



U.S. Army Research, Development and Engineering Command



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SWEAT Course (Soldier-System Weapon & Equipment Assessment Tool)

David Sapp

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Small Arms Capabilities Based Assessment - Priority Findings

Requirements for improving small arms analyses

- **Adopt an effects based standard** (Probability of Incapacitation, P_i)
- **Develop higher fidelity, operationally relevant metrics** to enable effective analysis of the performance of specific current (and projected) non-materiel and materiel combinations
- **Develop the modeling and simulation base** that enables sensitivity analyses of Soldier and small unit performance to add quantitative and qualitative value to threshold and objective requirements

Small Arms & Ammunition

Joint Assessment Team - Conclusions

- The lack of measurable, effects-based standards for some measures of effectiveness impacts DoD's ability to precisely define requirements and evaluate potential solutions for many capability gap areas.
- To optimize small arms capability, it's important to use an overall system approach; weapons, ammunition, optics/enablers, training, and human factors should be designed and integrated as matched components.

Small Arms CBA and SAA JAT findings both support the need for better performance assessment tools in the small arms arena





- Live fire course
- Standardized & Modular
- Relevant operational framework
- Baselined by trained soldiers with current weapons, equipment, and ammunition

SWEAT is a scientifically derived course that objectively measures the applied lethality of the soldier system to compare against a Baseline in a confidential and cost effective manner.



This brief will provide an update on the results of Phase I

Status:

- Multi-phase and Multi-year project
- Currently, Phase I has been completed by SAIC and its subcontractors

Goal:

- To design, develop, model, test, and build a modular prototype SWEAT Course. A joint Industry and Government team will investigate the concept and design the course.

Value to Warfighter:

- The current measure of effectiveness is the weapons qualification course. It has remained virtually unchanged for 30 years. The SWEAT Course will update the measure of effectiveness of the Warfighter.





Sponsors

- Joint Armed Warfighters supported through the Joint Service Small Arms Program (JSSAP) Office
- Joint Service Small Arms Synchronization Team (JSSAST) (Army, Navy, Air Force, Marine Corp, Coast Guard, SOCOM)

Endorsements

- Maneuver Center of Excellence

Contractor Development Team

- SAIC (Science Applications International Corporation) (Prime)
- SDE (System Design Evaluation Ltd)
- AIS (Advanced Interactive Systems)
- County College of Morris (New Jersey)



- A. Determine physical layout required to accommodate the +/- 28 shooting stations desired. **COMPLETED**
- B. Determine the number, type and mobility for the targets at each station. **COMPLETED**
- C. Identify the sensors, lighting, signals and audio required at each station. **COMPLETED**
- D. Determine the ballistic protection and bullets traps required for each station. **COMPLETED**
- E. Identify safety zones for each station for the full range of weapons and ammunition. **COMPLETED**
- F. Determine method of target damage assessment, computational requirements, and target reaction for each station. **COMPLETED**
- G. Determine the system required to overlay target vulnerability, impact location and damage assessment in real time to allow target reaction. **COMPLETED**
- H. Investigate alternate techniques to accomplish the required functions including both technical maturity and financial aspects. **COMPLETED**
- I. Determine the Modeling and Simulation effort necessary to integrate the physical concepts with M&S programs such as America's Army and IWARS. **COMPLETED**
- J. Determine overall physical configuration including training, control and briefing rooms
- K. Determine requirements for After Action Review Tools **COMPLETED**

