and related disability R&D activities to improve accessible transportation for travelers with disabilities, and extend these benefits to all travelers.

The ATTRI initiative has conducted a state-of-the-practice/innovation scan and a stakeholder engagement/user needs assessment to identify promising technologies for development and user needs of travelers with disabilities. Final reports are planned for the end of 2015. ATTRI focus areas are described in figure 1 below.
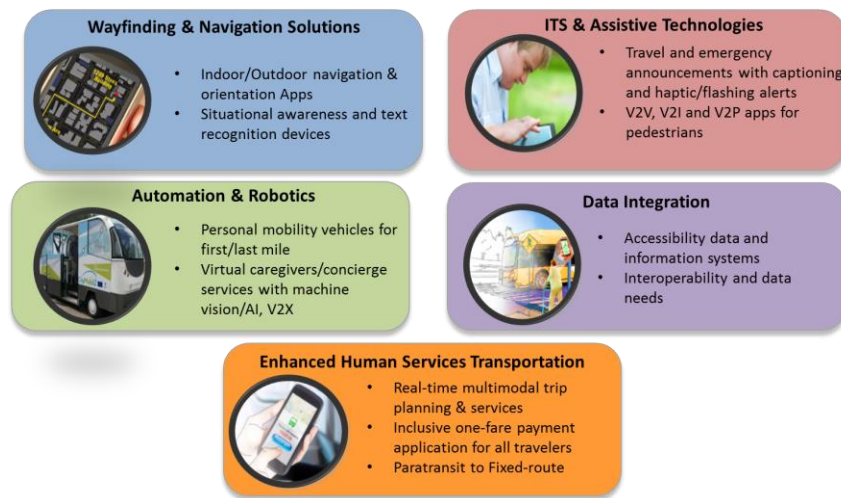


**Figure 1: ATTRI Areas of Focus** *(USDOT)*

By leveraging technologies and innovations from different federal intelligent transportation systems and related disability R&D activities, ATTRI can improve accessible transportation for travelers with disabilities, and extend these benefits to all travelers. The next step will be for ATTRI to move forward with developing transformative applications that can improve travel for all travelers, including those disabilities. The Roundtable kicked off this next stage by informing other federal agencies about ATTRI and their findings to date, and engaging federal agencies in a dialogue to identify their own interests and priorities and identify areas of mutual interest and potential future partnerships.

# Accessible Transportation Technologies Research Initiative (ATTRI)

## Presenters

- **Mohammed Yousuf**, Chair, Roundtable on Accessible Transportation Technologies Research & ATTRI Program Manager, Federal Highway Administration, USDOT
- **Bryna Helfer**, Deputy Assistant Secretary for Public Engagement, Office of the Secretary, USDOT
- **Ken Wood**, Program Specialist and Manager, Switzer Research Fellowship Program, NIDILRR
- **Bob Sheehan**, Program Manager, Multimodal ITS, ITS/JPO, USDOT

## Overview

ATTRI is a USDOT multimodal multiagency R&D effort to document user needs of travelers with disabilities in order to improve personal mobility, and extend these benefits to all travelers. ATTRI has established relationships at the international, national, state, and local levels with private research communities and diverse stakeholders. Through these partnerships, ATTRI seeks new opportunities to develop and deploy novel applications for accessible transportation by leveraging technology deployment and resources that will extend to all travelers. ATTRI is focused on five technology research solutions that are briefly explained below.

**Wayfinding and Navigational Solutions**

Wayfinding and navigation technology solutions are to explore and develop situational awareness and assistive navigation. Technology can provide obstacle avoidance and intelligent wayfinding capabilities in indoor and outdoor environments. These solutions utilize Global Positioning System (GPS), Geographic Information System (GIS), as well as ITS and Simultaneous Localization and Mapping (SLAM) to assist users with waypoint navigation, path planning, and advanced warning of events. Examples include:



**Wayfinding & Navigation Solutions**

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

- Ability to recognize and detect stationary objects (e.g., doors, elevators, stairs, crosswalks, and traffic lights) and communicate just-in time information (JIT) to the user.
- Ability to read and construct important text and signage based on a user's query or environment.
- Wearable, three-dimensional orientation devices or pedometers, used in conjunction with a wearable device to provide auditory and tactile guidance for wayfinding and navigation.

**Intelligent Transportation Systems (ITS) and Assistive Technology**

Intelligent Transportation Systems (ITS) and assistive technology utilizes a broad range of wireless and sensor-based communications and information technology. Assistive technology combines smart, accessible, assistive, and adaptive devices that help with transportation and daily living activities. Together, these technologies can track the user's movements to map routes in accessible formats based on the travel environment and user profile. The wearable or portable technology can "sense" the environment such as sidewalk obstacles and traffic conditions at street crossings using ITS infrastructure and sensors.

**ITS & Assistive Technologies**
- Travel and emergency announcements with captioning and haptic/flashing alerts
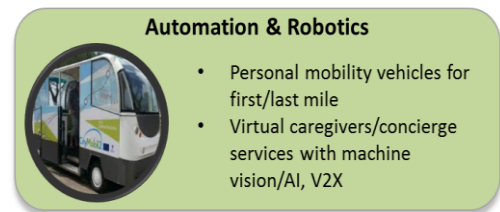- V2V, V2I and V2P apps for pedestrians

ITS and assistive technology examples include wearable technologies that allow smartphones, watches, wrist bands, glasses, and/or clothing to interface with vehicles, infrastructure, and pedestrians using Dedicated Short Range Communication (DSRC) or other communication technologies to provide connectivity of:

- Vehicle to vehicle (V2V).
- Vehicle to infrastructure (V2I).
- Vehicle to pedestrian (V2P).
- Internet of Things (IoT) (i.e. wearable devices, cars, thermostats, or cellphones, communicating/interacting with other things via the Internet).

