

# **Inertial Labs, Inc<sup>TM</sup>**

## **Position and Orientation Tracking After Action Review System**

### **POTAARS**

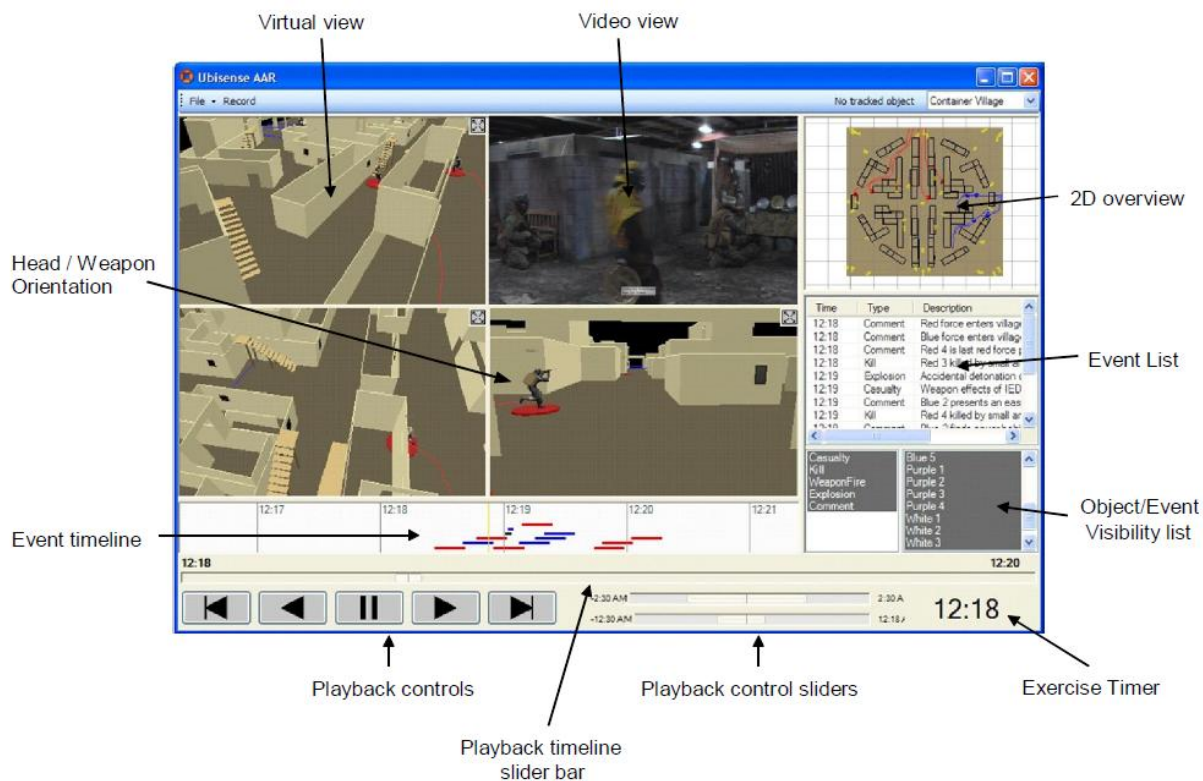
**Datasheet  
Revision 1.4**

**July, 2010**

The **Inertial Labs™ POTAARS** position and orientation tracking after action review system combines Inertial Labs OSv3 Orientation Sensor with the Ubisense RTLS ultra-wideband RF position tracking system to deliver precise location and orientation of people, vehicles, weapons, and other assets during military and law enforcement training exercises. Its accompanying software (available as a standalone application or integrated to existing systems) was developed with Ubisense and can provide both real-time Exercise Control (EXCON) during operations and enhanced After Action Review (AAR) post exercises.

## Overview

There are many training systems currently available which provide excellent functionality when managing video, targets, audio, weapons effects and other common training elements. The gap in the training industry has been a system that can effectively collect and manage location and orientation information and extract the full training value from that data. POTAARS can manage any location/orientation tracking data including precise 3D ultra-wideband data and/or GPS data for open outdoor areas and orientation data from Inertial Labs OSv3 inertial sensor.