Determine Physical Layout to Accommodate the 26 Shooting Stations

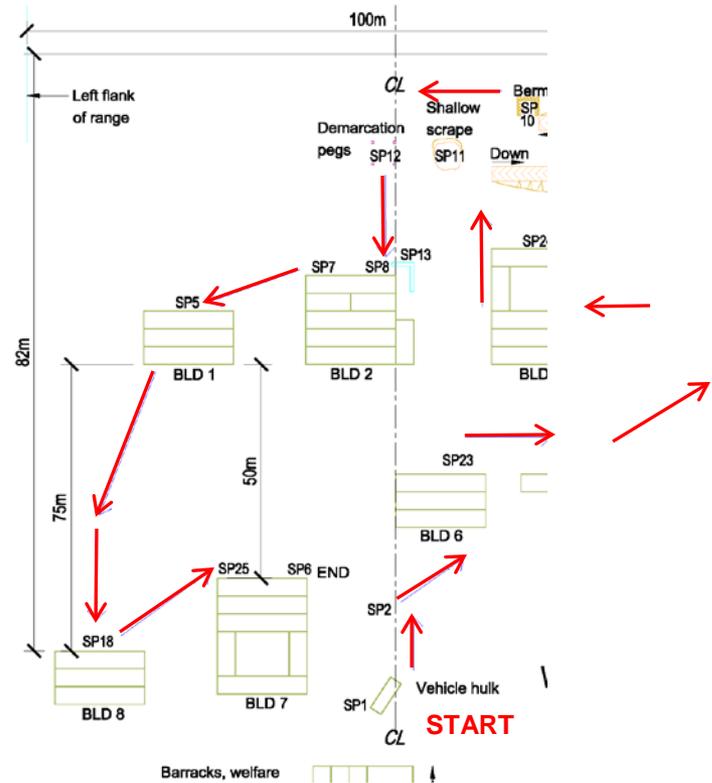
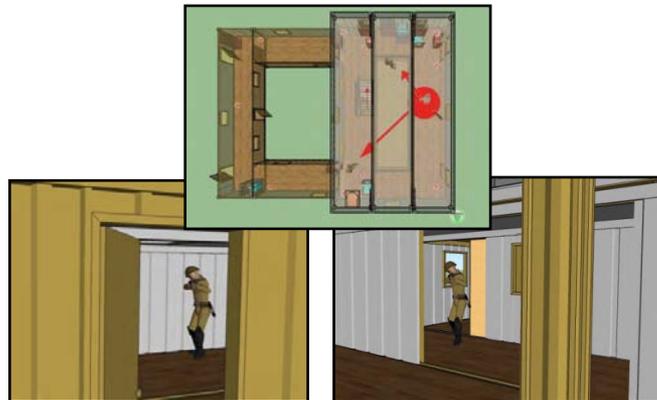
- Layout is finalized
- May change slightly in Phase II to accommodate necessary adjustments discovered through proof of concept testing and geographic location.





Determine the Number, Type, and Mobility for Each Target Station

- Identified at each station
 - Shot Position Indicator
 - Lifters
 - Targets
- Ancillary technology to fulfill engagement requirements identified
- Pilot Study Conducted
 - Shooting Position relevancy
 - Target reaction realism





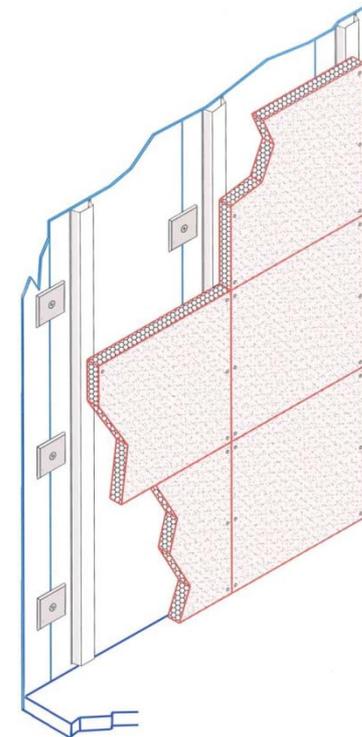
ID Sensors, Lighting, Signals and Audio for Each Target Station