**Automation & Robotics**

Automation and robotic technologies are expected to improve mobility for those unable to drive or who choose not to drive. Automation and robotic technologies may use machine vision, artificial intelligence (AI), assistive robots and facial recognition software. Assistive and collaborative robots can be used in a variety of ways to assist travelers with disabilities. When used in tandem, they can assist with activities in daily life such as walking, and provide related services to individual travelers and human transportation services at different stages of the travel and locations such as transit facilities, airports, and railway stations.

**Automation & Robotics**
- Personal mobility vehicles for first/last mile
- Virtual caregivers/concierge services with machine vision/AI, V2X

Automation and robotic examples include:

- Vehicle automation technology to solve ways to get travelers between where they are to existing public transportation or other transportation hubs and from public transportation stops to their desired destination.
- Virtual caregivers/concierge services can provide connectivity throughout travel and assist in travel decision making such as getting off at a desired bus stop.

**Data Integration**

Data integration technology works by integrating user profile information with service/infrastructure information. This technology includes information that travelers with disabilities can provide and information that they need. Travelers with disabilities need in-depth accessibility information about points of interest, infrastructure, facility amenities, and potential obstacles (both dynamic and static), integrated with maps and other information for their intended route and travel plans.

**Data Integration**
- Accessibility data and information systems
- Interoperability and data needs
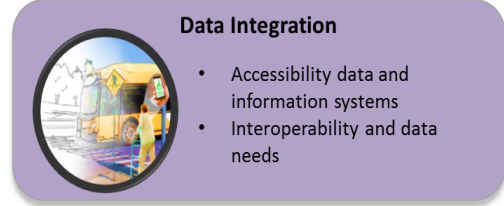
Data integration technology examples include:

- Pre-trip planning/booking services that can integrate the user mobility profile with accessibility needs for intended travel and planning.
- En route schedule, dispatch, and routing services integrate the needs of the traveler with the operation of the transit system. The integration technology allows travelers to know when there are elevator outages at a metro stop, or that an exit door is malfunctioning. Travelers can then make other arrangements or know what side of the train to exit while en route.

**Enhanced Human Service Transportation**

The enhanced human service transportation technology area focuses on real-time, multimodal trip, and services planning and traveler decision support applications. The technologies assist travelers with disabilities in finding and choosing accessible transportation solutions that best meet their traveler needs. These solutions create multimodal trip options based on origin and destination types.

**Enhanced Human Services Transportation**
- Real-time multimodal trip planning & services
- Inclusive one-fare payment application for all travelers
- Paratransit to Fixed-route

Enhanced human service transportation examples include:

- Integrated payment system where travelers can use the same smart card or mobile app to pay for various types of transportation, mobility options, and parking.
- Applications that link paratransit, demand-response transportation, and fixed-route transit in order to increase flexibility and options of travelers with disabilities.

ATTRI aligns with overall USDOT policy goals. Beyond Traffic 2045 is USDOT's 30-year framework to assess American transportation and the difficult challenges of the future. Ladders of Opportunity is an initiative to help more Americans reach opportunity by ensuring that our transportation system provides reliable, safe, and affordable ways to reach jobs, education, and other essential services.

# User Needs

The ATTRI user needs assessment focused on the end user: the person with a disability. It assessed the entirety of systems individuals with disabilities need and want to access, including education, health, financial, housing, employment, travel and leisure, recreation and fitness, community services, and family and social networks (see figure 2). A key driver for these systems and connections is transportation. The presence or lack of transportation a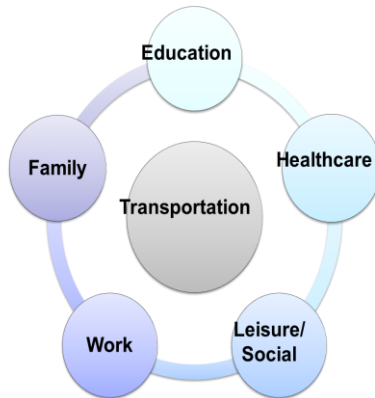ppears to have a profound effect on people with disabilities, including older adults and veterans with disabilities/wounded warriors more than other groups served by transportation.



**Figure 2: Relationship between transportation and user needs (USDOT-ITS/JPO)**

USDOT held a series of webinars and workshops to align the five ATTRI target technology areas to identified travel needs in vision, mobility, hearing and cognition. The three webinars held during March and April 2015 reached over 700 individuals and focused on the needs of people with disabilities, older adults, and veterans with disabilities. A user needs assessment workshop in April 2015 reached over 70 individuals. Stakeholder input helped to identify top user needs and barriers, as well as the leading technology issues.

## Identified Barriers

Participants provided 965 responses to the question, "Describe barriers to safe, independent travel." The top eight barriers were:

1. Lack of accessible signage/maps/landmark identifiers/announcements.
2. Navigation difficulties (do not know when to arrive, transfer time, distance).
3. Inconsistent accessible pathway infrastructure.
4. Lack of accessible service, facility information.
5. Lack of available transportation (limited hours, vehicles, service area, etc.).
6. Weather.
7. Limited or no accessible amenities (restrooms, benches, shelter, water fountains).
8. Unreliable transportation (fleet, equipment, on-time performance).

