US ARMY RDECOM

U.S. Army Research, Development and Engineering Command

J.S.S.A.P. JOINT SERVICE SMALL ARMS PROGRAM

Malcolm Baldrige National Quality Award 2007 Award Recipient

ARMAMENT RESEARCH, DEVELOPMENT AND ENGINEERING CENTER PICATINNY ARSENAL, NJ

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Deep Future of Small Arms Study - Maintaining Small Arms Dominance

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Agenda

- *Background*
- *Acknowledgements*
- *Analysis (Phase I)*
- *Results (Phase I)*
- *Analysis (Phase II)*
- *Results (Phase II)*
- *Summary & Final Thoughts*

Background

Objective

- Joint Service Small Arms Program (JSSAP) office commissioned a two phase study to further examine futuristic technologies and notional concepts from a series of reports and workshops on their applicability to maintain small arms dominance.

  – Phase 1:
    - Workshop sponsored by Deputy Assistance Secretary of the Army for Research & Technology War-Gaming Implementation Office (SAAL-ZT).
    - Outcome: Report Titled: “Envisioning the Deep Future of Small Arms: 2022-2042”

  – Phase 2:
    - JSSAP Sponsored Enclaves and Meetings
    - Fifteen (15) JSSAP Futures reports dating back to 1986.

Acknowledgements

Contract Partner

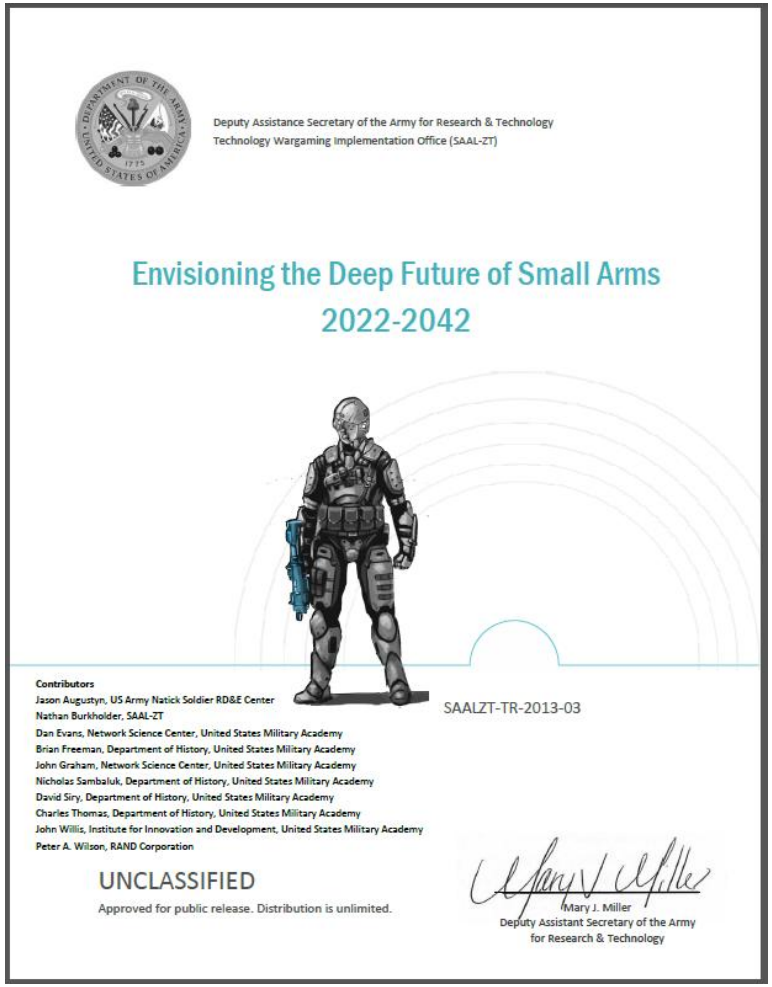
- Battelle Memorial Institute, Columbus, OH
- Mr. Ron Loesar, Project Manager
  - Jason Paugh, Principal Research Scientist
  - Chris Perhala, Principal Research Scientist
  - Jeff Widder, Senior Research Scientist

