



Fort Bragg Autonomous Warrior Transport On-base Participant Guide

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1 Overview

Applied Robotics for Installation and Base Operations (ARIBO) is a nation-wide program to join technology with operational needs to demonstrate and evaluate autonomous systems in real-world, semi-controlled environments. ARIBO aims to familiarize people, whether users or non-users, with autonomous and semi-autonomous technologies to build trust and confidence in these new technologies while collecting valuable operational and performance data.

The Autonomous Warrior Transport On-base (AWTO), an ARIBO Program, is addressing the real-world needs of the Warrior Transition Battalion (WTB) at Fort Bragg. The soldiers in this battalion, some of whom have mobility difficulties, often require transportation assistance from the barracks to the Womack Army Medical Center (WAMC). TARDEC and Robotic Research are utilizing robotic technology to provide an unmanned transport system and reservation/reminder system for these soldiers and caretakers. The Program uses a multi-phase approach to gradually build trust and establish safety and reliability metrics for the system.

In the first phase, the test-vehicles (herein referred to as the *Shuttle*) will be controlled by human operators. Passengers can familiarize themselves with the system while data and statistics are collected on the vehicle for evaluation. The follow-on phases will begin to gradually introduce more and more autonomous capabilities, eventually removing the human operator completely. By establishing the practical capabilities early on in a real-world environment, the Army can determine the cost-benefit of transitioning these technologies to other on-base applications. Lessons learned and component improvements may also transition to more complex tactical environments. Nexus EMC is responsible for developing and supporting the implementation of this Evaluation Plan to quantify the performance of this groundbreaking technology.

This technical evaluation will be continually monitored by the engineering team. Shuttles have been operated by engineers from the development team in the actual operating environment since August 2015, continually tuning the technology to the conditions. The Shuttle will be remotely monitored in real time at the duty desk at WTB for the duration of the Program. Because distances involved in this Program are so short (about 1/2 mile) the Shuttle will never be more than about 200m from either WTB or WAMC so humans can respond quickly to an emergency.

The Program will proceed in three phases. Each of the phases and their associated risk analysis are listed below. Please note that each phase carries forward the risks of the previous phase in addition to the ones listed; as such, the Phase Risk Assessment is accumulative:

PHASE 1

Phase 1 is the chauffeured phase where a trained human driver operates the Shuttle with the passenger(s). Because the use of OEM components on the Shuttle control systems have been maximized, there is essentially no difference between driving this Shuttle and a GSA-purchased electric golf car. Sensors and the autonomy system run in the background collecting data (but not



controlling the Shuttle with the passenger). Data from the driver and the robot is compared and - after engineers and leadership are confident in the performance - the Program moves to Phase 2.

PHASE 2

Phase 2, the driver becomes a safety operator. The robot is now controlling the Shuttle and the safety operator is ready to take control in the event of an emergency.

PHASE 3

Phase 3 removes the human safety operator; the shuttle is fully autonomous. Phase 3 will not occur until leadership is confident that the data collected shows the Shuttle to be safe and reliable.

1.1 Route

The shuttle will transport participants over a roughly one-mile, round-trip route. This route has been divided into five (5) *route zones* that combine a series of potential scenarios that the shuttle will encounter such as navigating an intersection or operation in a parking area. During the first phase of the evaluation, passengers will only ride on shuttles driven by human drivers and as such there should be little or no difference between a standard shuttle services that utilizes golf carts for shuttles. The figure below illustrates the full route and the five route zones.