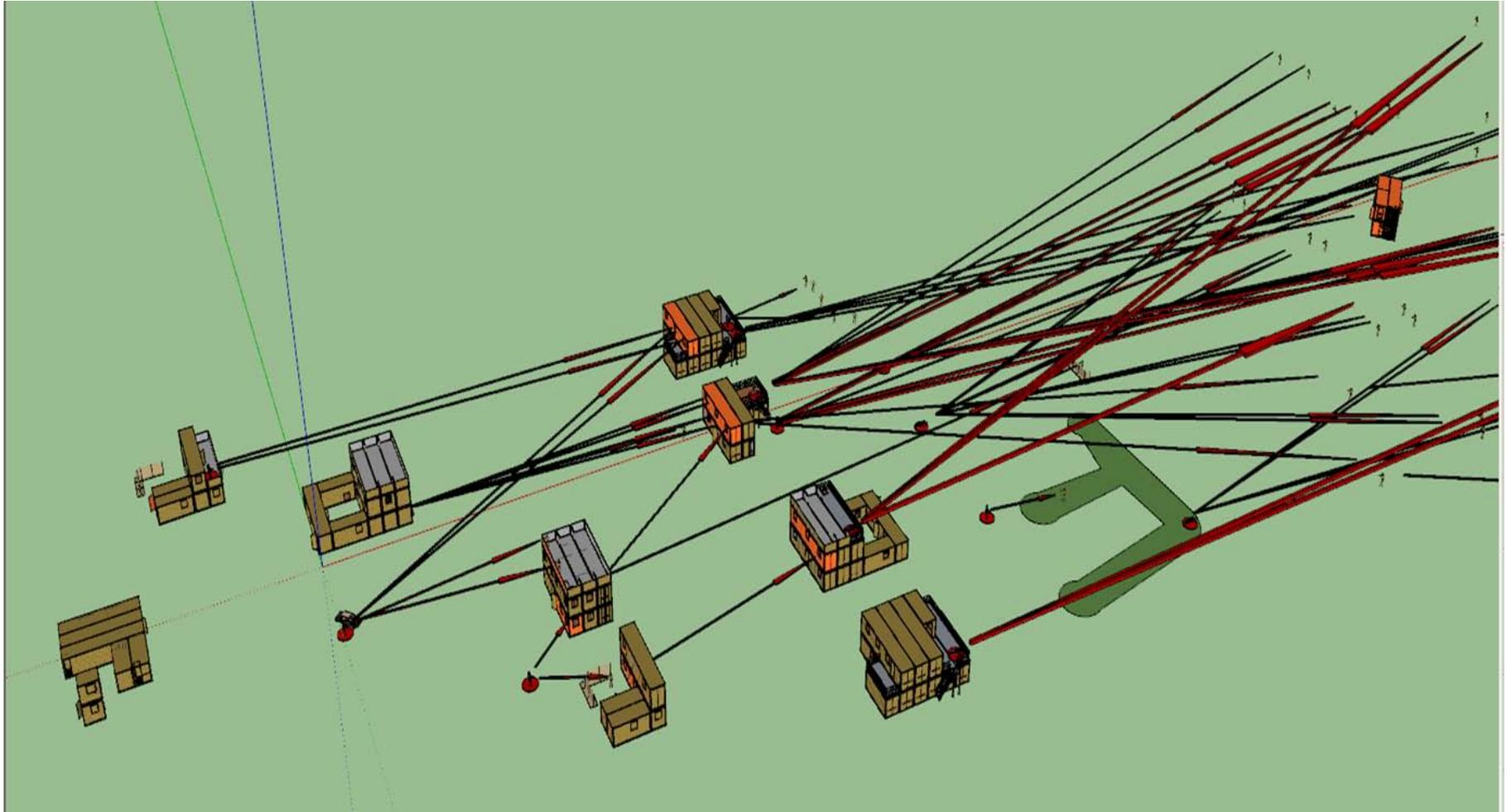
- Shooter tracking
 - Waypoint
 - Continuous
- Triggering the Target (Goal: Target presentation needs to be automatic)
 - High Speed Video
 - Potential Solutions
 - GPS Sensors
 - RFID Sensors
 - PIR Sensors
- Cueing the Shooter
 - Audio Speaker
 - Intra Squad Radio
 - Combined System
 - Gunfire Simulator



Determine the Ballistics Protection/Bullet Traps for Each Station

- Ballistic protection plan designed to preserve overall lifetime of course and keep a low total of cost ownership
- Design Considerations
 - Create safe and realistic environment
 - Ammunition
 - 9mm
 - 5.56 (M855A1 in Phase II)
 - 5.7mm
 - 6.5mm
 - 6.8mm
 - 7.62
 - Maintenance life-cycle cost
 - Durability