USDOT received over 1,203 responses to the question "Describe your needs." Of the responses, over 69% were related to traveler information. The top 10 needs were:

1. Amenity information (e.g. restroom, shelter).
2. Real-time transportation information.
3. Safety, security and emergency information.
4. Traveler help line/customer service.
5. Connected, continuous, accessible pathways.
6. Transit schedule and other information.
7. Destination information (hours, entrances, layout).
8. Mapping/directions.

9. Roadway/pathway real-time conditions.
10. Personal care attendant or other assistive/training services.

A total of 275 participants answered the question, "What issues might you have with new technology?" The top seven issues were:

1. Training and awareness of new technology.
2. Affordability.
3. Performance quality (especially long-distance travel, rural areas).
4. Accessibility to all disability types.
5. Integration and compatibility with existing technology.
6. Maintenance.
7. Confidentiality and theft.

The top two responses related to training and affordability correspond to previous research including online dialogues on accessible transportation technology conducted by Easter Seals.

## State of the Practice Scan

**Technology Scan**

The purpose of the technology scan was to identify current practices with technology in accessible transportation, assistive technologies, applications, and systems for travelers with disabilities. Examples included:

- Google Maps or similar technologies to help people navigate while driving in unfamiliar areas.
- Accessible GPS in portable standalone devices and software solutions that use technologies such as talking menus and talking maps. These devices integrate information from a variety of sources to allow the user to create and save routes and points of interest (POI).
- Coordinated & multimodal fare systems in public transportation such as in the San Francisco Bay Area where travelers use the Clipper Card, a single fare card that works across many different transit systems.
- In-vehicle collision avoidance systems, such as systems that provide blind spot warnings.
- Pedestrian warning systems.
- Automated vehicle parking.

**Innovation Scan**

The purpose of the innovation scan was to identify other research or demonstrations currently being conducted, or innovative practices in other countries that offer technological innovations for accessible transportation in the U.S. Examples included:

- **AccessMyNYC** is a web application with multimodal transportation options including public transportation, private vehicles, and walking. Directions are integrated with information about points of interest.
  - Directions have embedded accessibility details.
  - Personalization of the application for the abilities and favorites of the user.
  - Users can rate accessibility for the benefit of subsequent users.

- **Tactile Kiosks (Tokyo Transit)** are station maps in prominent locations in train stations with kiosks that integrate Braille (raised lines in maps with high contrast colors and control buttons for integrated audio).
- **Novel Fare Gates (Seoul)** are low smartcard reader placement height and wide, barrier free gates that can be used by everyone.
- **3D Soundscape Technology (Microsoft)** are useful for individuals with low or without vision. Directly provides the user with navigation and other information about the person's immediate area.
  - Bluetooth beacons installed around a city.
  - Beacons send information directly to bone-conducting headphones that have GPS location capability.
  - Information can include directions, POI information, and other information relevant to the person's immediate area.
- **Tiramisu Transit (Rehabilitation Engineering Research Center on Physical Access and Transportation)** is a smartphone app for use on public bus systems.
  - Collects and generates crowdsourced real-time accessibility information from riders about delays, occupancy, accessibility of buses and bus stops.
  - Information from riders is aggregated and processed by the system, and made available to all app users and tailored to their requests for info about specific buses and locations.
  - Merges agency-supplied data with transit rider observations.
  - Can assist with current and future travel.
  - The app has universal design features so it supports users with a wide variety of multiple disabilities.

## Application Priorities

ATTRI published a request for information in February 2015 to gain insight on technology applications and receive informed input from researchers, technology experts, and others to identify future focus areas of application. Responses informed a two-day public workshop in May 2015 to prioritize potential application development direction. Workshop participants considered the ATTRI technology areas, user needs, and functional areas. Some foundational considerations included the need for a standard accessible data platform, universal design, integrated payment, and leveraging existing technologies. They categorized and prioritized applications according to four technology areas with examples of such technologies in the order of priority as established by the workshop participants is as follows:

1. **Smart Wayfinding & Navigation**
   - Navigation Systems including smartphone-based navigation systems for indoor/outdoor use, and beacons or electronic tags to interact with the built environment.
   - Wearable, discreet assistive navigation tools and those that connect with assistive devices already in use (e.g. white cane).
   - Community Navigators or community volunteers who provide data on their neighborhoods.
2. **Pre-Trip Concierge & Virtualization**
   - Pre-Trip Concierge to provide pre-trip and en route traveler information (crowd sourced) for people with blindness, low vision, cognitive and mobility issues.
   - Virtualization to help passengers "see" their entire routes on an app with landmarks (to remove fear and facilitate independent mobility), or help planning routes and tracking traveler's movement through a virtual caregiver.
3. **Shared Use, Automation & Robotics**

- Robo-Ped - Automated robotic characterization of pedestrian zones that is crowdsourced/fleet, networked in real time, and provides market intelligence in a smartphone/mobile app.
  - RoboScout – Machine and robotic crosswalk assistant that leverages existing ITS and V2I technologies.
  - RoboSAV - Slow-speed automated vehicle connectivity that provides autonomous assistance to destination in a constrained environment.
4. **Safe Intersection Crossing**
  - Pedestrians interface with traffic signal and vehicle receive alerts.
  - Automated intersection crossing assistance.
  - Design for people with blindness, low vision, cognitive, and mobility issues.
  - Beacons or electronic tags to interact with the built environment.
  - Multiple communication formats (visual, audible, haptic) including multiple languages.