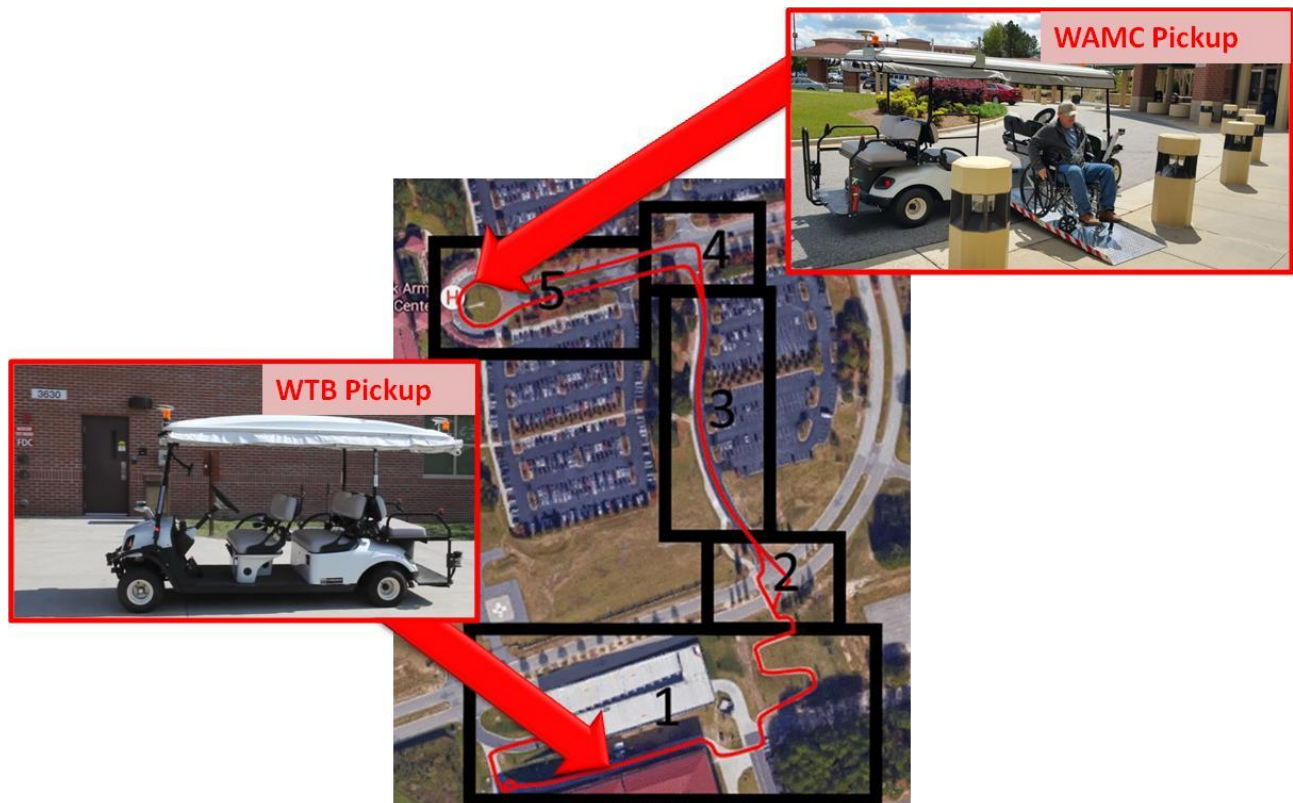
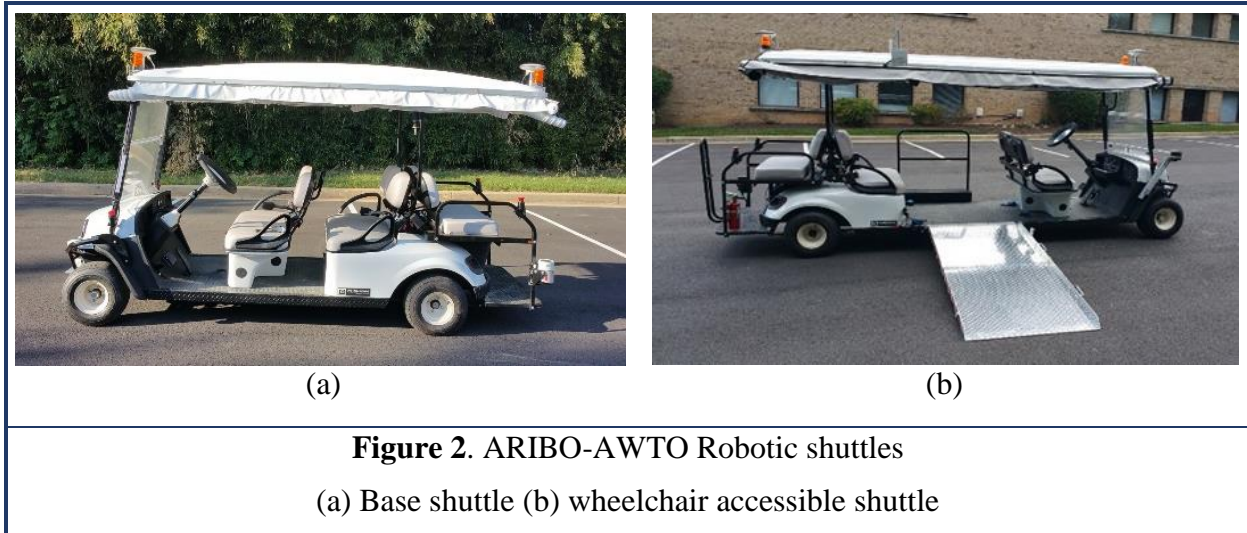