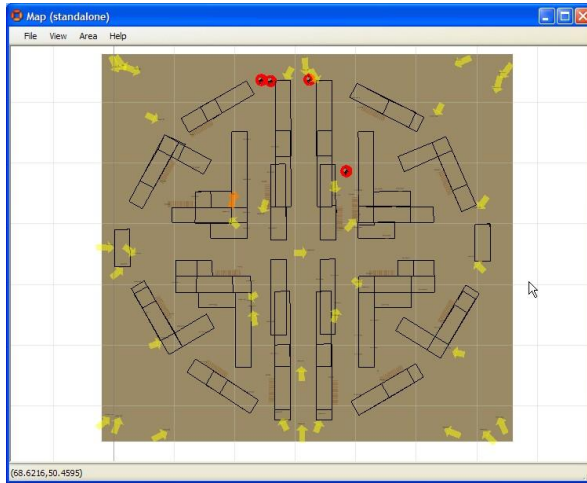
## Benefits

- Real-time visualization of operations in any lighting condition and/or smoke filled environments
- Automatic camera selection in AAR based on user selectable objects, personnel, or events
- Tracking of weapon fire events, kills, and virtual round ballistics including shoot-through-wall
- Potential to perform Real-time Casualty Assessment (RTCA) from within system software
- Ability to perform tactical analysis of weapon handling through character POV features
- Review subtle details of room clearing exercises tracking where the eyes were focused
- Provides the ability to include location based weapons effects such as IEDs or grenades for more realistic training

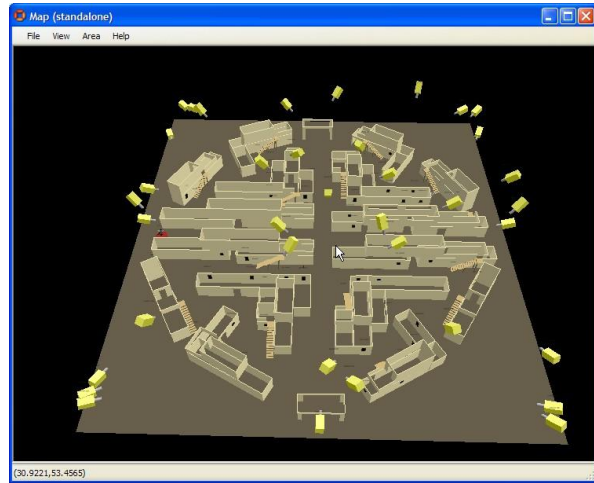
## Features

### VIRTUAL AND REAL CAMERA VIEWS

Camera views are loaded into the system and can either correspond to real camera locations or virtual world view points. Each camera view has an area associated with it that corresponds to its field of view within the exercise environment. Camera views are easy to place using a click and drag interface. Virtual views are shown in yellow and cameras are shown in orange. A view can be chosen just by clicking on it in the 2D overview window.



