Embedded Live, Force-on-Force Training for Infantry Soldiers

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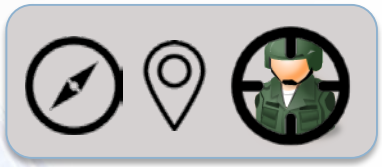
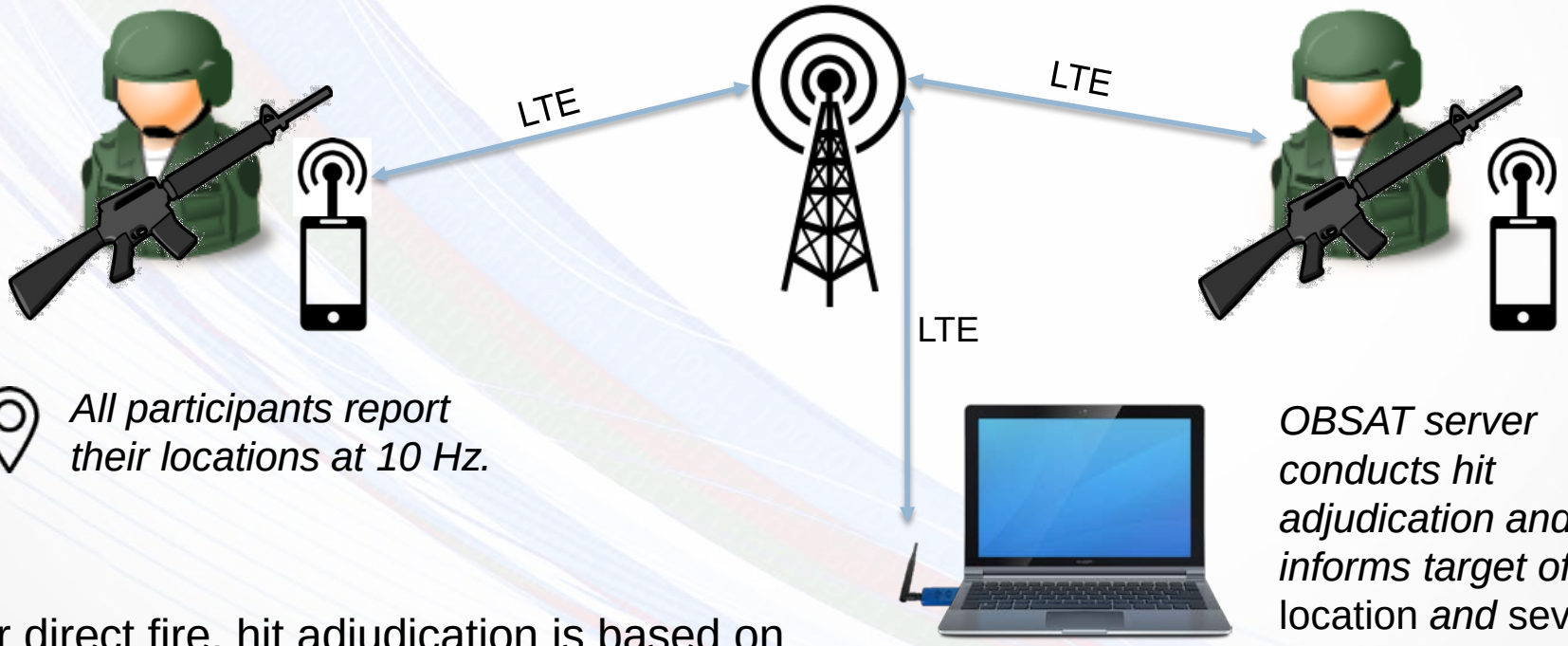
Motivation

- Negative training associated with laser engagement systems (e.g., MILES):
  - Cannot lead moving targets
  - Cannot fire through foliage
  - Cannot properly elevate rifle based on range
  - Cannot represent grenade launchers
  - Cannot fire “non line of site”
- Create a technology that improves live, force-on-force training.
  - Eliminate the negative training
  - Reduce additional equipment needed for live, force-on-force training
  - Provide an expeditionary and deployable capability soon, not in twenty years
  - Be AR/MR “ready”
- This work pointed the way to a technology solution that would **eliminate the negative training associated with MILES-type systems** while providing additional capabilities

Overall OBSAT Patent-Pending Process



When a shot is fired, the orientation of the weapon, location of the shooter, and processed sight picture is transmitted to the OBSAT server.



All participants report their locations at 10 Hz.

OBSAT server conducts hit adjudication and informs target of location *and* severity *of wounds.*

For direct fire, hit adjudication is based on the sight picture, *not* geometric pairing.