Figure 1. Shuttle route divided into 5 zones

1.2 Shuttle

The ARIBO-AWTO Robotic Platform is a modified Cushman Shuttle6 electric golf cart. All modifications made were designed to minimize changes to manual operation, and therefore it drives almost identically to electric golf carts used throughout the county. There are two current models; Figure a shows the base model, and Figure b shows the wheelchair accessible model. Participants will have the ability to specify request the wheelchair accessible shuttle if needed for their transport.



1.3 Participant / User Admission Process

On a regular basis, a presentation will be given to patients and potential users about the AWTO program at Fort Bragg. The presentation will include an overview of the following topics:

- ARIBO's AWTO program at Fort Bragg
- Shuttles – Technology overview
- Phases of the program (human / robot drivers) with an emphasis on Phase 1.
- Associated risks for Phase 1
- User expectations (scheduling tool, questionnaires)
- Question / Answer

Users will need to complete an application and consent form to participate in the AWTO program (located at the end of this document). The application includes participation consent and the minimal information needed for users to participate in the program. Interested parties should complete the application and submit it at the end of the presentation meeting or at a designated drop box

Once received, Robotic Research will review, approve and maintain the user applications. Robotic Research will then enter the user's information into the scheduling application and assign a User ID. The User ID is need for the shuttle scheduling tool. Participant email address will be sent to Nexus EMC for use with the questionnaires. Upon receipt of the user's email address from Robotic Research, Nexus EMC will assign and sent a Questionnaire ID (Q-ID) to participants. The Q-ID will be used for the online questionnaires and given to the driver when riding the shuttle.

2 Privacy and Data Handling

Ensuring that participant data and personal identifiable information is kept secure is of the utmost importance. Participant identity with regards to the questionnaire will be treated as confidential. The questionnaire and scheduling tool are not linked and DO NOT actively share personally identifying data. The questionnaires utilize User IDs to mask personal identities. Questionnaire data will only be accessible by research and engineering personnel. However, any records or data obtained as a result of your participation in the AWTO program may be inspected by an Institutional Review Board (if convened), or by the persons conducting this program, provided that such inspectors are legally obligated to protect any identifiable information from public disclosure, except where disclosure is otherwise required by law or a court of competent jurisdiction. These records will be kept private in so far as permitted by law.

Only aggregated results will be shared beyond the Program team. The results may be published; however, participant names or any identifiable references to participants will not be used without additional, separate written consent.

This privacy policy explains how participant's information and data is handled.

- **HIPAA Compliant Questionnaires:** For the ARIBO program, data will be collected using online questionnaire forms. The online surveys will be hosted by SurveyMonkey utilizing their Health Insurance Portability and Accountability Act of 1996 (HIPAA) compliant services. Additional details regarding SurveyMonkey's HIPAA compliance may be found at:

http://help.surveymonkey.com/articles/en_US/kb/HIPAA-Compliance-and-SurveyMonkey

- **Survey Inquiries:** If users have questions about a survey they are taking, please contact the POC for this document directly as SurveyMonkey is not responsible for the content of that survey or your responses to it. Direct all questions to Aribo.Support@RoboticResearch.com.
- **Anonymous Responses:** Responses to online surveys will be associated with a User-ID and not directly connected to the participant. Additional information about SurveyMonkey's respondent anonymity can be found at:

http://help.surveymonkey.com/articles/en_US/kb/Are-my-survey-responses-anonymous-and-secure?