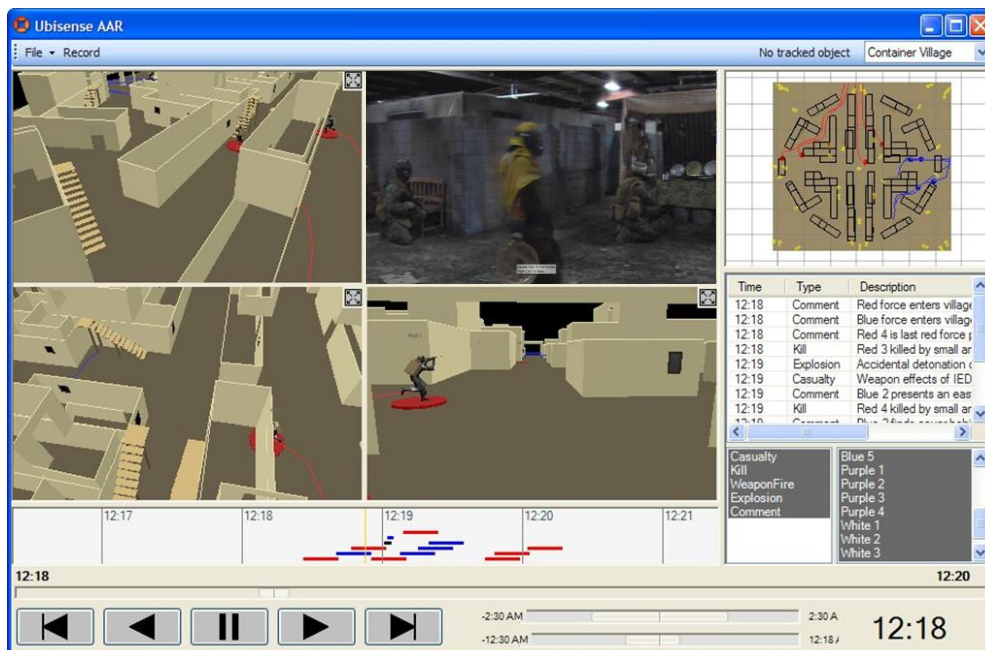
2D view of camera locations



3D view of camera locations

### MULTI VIEW

By selecting a person, object, event, or simply clicking on a place on the map the system can automatically determine which camera positions get the best views and display them simultaneously within the main application window.



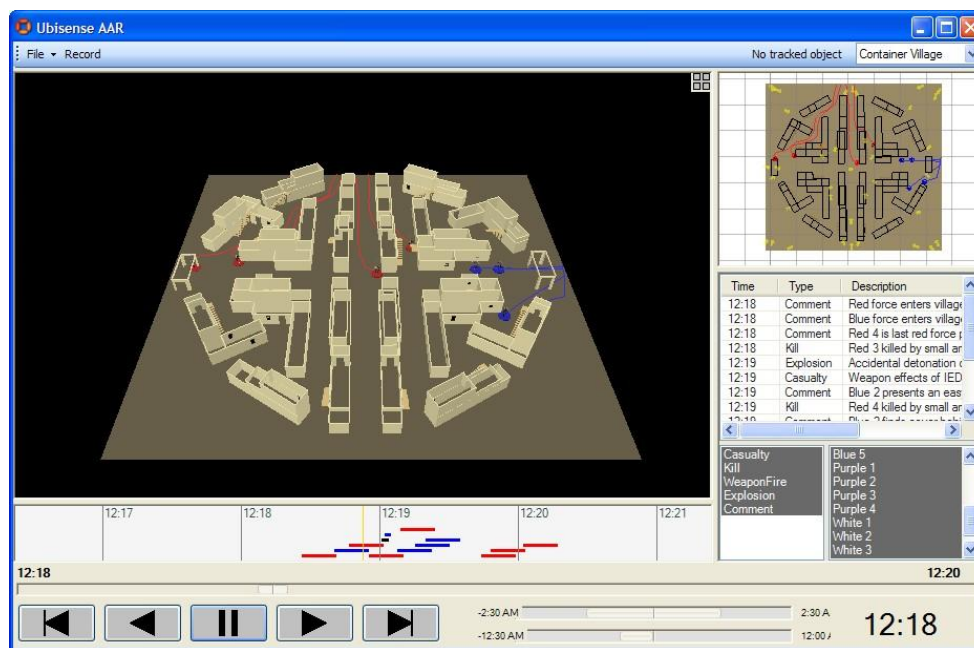
Multiple views can be selected by clicking on the 2D map

POTAARS provides a single interface with integrated virtual and video camera data. Views can be chosen by the operator or dynamically selected based on the location of the person or asset. By selecting to jump to a specific event in the event list, the viewer windows are automatically switched to show the best virtual and camera views in the system for that event. Also, views can be assigned to a specific soldier displaying a first person shooter view of the environment from the chosen soldier's perspective. Each view supports dynamic zooming in and out, click and drag panning, and changes to altitude and angle for an easy to use display of your virtual environment.

Any number of views can be displayed depending on screen size. Views can also be accessed and incorporated into other applications if required through the .NET API.

