

## **SPEAR™: Think-A-Move’s Speech Control System for Unmanned Vehicles**

Think-A-Move, Ltd. (TAM) has developed innovative speech command technology enabling heads-up, hands-free device control of unmanned systems in noisy environments. TAM’s speech control system can be used as a supplementary control method, allowing concurrent control of various functionalities on a robotic platform. The system capabilities also include a primary control input option; completely substituting for a hand-controller.

When someone speaks, not only does sound emanate from their mouth, but it also travels back to their ear canal. SPEAR captures this in-ear speech with an in-ear microphone, and processes it with proprietary speech algorithms enabling the system to maintain effectiveness in noisy environments such as battle fields, or in windy conditions. The earpiece design also lets the operator receive audio feedback from the unmanned system through an in-ear speaker. This paper highlights the benefits of using Think-A-Move’s patented Speech Processing Earpiece (SPEAR) technology.

### **Mission Scenario**

*The following scenario illustrates potential benefits of using Think-A-Move’s SPEAR.*

A UGV operator uses speech commands to drive a UGV to a target down range, several hundred meters away. Due to SPEAR’s ability to act as a complete substitute for a hand-controller, the warfighter **maintains full control** of the unmanned system, while holding a weapon with two hands. The operator’s **situational awareness increases**, as he maintains eye contact with the target and his surroundings and does not need to focus all of his attention on maintaining system control through a hand-held device.

As the UGV approaches a window the operator would like to look through it to identify possible secondary devices. While still driving the robot with a hand-controller, the operator uses speech commands to position the flippers forward (for added robot stability) and deploy the manipulator arm to the required position. This action illustrates the user’s **ability to multi-task**, leading to **decreased time to mission completion**. **Situational awareness increases** further as SPEAR allows audio feedback and alerts to be sent to the warfighter, keeping him informed on the status of the UGV, such as battery life



*As SPEAR recognizes speech commands, it sends them directly to an OCU which transmits them to the UGV, enabling heads-up, hands-free system control.*

### **SPEAR’s Added Functionality**

SPEAR provides added functionality to the UGV through simultaneous control, menu shortcuts and macros. In addition, by allowing heads-up, hands-free device control, SPEAR helps the user maintain situational awareness without endangering himself, the squad, or the unmanned system. SPEAR lets the operator control the system through speech, eliminating the need to use a hand-controller all of the time and therefore, permitting greater focus on the system, mission and environment.

## **Benefits**

Benefits from using SPEAR include added system functionality, supplemental and substitute control capabilities, increased situational and operational awareness, and alternative use of hands while still maintaining full control of the unmanned system. These benefits provide decreased time to mission completion and reduced operator vulnerability.

### **A. Added System Functionality: Simultaneous Control, Macros and Menu Shortcuts**

Speech commands may be used for simultaneous control of multiple functions on the unmanned system. While controlling the movement of the robot, an operator may simultaneously control the camera or the manipulator arm with speech commands. Creating macros to execute a specific series of tasks (e.g. flipper movement and manipulator arm position) can also be done through speech commands, again, reducing time to mission completion.

Certain control functions for a UGV cannot be accessed directly by an operator, but require multiple steps to be executed, such as navigating through different menus. Speech commands can serve as menu shortcuts, enabling the operator to access them directly, reducing time to mission completion.

Listed below are examples of specific functionalities speech commands can control:

- Tilt/Pan camera while in motion
- Zoom camera
- Switching cameras views
- Moving manipulator arm to preset positions
- Driving the Unmanned System

### **B. Complete substitution for OCU/hand-controller**

The primary control of most unmanned systems is a hand-controller. However, often times in critical situations it would be preferable for the operator to have his hands free to use a weapon, if needed. Currently, the operator has to drop the hand-controller to free his hands to do this, losing control of the unmanned system. TAM's system addresses this situation, permitting the operator to have their hands on a weapon while maintaining control of the system with speech commands. At this moment, speech control becomes the substitute controller for the system.

SPEAR's ability to act as a substitute control device allows the operator to free their hands for other tasks. Many times, the operator needs to use their hands for other purposes such as:

- Manning a weapon
- Using hand signals to communicate with the rest of the squad
- Assisting other Soldiers

### C. Increased situational and operational awareness

Situational awareness decreases as the system operator receives visual feedback from the unmanned system. Audio alerts can provide a supplemental warning system, helping to prevent information overload for the warfighter.

The various audio alerts that can be relayed to the warfighter include:

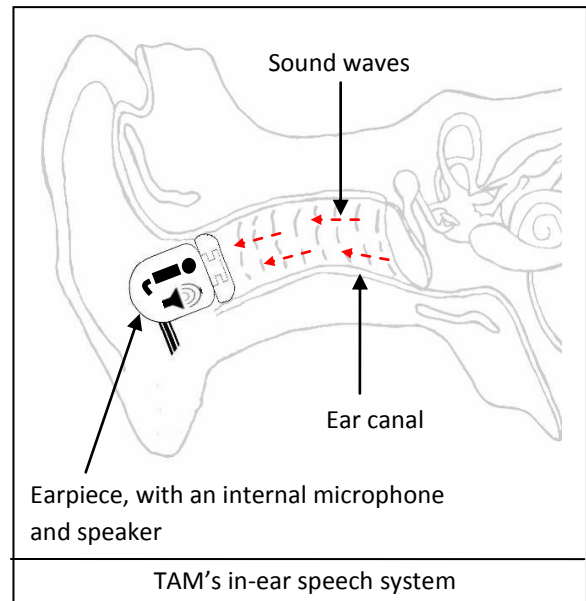
- Command confirmation for autonomous behavior
- Task status updates for autonomous behavior
- Emergency alerts, including low battery status
- Alerts from sensors mounted on unmanned systems
- Audio feedback from unmanned system microphones

## System Description

### Think-A-Move's Speech Control System

Under US Army Tank-Automotive Research, Development and Engineering Center (TARDEC) funding, Think-A-Move, Ltd. (TAM) has developed speech command input technology for unmanned system control. The novel idea behind TAM's technology is the capture of user speech in the ear canal. TAM has developed a proprietary earpiece, housing a microphone to pick up speech from within the ear canal, as shown in the figure. Because the earpiece seals off the ear canal from the environment, very little ambient noise leaks into the internal microphone providing a high signal-to-noise ratio even in high-noise environments. This makes the speech input system suitable for military applications in crowded urban settings and battlefield conditions.

The TAM system also includes a speaker in the earpiece to allow the operator to receive discreet audio feedback. This feedback can be from the microphone on the unmanned system or from the control unit providing the operator with a variety of vital information. Examples include urgent communications or emergency alerts generated by a sensor system mounted on the robot, as well as command confirmation and task status updates. For more detailed information about TAM's technology, please visit <http://www.think-a-move.com/technology.html>.



For additional information please contact:

Jonathan Brown  
Vice President, Sales and Marketing  
Think-A-Move, Ltd.  
23715 Mercantile Road  
Suite 100  
Beachwood, OH 44122  
Tel: 216-765-8875