- **Security:** Only as much personal data that is required for the applications and informed consent form will be collected. This personal information from the application and informed consent forms will be safeguarded separately from data collected through the online survey. Demographic information collected through the online survey will NOT be associated with the User-ID, participant's name, phone number or personal email address. Survey URLs begin with **https://** indicating that survey responses are sent over a secure, SSL encrypted connection. In addition, data captured through the online survey tool meets HIPAA compliance standards for security. Additional online survey security information can be found at: <https://www.surveymonkey.com/mp/policy/security/>
- **Participation is Voluntary:** Participating in the user evaluation is currently restricted to WTB soldiers, WTB staff and individuals providing travel assistance or needed help to those soldiers. Participation is voluntary. Participants have the right to withdraw at any time, for any reason. Soldiers or anyone else participating in the user evaluation or use of the shuttle may be removed from the program and barred from participation if the research team or drivers conclude willful misbehavior or malicious intent.

3 Participant Responsibilities

Participants are an important contributor to the collection of accurate, useful day-to-day program data. Participation in this program is relatively straight forward in that participant's will initially use a shuttle for transport between the Barracks (WTB) and WAMC. During the first phase of the program, no participants will ride on shuttles operating in robot mode. During later phases of the program, participants may be transported between the WTB and WAMC on both human and robot driven shuttles. Below is a list of the key responsibilities of the participants:

- **Reservation / Scheduling Tool:** Participants will be expected to use the scheduling tool app "ARIBO Mobile" to schedule the rides on the shuttle.
- **Questionnaires:** The participant will complete regular questionnaires providing information in support of the analysis of the shuttle performance including any outlying circumstances that may have had an impact.
- **Guests:** Participants will periodically be allowed to bring guests over the age of 18 on the shuttle.
- **Passenger Code of Conduct:** Participation in this study will use the shuttles for transport between the Barracks and WAMC. Participants riding the shuttle will be expected to observe an appropriate code of conduct.
- **Program Withdrawal:** Participation is voluntary and participants may withdraw from the program at any time and without repercussions. Participants may be removed from the program and barred from participation if the research team or drivers conclude willful misbehavior or malicious intent.

3.1 Reservation / Scheduling Tool (ARIBO Mobile)

Participants will be required to use ARIBO Mobile to schedule rides. ARIBO Mobile is the mobile application used to interface with the ARIBO transportation system, allowing the user to request transport reservations, modify/view existing reservations, and receive reminders for existing reservations. ARIBO is an AS-NEEDED transportation system, allowing participants to reserve a vehicle for a specified time and at predefined pickup/drop-off locations around WTB and WAMC.

ARIBO Mobile is currently only available for ANDROID devices, however, Non-Android users will have access to ARIBO Kiosks (figure 3) to make reservations. Also, non-Android users will be setup to receive SMS reminders.

Since ARIBO Mobile is currently in the evaluation period, we are limiting participation and as a result, participants will have to manually download and run the ARIBO Mobile application installer as opposed to going through Google Play™. ARIBO staff will provide the download link, an ARIBO Mobile App guide covering installation and use, and will assist all participants that needs assistance in downloading, installing, and setting up their initial account. After installation assistance will also be provided as needed.

KIOSK LOCATIONS (Figure 3)



3.2 Questionnaires (Subjective Data)

Capturing objective data on the technical performance of the Shuttle only tells part of the story. It is critical to capture the user experience to:

- Contextualize objective shuttle data and understand the circumstances in which the vehicle did what it did (for both the human and robot driver).
- Baseline acceptable driver performance to compare with acceptable robot driving.
- Characterize participant perception of the shuttle and scheduling tool and the impact they have on acceptance and utilization of the shuttle (human & robot mode).

- Quantify rider ‘break-in’ periods and comfort level. This is critical in qualifying the data collected and understanding the impact on missed appointments.
- Quantify the likelihood for success of the shuttle in other use cases at Fort Bragg

Participants and Drivers will generate an ongoing log throughout the program by completing four (4) separate questionnaires on a regular basis. These questionnaires will provide data for future analysis of shuttle performance.