## MOVEMENT TRAILS

As data is viewed in POTAARS trails appear showing the paths of people, vehicles or objects through the area. Multiple areas can be chosen using the pull down menu in the top right of the application.



*Main view with trails behind the players*

Trails can be configured using the playback control sliders so that they appear both behind the person and in front of the object (if playing back recorded data) to display a preview of where they are moving towards.

## EVENTS

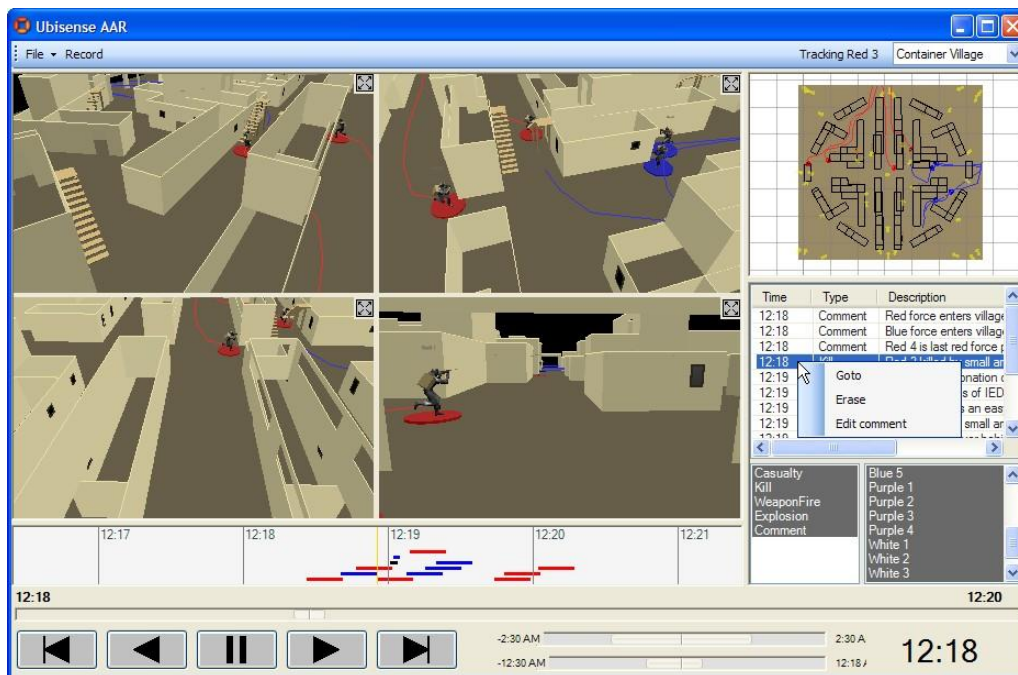
Events appear in the events list either as system generated events, manually entered events, or imported events from external systems:

- *System generated events* are those which are logged automatically by the system and are completely configurable by the user. They can be setup to include entry into certain areas or rooms, proximity to specific objects, kill events, triggered events (such as weapon firing), explosive device detonations, etc.
- *Manually entered events* are those which are entered by the trainer or analyst directly into the system. Such events can be used to allow for recollection of specific points within the AAR that

need to be reviewed and can either be added during playback of events or even added during live tracking of an exercise.

- *Imported events* are those generated by other systems within the training environment that may be performing functions outside of POTAARS. Examples such as door/window opening or kill/resurrect events that may be occurring within the existing training system by some other means.

Any event can be clicked on and then either edited, erased, or jumped to both in time and view. New types of events are designed to be easily integrated into the system enabling a library of different events to be available for a user and to be extended over time. Additionally event logs are able to be extracted from the system for external data and statistical analysis as needed.