West Point Study

Envisioning the Deep Future of Small Arms: 2022-2042

27 concepts

- Exoskeleton (Iron Man)
- MAPS (Military Artificial Proxy Soldier)
- HERO (Holographic Environment Radius Operations)
- Micro Robotics
- CLAWS (Combat Lightweight Automatic Weapon System)
- AVATAR
- WASP (Weaponized Assault Surveillance Platform)
- Robotic Support
- IQ Box
- WISH (Weapon Informatics Soldier-Human)
- Rowe-Bot
- HEPA (Hyper Energy and Power Ammunition)
- SLACK (Squad Level Active Collaborating Knowledge)
- SAVE (Soldier Asymmetric Vision Equipment)
- Kinetic Modular Weapon Platform
- DENI (Directed Energy Negation and Integration)
- Super Soldier (Bio enhancement)
- GAP (Genius Ammunition Project)
- Effects Options
- Energy Harvesting
- Neuroscience Enhancement
- Electric Rifle
- Self-Healing Weapons
- HOPE (Hyperbolic Operations Projector Experimental)
- Fake (Flabbergasting Armament Kinetic Employer)
- PREP (Personal Rocket Explosives Project)
- Front Line Soldier Fabrication



Deputy Assistance Secretary of the Army for Research & Technology
Technology Wargaming Implementation Office (SAAL-ZT)

Envisioning the Deep Future of Small Arms
2022-2042

SAALZT-TR-2013-03

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Mary J. Miller
Deputy Assistant Secretary of the Army
for Research & Technology

Based on Four (4) Scenarios

- Cold War II
- Global Footprint
- Turning Inward
- Standing in a Tinderbox

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TECHNOLOGY DRIVEN. ***WARFIGHTER FOCUSED.***

JSSAP Sponsored Enclaves

- **Generate revolutionizing ideas for future weapons to maintain our overmatch and dominance**
- **Over 15 references from 1986 onward**

Analysis of Future Technologies for Infantry Weapon Bursting Munitions
Analysis of Future Technologies for Individual Weapon Systems
Analysis of Future Technologies for Small Arms Fire Control
Analysis of Future Technologies for Crew Served Weapon Systems
The JSSAP 1994 Sniper Conference
The Objective Personal Weapon Shooters' Conference
The Results of the Objective Personal Weapon and Objective Sniper Weapon Technology Assessment
Future Small Arms Conclave: Objective Individual Combat Weapon and Objective Crew Served Weapon Technical Working Groups
Reassessment of Directed Energy Technologies for Small Arms
Summary Report on Future Alternative Weapons Concepts Workshop held at Battelle Conference Center
Future Alternative Planning and Assessment for Potential Weapon Concepts
Report on the Results of the Future Small Arms Conclave-Blue Sky-2020
Report on U.S. Army Joint Service Small Arms Program Futures Meeting
Final Report: Futures Meeting November 2009
2011 Futures IV Vision Workshop April 2011

Analysis Methodology (Phase 1)

Approach

- Engage SMEs, generate robust system statements
- Utility rating and applicability assessment
- Engineering/feasibility evaluation
  - Identify technical hurdles and limiting / pacing technologies.

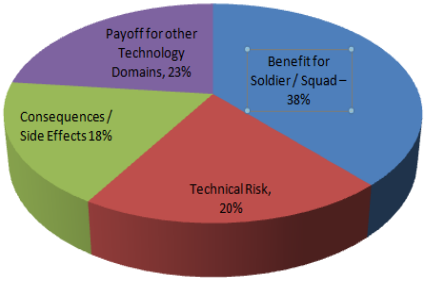
Concept Evaluation

- Define applicable performance characteristics and metrics
  - Which characteristics and metrics for consistent comparisons? (i.e. Weight, size, energy efficiency, other?)
- Define **utility and applicability rating** methodology
  - How to consistently and quantitatively rate performance characteristics and metrics?
- Apply utility and applicability rating method
- Define engineering assessment/evaluation factors
  - Based on the cost and time associated with developing the limiting technologies

Rating Methodology

Utility Rating

- Based on Weighted Criteria
- Each Scored 1 - 100
  - Benefit for Soldier / Squad, 38%
  - Technical Risk, 20%
  - Consequences / Side Effects, 18%
  - Payoff for other Technology Domains, 23%



Applicability Rating

- Based on 4 Future Scenarios
- Presented using the deviation from the mean
  - Scored 1-7 (1= Low, 7 = High)