- **Onboarding Questionnaire:** Users will complete this questionnaire shortly after joining the program and being added to the system. This anonymous questionnaire will capture generic demographic information to quantify the user population. The estimated time to complete this questionnaire is approximately 4 minutes.
- **Ride Questionnaire:** Conducted by the participant after each ride; this questionnaire will provide insights into the performance and circumstances of each trip. When correlated with data captured by the vehicle, it will be a foundation to evaluate shuttle performance. The estimated time to complete this questionnaire is approximately 2 minutes.
- **Trust Questionnaire:** Conducted by the participant after each ride; this questionnaire will provide insights into the trust you have in the system.
- **Periodic Questionnaire:** This questionnaire will be used to quantify changes in perception over time. It will also be used to better understand trends and discoveries identified by the AWTO project team, through the Questionnaires and from captured shuttle performance data. This questionnaire may be as frequent as once per week with an estimated time to complete of approximately 5 minutes.
- **Scenario Questionnaire:** On occasion, scenarios will occur for which additional participant input will be valuable. Some of these scenarios may be staged or planned in advance by the AWTO program team. To obtain participant input, an email may be sent with a link to a **Scenario Questionnaire** within a week of the occurrence. The estimated time to complete this questionnaire is approximately 10 minutes.

3.3 Accompanying Passenger

Participants will be allowed accompanying passengers that meet certain criteria. The ARIBO Team is currently working with WTB leadership to further define these criteria. Until notified otherwise, guests can be either family (over 18 years old), WTB cadre, and/or Non-Medical Attendants (NMA). In the event guests would like to make their own reservations for their own transport, they will be required to join the program by filling out an application form or contacting Aribo.Support@RoboticResearch.com. Once approved and enrolled, these guests will now be considered as a “participant” and as such, will be required to abide by this document.

3.4 Passenger Code of Conduct

The following rules of conduct will be enforced to ensure that passengers and drivers have a safe and pleasant ride while using the shuttle. Must adhere to Fort Bragg policies as well as the following:





- A. Passengers are expected to listen to and follow the instructions of the driver
- B. No one under the age of 18 will be permitted to ride on the shuttle. The driver reserves the right to verify the age of non-participants by reviewing a driver's license or other government issued identification.
- C. Smoking is prohibited on all shuttles.
- D. Passengers must remain seated at all times while the shuttle is in motion.
- E. Passengers are prohibited from disturbing other passengers and the driver. Examples of disturbances include, but are not limited to: excessive noise, throwing objects, physical violence, offensive behavior and speech, public intoxication, and harassing behavior.
- F. Reasonable judgment should be applied to the types of articles brought onto the shuttle. Examples of prohibited articles include but are not limited to:
 - gasoline, kerosene or any other flammable liquid or explosive material
 - weapons, including but not limited to guns or knives [blade size?]
 - illegal drugs
 - open containers of alcohol
 - animals, other than service animals for the disabled
 - any article that cannot safely be held by a passenger that could have potential to hurt another passenger or the driver during a sudden or unscheduled stop
- G. Passengers are prohibited from throwing objects from the shuttle, or sticking anything, including body limbs, out of the shuttle.
- H. It is a serious health risk to other passengers and the driver to allow patrons whose bodily fluids are exposed to ride the shuttle. Passengers who are experiencing this condition will be removed from the shuttle or denied access to the shuttle. This includes, but is not limited to bodily eliminations, spitting and blood.
- I. Passengers are prohibited from performing any personal hygiene task while riding the shuttle (i.e. clipping fingernails, toenails, putting on perfume, etc.).

3.5 Program Withdrawal

Participating in the user evaluation is currently restricted to WTB soldiers, WTB staff and individuals providing travel assistance or needed help to those soldiers. Participation is voluntary. Participants have the right to withdraw at any time, for any reason. There will be no penalty or loss of benefits to which you are otherwise entitled if you choose not to participate. Soldiers or anyone else participating in the user evaluation or use of the shuttle may be removed from the program and barred from participation if the research team or drivers conclude willful misbehavior or malicious intent.