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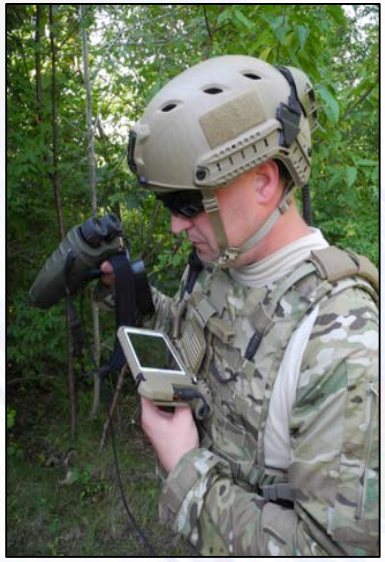
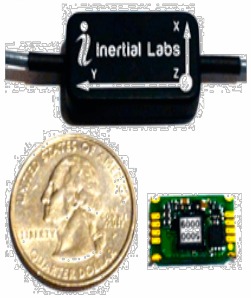
Minimal Appended Equipment



- Human Systems Integration, Inc. wearable USB hub, smart phone, player software, and smart phone enclosure.
- *Surrogate* for Nett Warrior device.

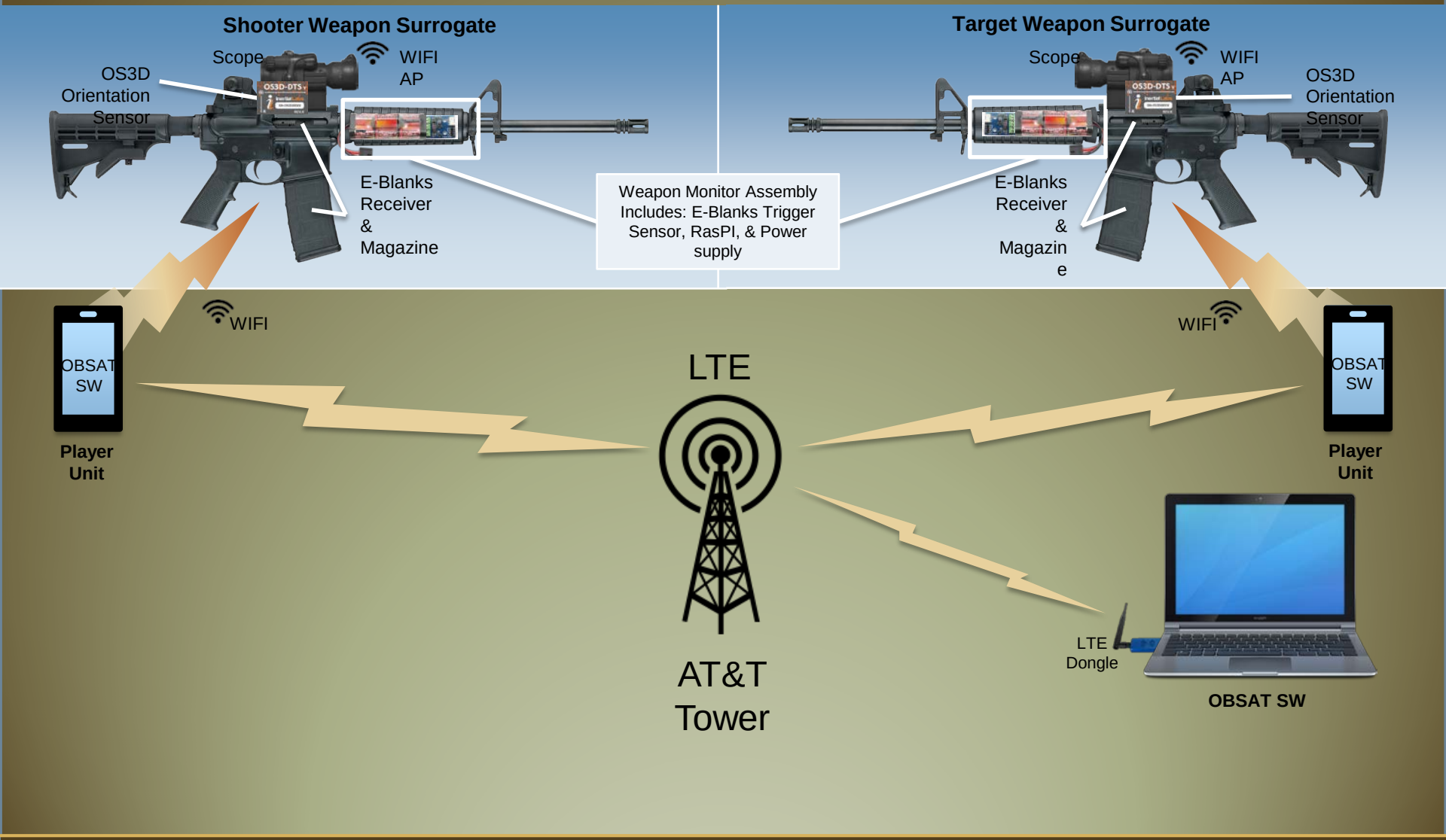


- A single Inertial Labs OS3DM sensor mounted to Picatinny Rail on rifle or scope.
- Will be embedded in next-generation digital scopes and/or IVAS.