# Interagency Dialogue

ATTRI has completed exploratory research and user needs assessments and is moving into selecting applications to develop concepts of operation and prototype. Transportation is a complex challenge that affects all aspects of life, including health, education, recreation, social, and economic activities. Accessible transportation requires a multiagency approach. To move forward with application development, this initiative needs multi-agency collaboration to leverage resources that can address transportation and mobility challenges in a comprehensive way.

The roundtable invited agency representatives from CDC, ACL, FCC, USDOT, U.S. Access Board, NIH, Army/TARDEC, SSA, DOL, and DOS for an interagency dialogue to gain input into the initiative and explore potential partnerships. Questions posed to the federal agency representatives.

1. What existing research initiatives exist that might be leveraged to support accessible transportation technologies?
2. What other ongoing efforts exist that can advance accessible transportation technologies?
3. What other federal resources might support the activities and development of technology applications with ATTRI?

## Global Perspective

Judith Heumann, Special Advisor for International Disability Rights from DOS shared her thoughts about international perspectives and implications for coordinated accessible transportation research and partnerships. The U.S. provides aid and consultation overseas including funding for transportation systems, however those projects are not automatically accessible. If accessibility is not considered and a country builds an inaccessible system, there is no other funding to correct it. Heumann and other agency representatives identified issues that occur when accessibility is not considered:

- **Mongolia**. A town, not aware of the need for accessibility, bought inaccessible refurbished buses from Korea. Heumann encountered a similar situation in Vietnam.
- **Vietnam**. People with hearing impairments are not allowed to drive.
- **Japan**. Scooter chairs are not allowed on trains.
- **Afghanistan**. A university did not have the same structure/transportation standards as the U.S. so the university was not being built with accessibility in mind.
- **China**. The concept of accessibility may not be the same as in the U.S. At an international conference, they had workers who carried people, in their wheelchairs, up and down the stairs.

A more positive example was in Ethiopia. During the planning stage for a light rail system, DOS brought in the U.S. Access Board to consult on accessibility design. The DOS has programs that bring in people from other countries to learn about topics and systems. These may be a potential source of information exchange.

**Discussion**

- We need to raise our expectations and take what we have learned in this country and apply it internationally.
- It would help to have a common understanding of accessibility.

- Governments do not know what type of contract language to use so without accessibility standards in the contract, the results are inaccessible.
- NIH was approached about standards for mobility in other countries and sharing technologies.
- USDOT is involved with international transportation projects and can be a resource.

## Interagency Perspectives

**Invited Panelists**

- **Allison Cernich**, PhD, Director, National Center for Medical Rehabilitation Research (NCMRR), Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHHD), National Institutes of Health (NIH)
- **Gina Clemons**, Associate Commissioner, Office of Disability Policy (ODP), Social Security Administration (SSA)
- **Michael Reardon,** Policy Advisor Team Lead, Office of Disability Employment Policy (ODEP), U.S. Department of Labor (DOL)
- **Edward Straub**, Program Manager, Tank Automotive Research Development and Engineering Center (TARDEC), Applied Robotics for Installation and Base Operations (ARIBO), U.S. Army

**NCMRR/NIH**

Through basic, translational, and clinical research, the NCMRR aims to foster development of scientific knowledge needed to enhance the health, productivity, independence, and quality-of-life of people with physical disabilities. The NCMRR supports research on the following topics: pathophysiology and management of chronically injured nervous and musculoskeletal systems; repair and recovery of motor and cognitive function; functional plasticity, adaptation, and windows of opportunity for rehabilitative interventions; rehabilitative strategies involving pharmaceutical and neuroengineering approaches, exercise, motor training, and behavioral modifications; pediatric rehabilitation; secondary conditions associated with chronic disabilities; improved diagnosis, assessment, and outcome measures; and development of orthotics, prosthetics, and other assistive technologies and devices. NCMRR works to coordinate rehabilitation research across the institutes and centers within the NIH and works with other federal partners to ensure a coordinated federal strategy in the area of physical disability and rehabilitation.

Cernich identified some mobility solutions being developed at NCMRR and throughout NIH. Each of the institutes have wide-ranging interests in transportation such as:

- Off-body robotics to aid in navigation and wayfinding or to provide assistance with load carrying.
- Adaptive mobility solutions (e.g., wheelchairs, scooters) that can traverse raised curbs, uneven or rugged natural surfaces, and/or stairs.
- Technologies that ease mobility for individuals with significant functional limitations in both the lower and upper extremities.
- Assistive technologies with learning features that can assist in wayfinding, public transportation system access and use, and problem solving in the face of delay or service disruption.
- Systems that allow or provide less intrusive or noticeable guidance for navigation to increase adherence with device use.
- Transportation and cueing systems including tongue-sensor guidance.

**ODP/SSA**

Office of Disability Policy's (ODP) mission is to create and ensure effective policy to empower individuals with a disability and minimize financial hardship by providing timely benefits to the right individuals in the right amount in accordance with the program's statutory intent. In fulfilling this mission, the ODP plans, develops, evaluates, and issues substantive regulations, policies, and procedures for the SSA administered disability programs. Additionally, the ODP provides expert advice, develops, and promulgates policies and guidelines for state, federal, and private medical contractors to support SSA's disability determination process. To further support the administration of the disability program, the ODP also provides medical reviews by medical consultant contractors for State Disability Determination Services, federal disability adjudicators, the Office of International Operations, and the federal quality review process.