*Event is selected in the event list*

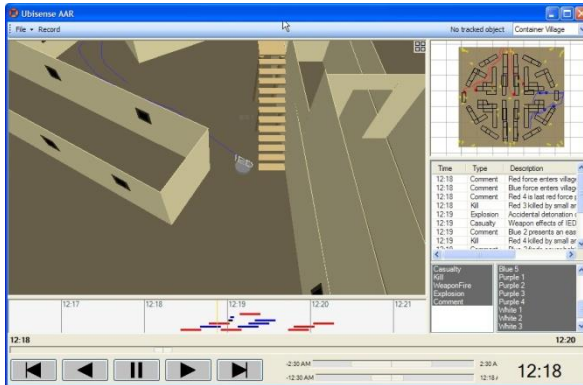
## REAL-TIME CASUALTY ASSESSMENT

By combining the information on location of all soldiers within an exercise with knowledge of weapon orientation and trigger firing events; POTAARS is able to provide a means through which real-time casualty assessment (RTCA) can be carried out through the system. Since weapon orientation is tracked using inertial sensors the system is able to determine kills for targets even in cases where the line-of-sight from the shooter to the target is obstructed (such as shoot-through-wall scenarios).

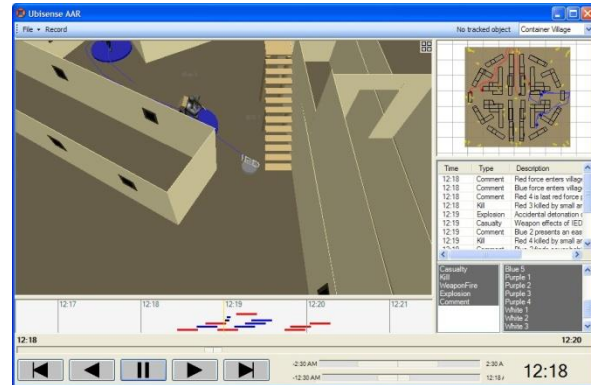
The orientation is tracked using Inertial Labs OSv3 orientation sensor. The OSv3 uses a combination of magnetometers, accelerometers, and gyroscopes to provide real-time orientation tracking for highly dynamic applications such as head tracking, weapon tracking, and human motion capture. Being under 0.4in<sup>3</sup> and performing the full orientation solution with an on board processor the OSv3 is able to be applied to the soldiers without hindering any typical actions while also being easily integrated into the system.

## LOCATION BASED WEAPONS EFFECTS

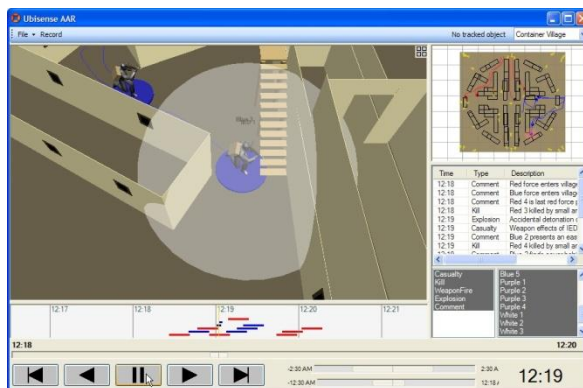
Utilization of POTAARS allows for the introduction of location based weaponry into the live training environment. By placing a tag on an object, such as a simulated IED, when a soldier moves to within a specified distance the system can simulate the device being activated producing a kill of those within the kill radius of the weapon.



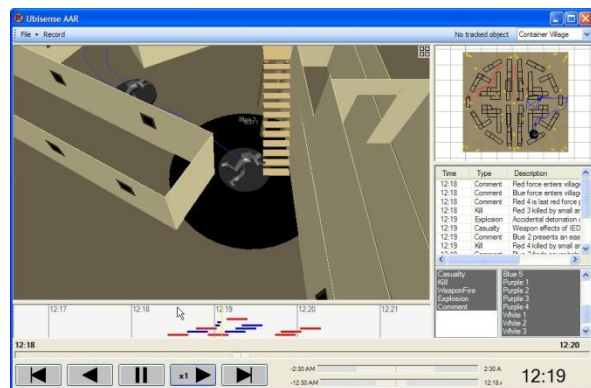
*IED object placed in the exercise*



*Soldier approaching the IED*



*IED object is activated*



*Soldiers icons changed to killed*

In addition to static weapons like the IED, the same functionality can be applied to weaponry such as grenades which are thrown into and detonated automatically within the environment. In this case, a tag is embedded within a mock grenade that is able to be activated and thrown exactly as would be the case in combat. Within POTAARS the grenade position is tracked and the kill zone for the grenade is calculated based on its location at the point of detonation.