- AtN commercial digital daylight or thermal scope.
- *Surrogate* for next-generation digital scopes under development.

- AR-15 or M-4.
- Detect bolt cycling via E-blanks analog output.

OBSAT Small Arms System Configuration



OBSAT server being replaced by a CTIA OBSAT Gateway, but the overall architecture remains the same.

Hardening and Simplifying

Before

- Weapon tethered to Player
- Airsoft rifle
- Note 1 phone
- Lots of wires
- Image processing on the server

After

- Weapon untethered from Player
- AR-15 with eBlanks
- Note 8 phone + Raspberry PI
- Fewer wires
- Image processing on phone / player unit

This simplification and making the software more robust took six months.

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Ongoing Efforts

- Create a library of representative images
- Train a computer vision image classifier to identify the target in the sight picture
- Working with Google to leverage most advanced computer vision tools available
- Develop, prototype, integrate, and test the orientation sensor with optical correction

Stinger System Overview

- All participants report location to CTIA through a gateway.
- OBSAT CTIA Gateway subscribes to aircraft PLI.
- Shooter tracks targets and sends position and orientation to OBSAT CTIA Gateway.
- OBSAT CTIA Gateway determines friend or foe and reports to shooter's Player Unit.
- Player Unit displays correct tone.
- When the shooter fires, the player unit determines if the shooter properly tracked and super-elevated.
- The OBSAT CTIA gateway determines hit or miss.

Targets with no MILES gear report their location.

LTE Network

LTE

LTE

Soldier Worn Player Unit (Net Warrior Surrogate)

Wi-Fi

Optional instructor Operator Station

OBSAT CTIA Gateway

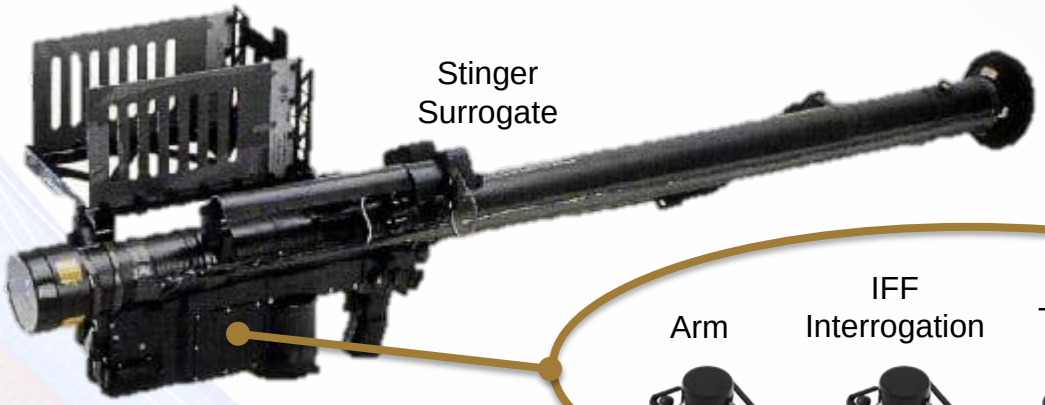
Ethernet

CTIA

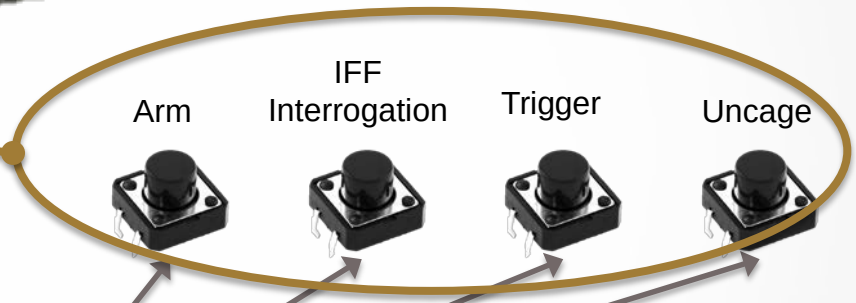
Stinger System Overview

(Player Unit and Stinger Surrogate)

Instructor Operator Station (IOS) (Optional)