The Disability Trust Fund is projected to be depleted in 2016 so SSA has an urgent interest in getting people employed. The Institute of Medicine (IOM) is currently conducting an environmental scan to identify potential solutions. SSA has limited involvement on the issue of accessible transportation, however they can provide access to surveys and data sets for research purposes. For instance, the National Beneficiary Survey (NBS) is a national survey established by the SSA and administered by Mathematica Policy Research. The survey sample includes working age Social Security Disability Insurance (SSDI) and Supplemental Security Income (SSI) beneficiaries (n=2,298) and Ticket to Work (TTW) program participants (n=2,780).[1]

Social Security beneficiaries with disabilities list transportation, which must be accessible, as a critical missing piece that would enable them to return to work. Some transportation-related findings from the NBS:

- For those not working, "lack of reliable transportation to/from work" was cited as a reason for unemployment for 15.3% of all beneficiaries, 21.2% of SSI beneficiaries, 10.9 % of SSDI beneficiaries, and 19.2% of concurrent beneficiaries.
- For those working at the time of the interview, reliable transportation to/from work is a type of support that would help with work or increase earnings for 16.9% of all beneficiaries, 25.5% of SSI beneficiaries, 15.5% of SSDI beneficiaries, and 11.3% of concurrent beneficiaries.

**ODEP/DOL**

ODEP's mission is to develop and influence policies and practices that increase the number and quality of employment opportunities for people with disabilities. Access to reliable and accessible transportation is perhaps the most critical, and often the least appreciated, component of any person's ability to secure and maintain worthwhile employment. In order to fill in critical gaps in transportation services that impact the employment of Americans with disabilities, federal, state, and local agencies and transportation funders and providers must coordinate their respective efforts. ODEP has taken an aggressive policy approach to this critical issue. As a policy office, ODEP does not directly fund research. ODEP's employment-related transportation work includes:

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[1] Sample size is for 2010 and reflects actual completed interviews.

- **United We Ride**. An ODEP-funded interagency initiative supported open dialogue with key stakeholders using their collaborative workspace.
- **National Council of State Legislatures**. An effort to model legislation to increase employment-related transportation options for people with disabilities and other transportation-disadvantaged groups. The model legislation, accompanied by targeted technical assistance from intermediary staff, resulted in more than 30 states adopting proposed language with relatively little investment in resources or time. ODEP will soon greatly expand this effort to include other intermediaries and will independently evaluate its effectiveness as a policy translation tool.
- **[Partnership on Employment & Accessible Technology (PEAT)](#)**. An ODEP-funded initiative that disseminates information about transportation technology and initiates discussions in that arena.

The tremendous advance of technology has become in many ways the great equalizer for people with disabilities who are job seekers or who wish to move ahead in their professions. Taking advantage of this technological revolution, ODEP has focused on promoting universal design in information technology, and on increasing the availability of accessible technology for use in the workplace to benefit those with disabilities. The significant increase of new wayfinding and other technologies in recent years has greatly increased the ability of millions of Americans with mobility challenges to get to their jobs, their local businesses and their community supports.

### TARDEC/Army

The number of variables with advanced technologies in chaotic and complex environments is incalculable. As city microcosms, military installations can be testing grounds for technologies in more controlled environments. TARDEC's mission is to develop, integrate, and sustain the right technology solutions for all manned and unmanned Department of Defense (DoD) ground systems and combat support systems to improve current force effectiveness and provide superior capabilities for the future force. TARDEC helps the Army achieve enduring value through a number of means, including (1) developing advanced capabilities for the military; (2) maximizing adaptability and flexibility of current and future platforms; (3) reducing manpower, logistics, and similar burdens on the battlefield; and (4) improving operating efficiencies, such as reductions in space, weight, power, cooling requirements, and fuel and energy consumption for ground vehicles.

An example of technology testing on military installations are automated vehicles that transport soldiers for medical appointments at Ft. Bragg. The automated six-passenger golf cart can follow sidewalks and navigate roads to provide door-to-door transportation. Other related research includes.

- **Manned-unmanned teaming.** Objective is to integrate unmanned vehicles with humans as 'members' of the team.
- **Automated ground resupply.** Vehicle that can behave appropriately and can classify obstacles and navigate rough and complex terrain without requiring a human operator.
- **Degraded visual environment.** Vehicles with improved situational awareness capable of navigating through dusty and other adverse environments.
- **Unmanned Ground Vehicles (UGV) Interoperability Profiles (IoP) standard.** IoP V1.0 defines software and hardware interfaces for UGVs. It establishes payload/controller modularity with UGVs. The project will expand to establish interoperability with key external systems.

- **GVR-bot research platform**. A low-cost, open-architecture, Robot Operating System (ROS) based small robot with a growing user community and limitless applications.
- **ARIBO.** Deploys robots in real-world situations that can be bounded and somewhat controlled. Objective is to obtain improved technical reliability, data for informed policy decisions and system design, and increased trust and confidence in automated systems.
- **Shared vehicles.** One shared vehicle can reduce privately-owned vehicles by a range of 4-9 vehicles. TARDEC would like to explore how to put shared vehicles into continuous use instead of spending about 90% of time parked.

## Concerns

Over the course of the roundtable, agency representatives voiced a number of concerns for development projects.

- There is a need to consider the privacy of data being shared with intelligent systems.
- For autonomous vehicles, it will be important to make sure that the vehicles are aware of pedestrians. Blind pedestrians have no way of knowing a quiet vehicle is approaching on a pathway.
- Make sure that there is a way to get inventions and innovations to the ultimate users. Many new technologies are not covered for use/purchase, and are not affordable.
- It is important to test technologies in the natural environment that they will be used in.
- Listening to consumers is imperative.
- There needs to be a way for agencies to share what accessible transportation projects and research is already being funded. The ICDR has talked about doing this.