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AWTO Participant Guide



4 AWTO Program Application and Informed Consent

Prospective Participants: Read the AWTO Participant Guide and this consent form carefully and ask as many questions as you like before you decide whether you want to participate in the AWTO Program. You are free to ask questions at any time before, during, or after your participation in this program.

4.1 AWTO Program Information

Program Title:	Autonomous Warrior Transport On-base (AWTO)
Technology Organization	Robotic Research, LLC
Program Location	Fort Bragg, NC
DOD Sponsor	U.S. Army, TARDEC
Program Point of Contact (POC)	AWTO System Support Lead, Robotic Research, LLC
POC Phone	(910) 212-6832
POC Email	Aribo.Support@RoboticResearch.com

4.2 Purpose of the AWTO Program

The Autonomous Warrior Transport On-base (AWTO) a surrogate ARIBO Program is addressing the real-world needs of the Warrior Transition Battalion at Fort Bragg. The soldiers in this battalion, some of whom have mobility difficulties, often require transportation assistance from the barracks (WTB) to the Womack Army Medical Center (WAMC). TARDEC and Robotic Research are utilizing robotic technology to provide an unmanned transport system equipped with a reservation/reminder system for these soldiers and caretakers that will be released in multi-phase approach. Nexus EMC is supporting the Evaluation Plan including Plan modifications/updates and participant/survey/questionnaire management.

4.3 Participant Expectations

Participation in the AWTO Program requires the use of a customized scheduling tool, completing regular questionnaires and adhering to a passenger code of conduct. Below is a list of the key responsibilities of the participants:

- **Scheduling Tool:** Participants will be expected to use the scheduling tool app to schedule the rides on the shuttle.
- **Voluntary Questionnaires:** The participant will complete regular questionnaires providing information in support of the analysis of the shuttle performance including any outlying circumstances that may have had an impact.
- **Passenger Code of Conduct:** Participation in this study will use the shuttles for transport between the Barracks and WAMC. Participants riding the shuttle will be expected to observe an appropriate code of conduct.

4.4 Possible Risks

The Risk Analysis and Associated Management Plan resulted in a “low” risk rating for Phase 1. During Phase 1, participants will ride in shuttles operated and controlled by a human drivers. The risk is no greater than using/riding on a GSA-purchased electric golf cart. Sensors and autonomy systems will run in the background collecting data (NOT controlling the Shuttle with participants onboard). A new risk analysis will be completed prior to transitioning to each phase based on data collected from the previous phase with the appropriate authorization to proceed.

4.5 Possible Benefits

The only benefit in participating in the AWTO program is the availability of an additional transportation method between WTB and WAMC. There is no compensation (financial or other) for your participation in this program.

4.6 Confidentiality

Ensuring that participant data is secure and personal identifiable information is kept separate for study data is of the utmost importance. The questionnaire and scheduling tool are not linked and DO NOT actively share personally identifying data. The questionnaires utilize User IDs to mask personal identities. Questionnaire data will only be accessible by research and engineering personnel.

Any records or data obtained as a result of your participation in the AWTO program may be inspected by an Institutional Review Board (if convened), or by the persons conducting this program, provided that such inspectors are legally obligated to protect any identifiable information from public disclosure, except where disclosure is otherwise required by law or a court of competent jurisdiction. These records will be kept private in so far as permitted by law.

Only aggregated results will be shared beyond the program team. The results of the study may be published; however, your name or any identifiable references to you will not be used without additional, separate written consent.



4.7 Withdrawal from the Program

Participation is voluntary and participants may withdraw from the program at any time and without repercussions. There will be no penalty or loss of benefits to which you are otherwise entitled if you choose not to participate. Participants may be removed from the program and barred from participation if the research team or drivers conclude willful misbehavior or malicious intent.

In the event you decide to discontinue your participation in the study, please send an email to or call the primary point of contact notifying them of your decision.

4.8 Contact Information for Questions and Concerns

For questions related to the AWTO system or technical support contact:

Program Point of Contact (POC)	System Support Lead, Robotic Research, LLC
POC Phone	(910) 212-6832
POC Email	Aribo.Support@RoboticResearch.com

For questions related to the AWTO program, participants, and base operations, contact:

WTB Point of Contact (POC)	WTB Deputy Commander
POC Phone	(910) 907-5208