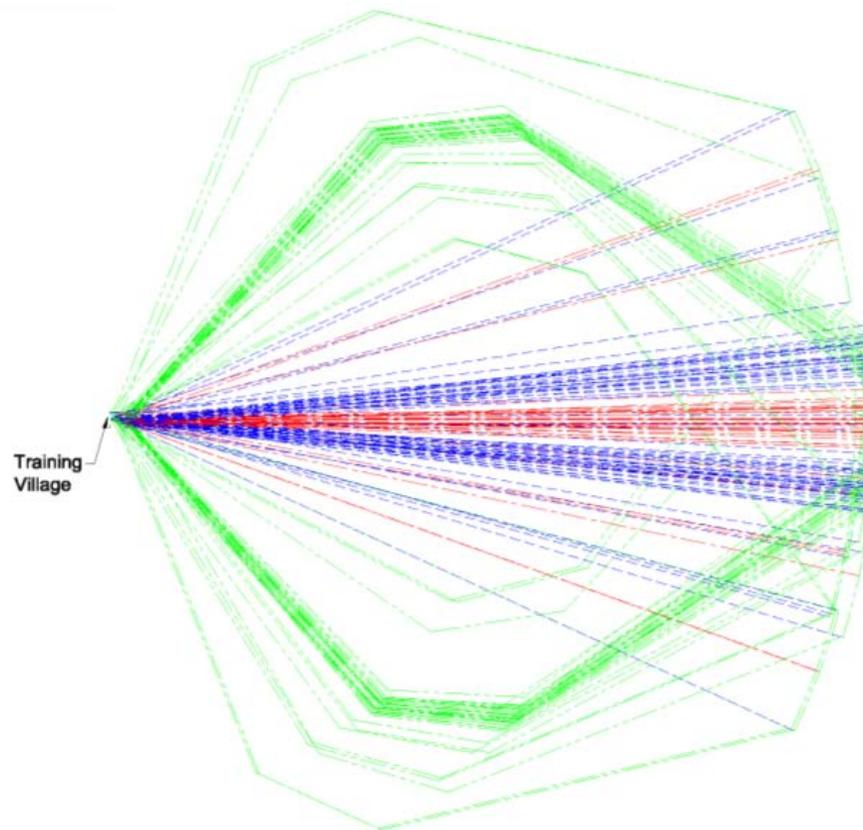






ID Safety Zones for Each Station for Full Range of Weapons and Ammunition

- May change base on site range regulations



Determine method of target damage assessment, computational requirements, and target reaction for each station

Damage assessment

- Shot Detection System
- Target Processing Unit
- Target Vulnerability Calculation

Target reaction

- Determined by output of the TPU and TVC

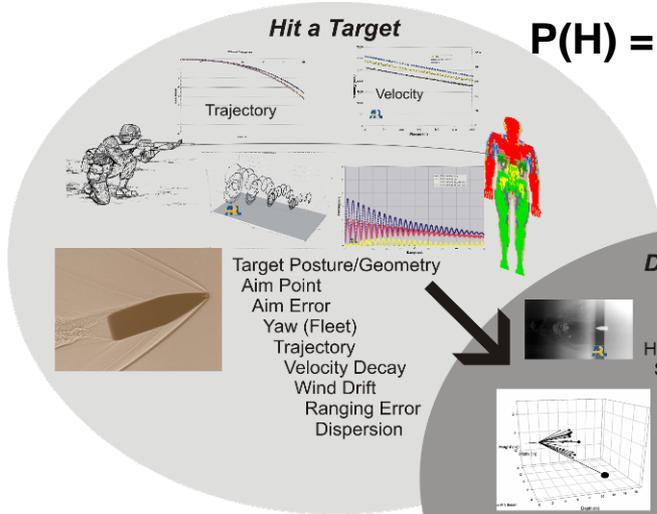
Computational Requirements

- Scoring System & After Action Review
- Range Control
- Shooting Position Cueing
 - Audio, Video, GPS
- COTS / GOTS software identified
 - OBAARS
 - HITS
 - TRACR