## Suggested Future Partnerships

Agency representatives engaged in a lively dialogue, sharing their knowledge and identifying a number of collaboration opportunities.

- **NIH** suggested opportunities to collaborate including:
  - Development and validation of assistive technology devices that accommodate for physical, sensory, and/or cognitive disability that provide options for combinations of these impairments for a single individual.
  - Off-body robotics for navigation and load-carrying with a concentration on user safety and robot-human interaction.
  - Development of systems to coordinate federal sharing of mobility, accessibility, and transportation solutions to promote the use of these solutions in the medical, home/community, employment, and educational settings for individuals with disabilities.
- **ODEP/DOL** has success in the past in working with USDOT on employment-related transportation issues and their current emphasis on technology policy. Therefore, ODEP has committed to sponsoring an "app challenge" and co-sponsorship other efforts to develop employment-related transportation technology.
- **TARDEC/Army** is open to the possibility of pilot-testing technologies developed through ATTRI on military bases.
- **SSA** welcomes collaborative efforts to improve transportation options for beneficiaries who want to work or workers with disabilities who want to remain in the workforce rather than apply

for disability benefits. Another potential source for research funding is the SSA Disability Research Consortium.

- **Access Board** is updating vehicle accessibility guidelines.
- **Environmental Health Center, CDC** examines how the environment promotes or detracts from health including healthy aging and disability and health. Examples include:
  - University of Illinois, Chicago's work in health empowerment zones and identifying key factors at the neighborhood level.
  - The AARP Livability Index provides a livability score that supplies information about factors such as transportation, health, and access to life, work and play for a given address.
  - Surgeon General's Every Body Walk! Initiative includes facts, materials and guidance on public transportation and wheeled mobility.
  - National Buildings Organization initiative in Atlanta working to make the building codes consistent with transit options.
- **Partnership on Employment & Accessible Technology (PEAT)**, funded by ODEP, can disseminate information about transportation technology and initiate discussions in that arena.
- **Small Business Innovation Research (SBIR)** has a potential funding source for projects, where 11 federal agencies fund extramural R&D for small business.
- **NIH's Office of Behavioral and Social Sciences Research (OBSRR)** is interested in health disparities and built solutions in lower socioeconomic status environment. Some of the pilot programs are studying the health effects of justice, health, education, and income.
- **Department of Energy** has 30,000 robots that are out of use. TARDEC is working with Energy and universities to create an open architecture system and an ability to control the robots with a laptop and Wi-Fi.
- **TARDEC Automated Vehicle** might have potential for partnerships between its automated vehicle test and the ATTRI Connected Vehicle Program. The connected vehicles current transmit messages ten times/second. Within a few years, these vehicles will identify themselves through signals.
- **ACL** can play a part in informing the work of ATTRI. ACL funds programs in every state for aging, independent living, and assistive technology.

# Biographical Information

## Leadership

**John Tschida, Chair, Interagency Committee on Disability Research (ICDR)**
Director, National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR)
Administration for Community Living (ACL)
U.S. Department of Health and Human Services (HHS)

John Tschida has spent the last 15 years using data and research to drive policy change. He comes to NIDILRR from Allina Health in Minnesota, where he served as director of public policy and innovation. In this role, he was developing integrated health delivery systems and financing models for people with disabilities. Allina Health recently merged Courage Center, Minnesota's leading nonprofit rehabilitation service provider, where for 14 years Mr. Tschida led a public policy and research team that focused on defining and achieving better outcomes for complex populations. His team received one of the first Health Care Innovation Awards distributed by CMMI at CMS. Prior to joining Courage Center, Mr. Tschida served as a research fellow at the National Rehabilitation Hospital Center for Health and Disability Research. Earlier in his career, he served as assistant director of the Minnesota House of Representatives Public Information Office. A graduate of Macalester College, Mr. Tschida holds a Master's degree in Public Policy and Health Services Research certificate from Georgetown University.

**Mohammed Yousuf, Chair, ICDR Roundtable on Accessible Transportation Technologies Research**
Research Transportation Specialist, Federal Highway Administration (FHWA)
U.S. Department of Transportation (USDOT)

Mohammed Yousuf is Program Manager for the Accessible Transportation Technology Research Initiative (ATTRI). He is leading the Universal Automated Community Transport (UACT) research project to develop a service concept for an inclusive automated community transport application for first mile last mile, paratransit and neighborhood travel. He is also leading research on new technology solutions for wayfinding and navigation guidance for people with vision impairments and other disabilities, under FHWA's Exploratory Advanced Research. He is involved in research related to wireless communications, positioning and navigation technologies for connected and automated vehicles. Prior to joining FHWA, he worked at General Motors and Chrysler Group. As a member of the White House GeoAccess Challenge Team, Mr. Yousuf co-authored the report, Data-Enabled Travel: How Geo-Data Can Support Inclusive Transportation, Tourism, and Navigation through Communities. He is a member of the FCC Disability Advisory Committee, National Robotics Initiative, Interagency Committee of Disability Research (ICDR) and Transportation Research Board committee on accessible transportation and mobility. He holds a BS in Electronics and Communication Engineering and a MS in Computer Engineering.