Stinger Surrogate



Wi-Fi

Thermal Scope

Player Unit

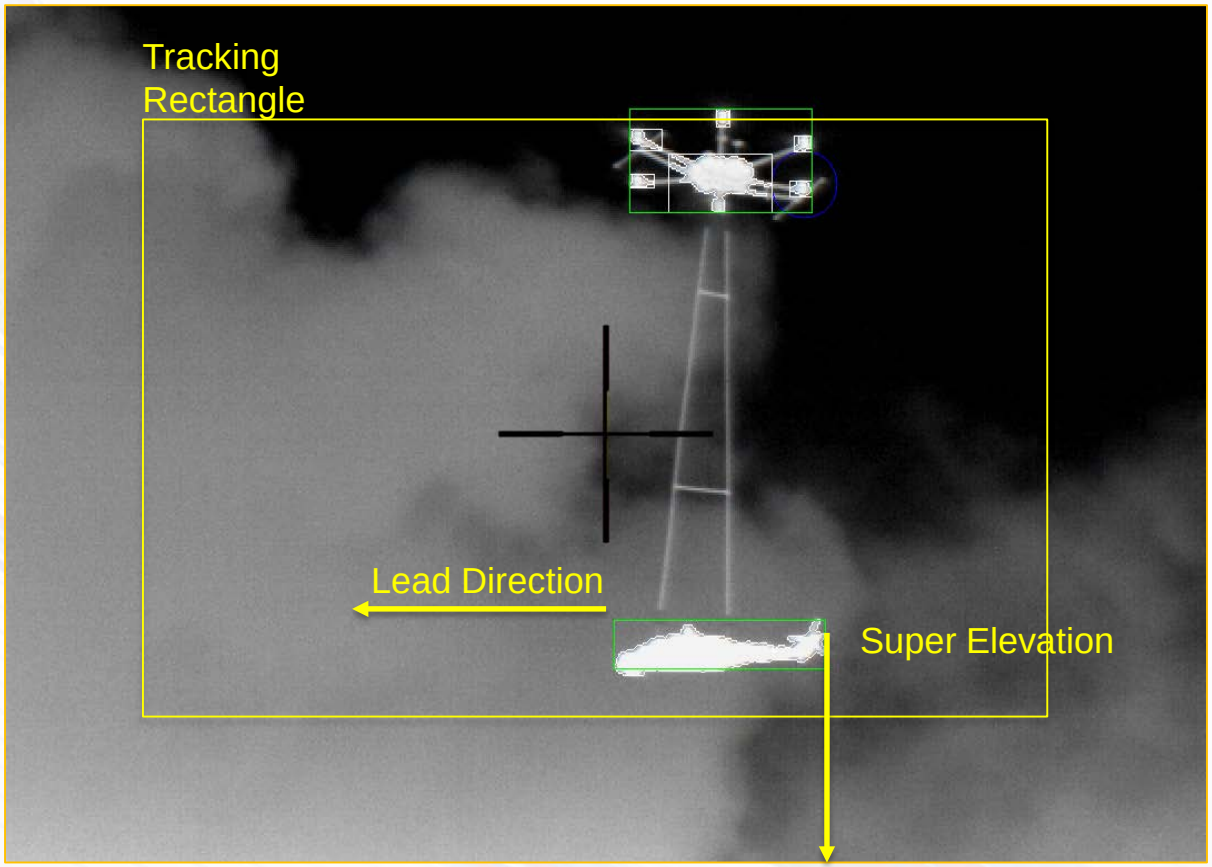
Wi-Fi

Wi-Fi

Raspberry PI Zero

Inertial Labs OS3D Orientation Sensor

Stinger Image Processing



Summary

- OBSAT Technology mitigates or eliminates negative training associated with laser engagement systems.
  - M-16
  - M-203
- OBSAT Technology is MR/AR ready.
- OBSAT Technology reduces need for appended equipment, thereby reducing training distractors and maintenance tail.
- Further maturation is required to get the technology ready for prime time.

Improvements in Image Processing

Old Image Processing Model				
Trials		Predicted		
		No	Yes	
Actual	No	**50**	0	50
	Yes	56	**114**	171
		106	114	

Accuracy = (114+50) / 220 = 75%

New Image Processing Model(1)				
Trials		Predicted		
		No	Yes	
Actual	No	**34**	28	62
	Yes	28	**131**	159
		62	159	

Accuracy = (34+131) / 200 = 75%

Notes of issues we are seeing:

- *Running side profile*
- *Side profiles*
- *Trouble with Peggy*

New Image Processing Model(2)				
Trials		Predicted		
		No	Yes	
Actual	No	**50**	11	61
	Yes	4	**155**	159
		54	166	

Accuracy = (54+166) / 200 = **93%**

Accuracy = (True Positives + True Negatives) / Total Trials

Image Synthesis Currently Problematic