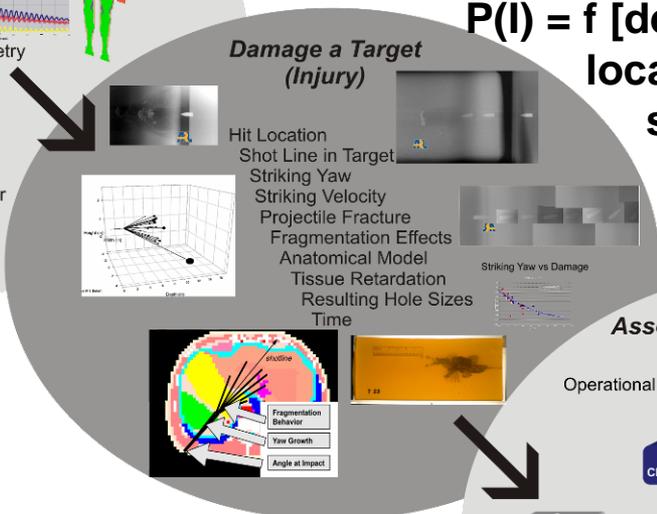


Determine the system required to overlay target vulnerability, impact location and damage assessment in real time to allow target reaction.

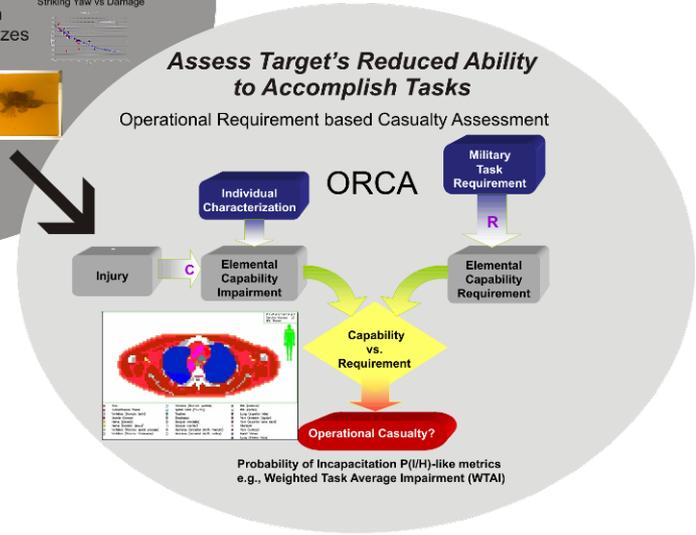
- Static / Dynamic Framework (SDF) – Army Research Laboratories (ARL)
- Operational Requirement-based Casualty Assessment (ORCA)
- SDF & ORCA modeling generate: Weighted Task Average Impairment (WTAI) & Probability of Incapacitation P(I)



$P(H) = f$ [Warfighter-weapon interface, aerodynamics, weapon & projectile design]



$P(I) = f$ [delivery, terminal effects, hit location and shot line, projectile/spall interaction with anatomical features, time]



Modeling and simulation in the Static/ Dynamic Framework / Operational Requirement-based Casualty Assessment (ORCA) model used to generate:

Weighted Task Average Impairment (WTAI)
Probability of Incapacitation P(I)

Empirically Driven System Effectiveness Models



Slide courtesy of the U.S. Army Research Laboratory

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Investigate alternate techniques to accomplish the required functions including both technical maturity and financial aspects.

- Technology analyses/alternatives for various system components (i.e. GPS, RFID, etc.)
- Attended trade shows throughout Phase I
- Integrate results into report detailing all relevant options for various technologies to be used in the course

Determine the Modeling and Simulation effort necessary to integrate the physical concepts with M&S programs such as America's Army and IWARS.

- Conducted deep dive investigation into AA and IWARS
- Determined tasks necessary to complete effort
- Investigated positives and negatives of each software platform

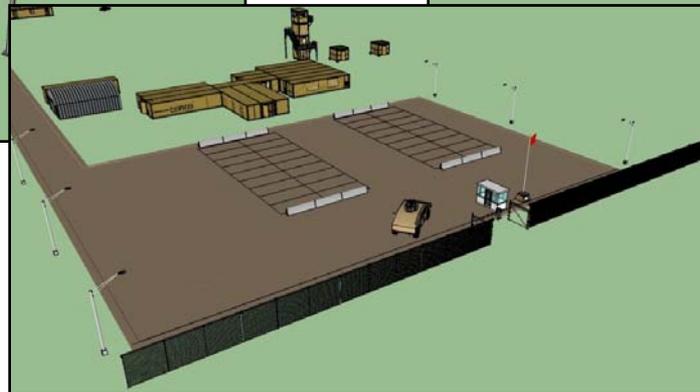


- Marketing potential
- Training Aid
- Allows soldier to become familiar with SWEAT prior to live fire
- Provides familiarity with:
 - Environment
 - Shooter position
 - Target location
 - Route between engagements
- Results in unguided execution of the SWEAT course