## Speakers

**Alison Cernich, Director**
National Center for Medical Rehabilitation Research (NCMRR)
Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHHD)
National Institutes of Health (NIH)

Alison Cernich, PhD serves as the Director of the National Center for Medical Rehabilitation Research (NCMRR) at the Eunice Kennedy Shriver National Institute of Child Health and Human Development, National Institutes of Health. She provides oversight for the portfolio of NCMRR and works within NIH to coordinate rehabilitation research. She serves on multiple interagency strategic planning committees and government oversight committees for major research initiatives in the federal government. She received her doctoral degree in Clinical Psychology from Fairleigh Dickinson University (FDU). She previously served as the Deputy Director for the Defense Centers of Excellence for Psychological Health and TBI (DCoE). She was previously the Director of Neuropsychology and Director of the Polytrauma Support Clinical Team at the VA Maryland Health Care System (VAMHCS). She is the lead or contributing author on multiple peer-reviewed articles and conference presentations, with a specific emphasis on traumatic brain injury and computerized neuropsychological assessment.

**Gina P. Clemons, MGA, PhD, Associate Commissioner**
Office of Disability Policy (ODP)
Social Security Administration (SSA)

Gina Clemons, PhD joined the Social Security Administration (SSA) in 2011 and is currently the Associate Commissioner for the Office of Disability Policy. Previously, Dr. Clemons was the director of the Department of Veterans Affairs (VA) Research Office of Communications, where she led VA Research's strategic planning efforts and the formulation of policies, procedures, and guidelines to optimize the effectiveness of VA's research programs. Dr. Clemons also has an extensive 13-year work history at the Centers for Medicare and Medicaid Services (CMS) where, among other positions, she served as lead for the End Stage Renal Disease Network Program; director of Eligibility, Enrollment, and Outreach within the Disabled and Elderly Health Programs Group; and CMS lead on issues related to limited English proficiency, homelessness, and Medicare/Medicaid dual eligible issues. Prior to her positions within the Federal Government, as the national director of provider relations for Dental Benefit Providers, Dr. Clemons was responsible for overseeing the provider relations activities in twenty-four states, and served as faculty member and research coordinator at the University of Maryland Dental School. She earned her Master of General Administration degree, with a Health Care Administration concentration, and her PhD in Health Care Public Policy through the University of Maryland system.

**Bryna Helfer, EdD, Deputy Assistant Secretary for Public Engagement**
U.S. Department of Transportation (USDOT)

Bryna Helfer, EdD has over 25 years of experience initiating, leading, and facilitating interagency coordination, program development, strategic planning, program evaluation, and systems change initiatives. She has a long history of coalition building at the federal, state, and local levels, and is known for her ability to forge partnerships between governmental programs and community based organizations. Prior to joining the Transportation, Dr. Helfer was the Senior Director of Civic Engagement for the National Academy of Public Administration. Her earlier federal experience includes the U.S. Government Accountability Office and the Federal Transit Administration. From 2002-2007, Dr. Helfer

served as a senior staff advisor for the Federal Interagency Coordinating Council on Access and Mobility, leading efforts to coordinate policies, programs, and services across eleven federal departments to enhance transportation services for people with disabilities, older adults, and individuals with lower incomes. The U.S. Department of Transportation presented Dr. Helfer with its Meritorious Service Award for United We Ride and its Gold Medal Award for her work in Gulf Coast recovery efforts after Hurricane Katrina.

**Judith Heumann, *Special Advisor for International Disability Rights***
U.S. Department of State (State)

Judith Heumann is an internationally recognized leader in the disability community and a lifelong civil rights advocate for disadvantaged people. In June 2010, she was appointed to her current position as the Special Advisor for International Disability Rights at the U.S. Department of State. As the Special Advisor, Heumann leads the Department efforts to encourage and assist foreign governments and civil society organizations to increase their commitment and capacity to protect the rights, and ensure the inclusion and full participation of persons with disabilities. She served as the World Bank's first Advisor on Disability and Development and served in the Clinton Administration as the Assistant Secretary for the Office of Special Education and Rehabilitative Services in the Department of Education from 1993 – 2001. She previously worked with numerous disability rights organizations including co-founding the World Institute on Disability and the Center for Independent Living in Berkeley, California.

**Kenneth M. Leonard, *Director***
Intelligent Transportation Systems Joint Program Office (ITS-JPO)
U.S. Department of Transportation (USDOT)

Kenneth M. Leonard serves as the Director of the U.S. Department of Transportation Intelligent Transportation Systems Joint Program Office (ITS-JPO) and is a member of federal government's Senior Executive Service. Mr. Leonard has over 30 years of federal government and private sector leadership experience providing solutions in transportation, energy, investment decision making, defense, environment, regulatory affairs, and information systems. He joined the ITS JPO from the Federal Motor Carrier Safety Administration (FMCSA), where he served as a Senior Policy Advisor and Director of the Office of Analysis, Research and Technology. Previously Mr. Leonard served as Federal Aviation Administration (FAA) Director of Aviation Weather, led the FAA's Technology Development Office and was manager of Investment Analysis. Mr. Leonard is a graduate of the George Washington University School of Public and International Affairs, where he earned a Bachelor's Degree in International Economics and completed graduate-level studies in Economics and Finance.

**Michael Reardon, *Policy Supervisor***
Office of Disability Employment Policy (ODEP)
U.S. Department of Labor (DOL)

Michael Reardon is a Policy Supervisor for the Office of Disability Employment Policy at the U.S. Department of Labor. He directs ODEP's Employment Supports Policy Team, which addresses a wide range of issues affecting the employment of people with disabilities, including transportation, housing, accessible technology and health care. A Federal 100 award winner and Secretary of Labor Innovation Award Honoree, he previously served in the Department of Transportation's Office of Civil Rights and with the Presidential Task Force on Employment of Adults with Disabilities. He came to Washington, D.C. from Columbus, OH where he was Director of the Ohio Developmental Disabilities Alliance.