## VIDEO INDEXING AND DYNAMIC TRACKING

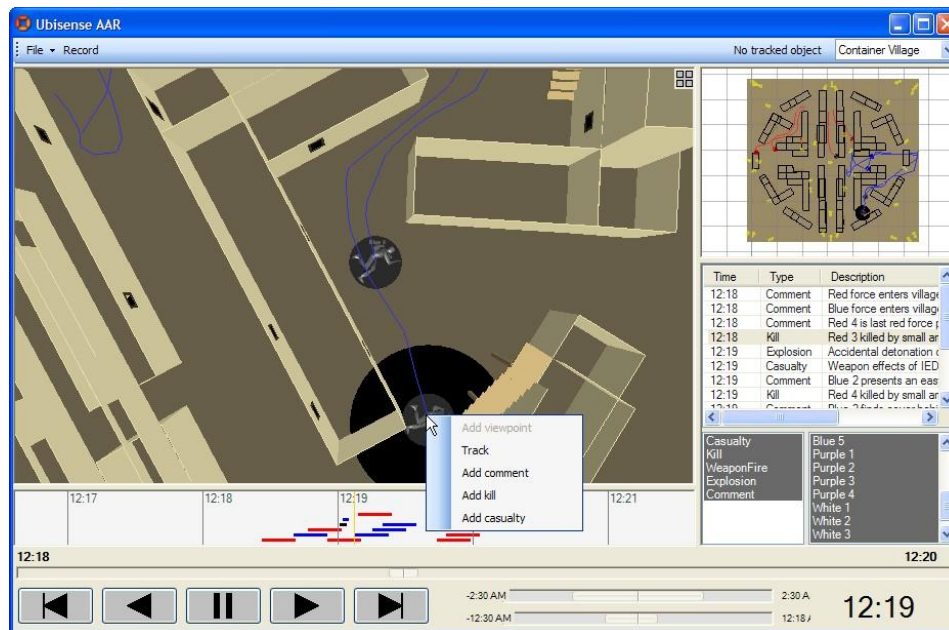
As POTAARS knows both where every tagged person and object is within the exercise, and the location of all available camera views; it is able to generate an index for each object detailing the times when a specific camera can see an object or event. This data can then automatically generate a library of clips which an analyst can use to automatically generate the AAR.

Clips can be automatically generated for

- A person or object for the complete exercise
- A defined time before and after a specific event such as a casualty, firing event, or room entry

By double clicking on any object you can choose to track or add events from an extendible library (in this case comment, kill or casualty events). The selected object will be followed throughout the exercise with

the system automatically determining the best possible cameras to view the object from. In the case of personnel it also is possible to utilize a first person shooter view providing the perspective of a specific participant throughout the exercise.



*An IED is selected for Dynamic Tracking*

By providing a means of automatically generating clips the system dramatically reduces the time it takes to generate the AAR.

## DATA RECORDING AND STATISTICAL ANALYSIS

As all event data collected from the exercise is recorded into a standard database format it is possible to extract and analyze any of the data post exercise for a variety of additional analysis.

For example weapon firing statistics could be analyzed to understand:

- hit/miss statistics per participant
- reaction times for individuals based on predetermined scenarios
- tendencies soldiers follow when engaging combatants
- probability of kills based on different situations
- crossfire situations

## INTEGRATION

POTAARS is developed using .NET technology and has a comprehensive API to allow easy integration to other systems. It has also been developed to allow individual modules to be incorporated into other systems or for developers to easily extend the functionality included in the base application to their specific needs.

## Summary

Location and orientation data have been available for military training exercises for many years but the true value of this data has not been utilized primarily because the tools used for AAR are designed to manage video and audio combined with other devices such as targets and weapons effects. POTAARS is a unique solution focused on managing and deriving maximum value from location tracking information in Military and Law Enforcement training environments with an open architecture for easy integration into existing solutions.