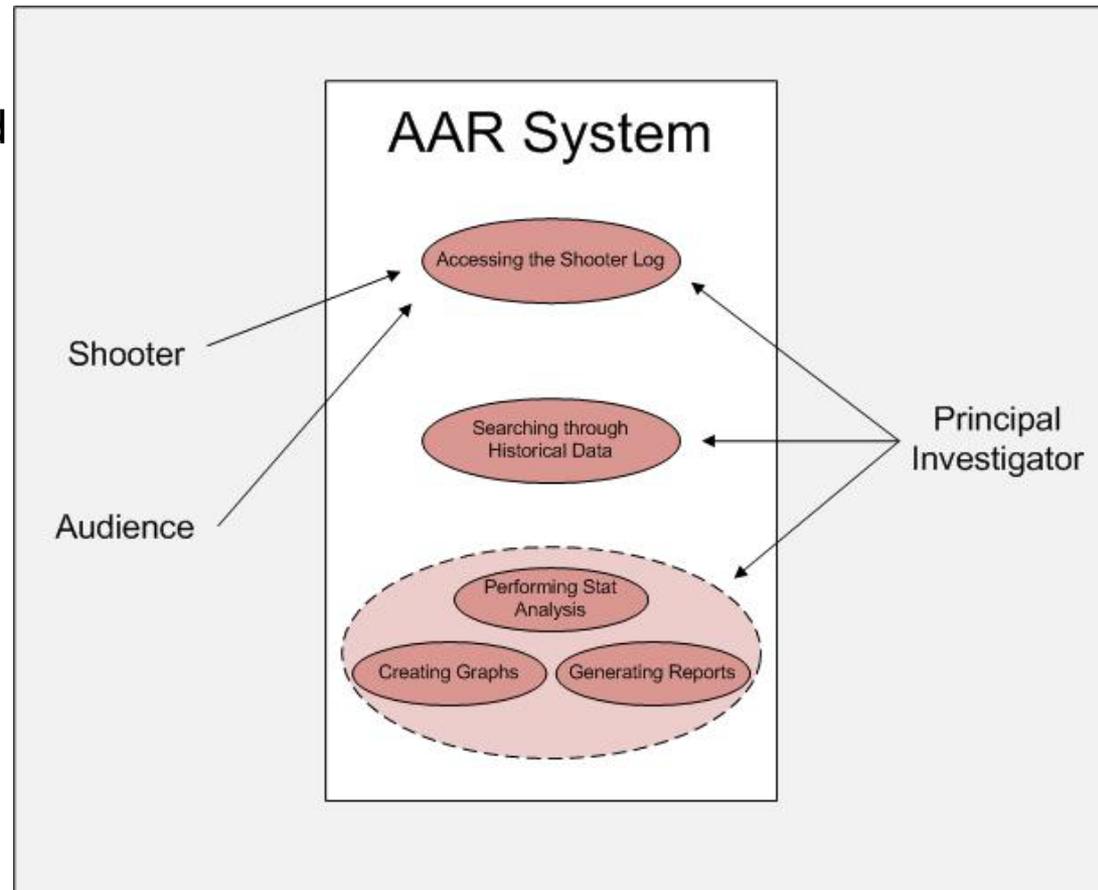
Determine overall physical configuration including training, control and briefing rooms

- Based on conversations with Government designed support facilities with certain amenities.
- Finalized course building layout and SDZ



Determine requirements for After Action Review Tools

- Developed 91 requirements and conducted functional analysis
- Developed five representative Use Cases
- Identified software solutions (Mostly COTS/GOTS)





- Phase II – Design
- Geographic location investigation
- Survey of Warfighters on Two Topics:
 - Realism of target behavior profiles
 - Realism of course scenario
- Modeling & Simulation adaptation





Questions?





Contact Information



David Sapp
973-724-7735
US Army – ARDEC
david.sapp@us.army.mil