**Bob Sheehan, PE, PTOE, Program Manager**
Federal Highway Administration (FHWA)
Office of Operations - Transportation Management
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Bob Sheehan directs the Multimodal Intelligent Transportation Systems Research and Connected Vehicle - Vehicle to Infrastructure efforts. He joined the Federal Highway Administration in August 2008 and managed the U.S. Department of Transportation's Integrated Corridor Management (ICM) Initiative and Active Transportation and Demand Management program until 2013 when he moved to the ITS-JPO. Prior to joining the FHWA, Mr. Sheehan spent 8 years at the Virginia Department of Transportation (VDOT), Northern Region as the Field Operations Manager for the Smart Traffic Signal System and as the Freeway Operations Engineer for the Smart Traffic Center. He received his Professional Engineer license in 2004 and his Professional Traffic Operations Engineer certification in 2008. He holds a Master's Degree in Transportation Systems from Virginia Tech and a Bachelor's Degree in Civil Engineering from West Virginia University.

**Edward Straub, Program Manager**
Applied Robotics for Installations & Base Operations (ARIBO)
TARDEC/U.S. Army

Edward Straub is a program manager and researcher with the U.S. Army. He is responsible for a unique program which takes an innovative approach to technology transition by integrating robotic systems into daily operations at military installations. Previous work includes consulting and strategic planning for defense organizations, automotive, and utilities companies in acquisition process improvement, organizational development, supply chain management, and software system integration. He is a former Marine and completed his Doctor of Management degree from Case Western Reserve University in 2015. Mr. Straub's area of study is team dynamics and human systems.

**Ken Wood, PhD, Rehabilitation Program Specialist**
National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR),
Administration for Community Living (ACL)
U.S. Department of Health and Human Services (HHS)

Ken Wood, PhD has served as Rehabilitation Program Specialist at NIDILRR for over seven years. He currently manages the Switzer Research Fellowship Program and serves as project officer for many NIDILRR grantees, including the data and statistical centers for the Burns Model Systems, Spinal Cord Model Systems, and Traumatic Brain Injury Model Systems. Before joining NIDILRR in 2007, he was a research scientist for many years at the Kessler Institute for Rehabilitation, making contributions in disability and rehabilitation research in the areas of rehabilitation outcomes, outcomes measurement, and family support of individuals with disabilities. He also managed data collection for and the operation of a large national database of brain injury survivors. Prior to that, he taught sociology at Laurentian University in Ontario, Canada. Dr. Wood has a PhD in sociology from Stanford University.

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# About the
## Interagency Committee on Disability Research

## Mission

The Interagency Committee on Disability Research (ICDR) promotes coordination and cooperation among federal departments and agencies conducting disability, independent living, and rehabilitation research programs. The ICDR was established by the 1973 Rehabilitation Act, as amended by the Workforce Innovation and Opportunity Act in 2014. The specific duties of the ICDR are:

- Identify, assess, and seek to coordinate all federal programs, activities, and projects, and plans for such programs, activities, and projects with respect to the conduct of research related to disability and rehabilitation research, including independent living, assistive technology, and universal design research;
- Obtain input from policymakers, representatives from federal agencies, individuals with disabilities, organizations representing individuals with disabilities, researchers and providers;
- Share information about research being carried out by members of the Committee and other federal departments and organizations;
- Identify and make efforts to address areas of research that are not being adequately addressed;
- Identify and establish clear research priorities;
- Promote interagency collaboration and joint research activities and reduce unnecessary duplication of effort;
- Optimize the productivity of Committee members through resource sharing and other cost-saving activities; and
- Develop a comprehensive government wide strategic plan for disability, independent living, and rehabilitation research.

## Executive Committee

The ICDR is chaired by the Secretary of the U.S. Department of Health and Human Services or her designee. The authorizing statute identifies the leadership from 16 other departments, agencies, and offices, as well as others the President may designate, as statutory members who provide leadership and oversight for the committee. Statutory members include:

- Secretary of Health and Human Services,
- Director of National Institute on Disability, Independent Living, and Rehabilitation Research,
- Commissioner of Rehabilitation Services Administration,
- Assistant Secretary of Special Education and Rehabilitative Services,
- Assistant Secretary of Labor for Disability Employment Policy,
- Secretary of Defense,
- Administrator of Administration for Community Living,
- Secretary of Education,
- Secretary of Veterans Affairs,
- Director of National Institutes of Health,
- Director of National Institute of Mental Health,
- Administrator of National Aeronautics and Space Administration,

- Secretary of Transportation,
- Assistant Secretary of the Interior for Indian Affairs,
- Director of Indian Health Service,
- Director of National Science Foundation, and
- Administrator of Small Business Administration.

Other federal departments, agencies, and offices can designate representatives to the ICDR as non-statutory members. ICDR standing committee co-chairs also participate. The Executive Committee meets quarterly.

## Standing Committees

Standing committees carry out many of the ICDR duties, in their specific area of interest. Each standing committee is led by volunteer co-chairs representing different agencies. Membership is open to federal employees and external stakeholders. Standing committees meet regularly. Standing committees can be created or discontinued in response to ICDR priorities. The current Standing committees are focused on five topical areas:

- Assistive Technology,
- Disability Statistics,
- Employment,
- Medical Rehabilitation, and
- Health and Health Disparities.

## For More Information

The ICDR welcomes the participation of federal representatives, researchers, individuals with disabilities and their representatives, and others with an interest in disability, independent living, and rehabilitation research. More information about the ICDR can be found at ICDR.acl.gov or by sending an email to ICDRinfo@neweditions.net.