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Down Selection

- Evaluate all Technologies / Ideas in the Current Futures Report
- List all Technologies / Ideas in Past Reports
  - Remove Redundant / Obsolete / Fielded Technologies
  - Rank order remainder
    - Deep Future Ranking- High Utility, Applicability
    - SME Input - Cost and time associated with developing the limiting technologies

Results (Phase 1)

- Phase I Results – Utility (Technical SMEs)
- Phase I Results – Utility (Benefit to the Soldier, ONLY) End User SMEs
- Phase I Results – Utility
- Phase I Results – Applicability Technical SMEs
- Phase I Results – Applicability End User SMEs
- Phase I Results – Applicability
- Phase I Results – Impact on TTP End-User SMEs
- Phase I - Top rated concepts based on Utility, Applicability, and Associated Technologies

Some of the concepts focus on technologies that enhance soldier capability do not fall under the JSSAP mission (i.e. concepts in areas such as survivability and communications)

Approach (Phase 2)

- **Concept Definition**
  - Define each concept to a sufficient level of detail to allow for quantitative estimates.
- **Development of Evaluation Criteria**
  - Criteria based on “Future Report,” further defined using basic infantry functions.
- **Concept Evaluation**
  - A series of standardized questions are used to guide the establishment of consistent ranking values.
- **Concept Ranking**
  - Rank the concepts based utility, applicability, impact to Tactics, Techniques, and Procedures, and number of Small Arms related technologies.
- **Engineering Analysis**
  - Nearly identical to Phase I
  - Evaluations conducted by technical SMEs only
  - TTP was not scored separately
- **Down-Select**
  - **171 S&T concepts identified and evaluated as part of the study**
  - **10 were selected for engineering analysis.**
  - **Approximately 40% of the 171 concepts were duplicates of, or similar to, other listed concepts. This included concepts that were covered in Phase I**
  - **Approximately 28% of the 171 had already been fielded or were ready to be fielded.**
  - **Approximately 23% of the 171 concepts were not well defined S&T concepts, or fall into a category where the technology is be being continuously developed.**

Results (Phase II)

CONCEPT NAME	CONCEPT DESCRIPTION
Maneuver Weapons Designed for Confined Spaces	Kinetic weapons have less-than-lethal versions but ranges may be too great for confined space. Non-kinetic weapons (Taser, blinding lasers) have been developed and deployed
Increase Weapon Bore Size	A larger diameter barrel enables more versatile rounds to be employed. Increasing barrel diameter using the same fabrication material will incur a weight gain; this is contrary to the current trend of making weapons lighter.
Area/Crowd Electro muscular Control	Electro-muscular control weapons deny someone voluntary control of limb muscles and are considered nonlethal. The weapon should be usable against all individuals in a room or on an unruly street crowd. Projectile based weapons are range restricted and are limited by rate of fire and magazine capacity.
Weapon Acoustic Signature	The acoustic signature of most weapons can be exploited by the adversary in order to detect the weapon. In addition to the use of conventional silencers and muzzle flash hiders, other means of reducing acoustic signature may be feasible, e.g. changing propellant characteristics.
DEMON	Demon is an electrically excited air defense laser which fits into a stinger or an avenger tube and provides the User with laser energy to be used against fixed and rotary wing aircraft.
Chemical / Organic Relay	Genetically tailored plants, or insects, to remotely relay/amplify simple binary data from sensors to soldiers/C3I,or between soldiers
Small Arms Launched Radio Jamming Device	Technology exists that is reasonably small scale but is of limited range. In addition to possible threats span from toy two way radios to cellular phones; try to jam all these devices is a formable task and may not be doable in a small arms projectile.
Internal First Aid (Nano-Doctors)	The concept envisions nano-bot medics that would be injected into the human body to immediately begin repairing battle wounds and other injuries. In addition to conceptual work, some early nano-doctor development has been done.
Short time-of-flight KE Projectiles	To use with an advanced combat rifle
Lump Gun	Anti-personnel chamber of gun can hold any lumps of ferrous metal, strips needle-shaped projectiles from lump and fires them.

Summary & Final Thoughts

- **Provides a Entry Point for JSSAP 'Futures' Requirements**
- **FINAL REPORT - Deep Future of Small Arms Study***
- **DOTC Annual Technology Plan (FY16)***
  - ✓**WPN-16-82, AMM-16-15, AMM-16-15**

* **Available to DOTC/NAC Members only (http://www.nac-dotc.org/)**

DOTC: Defense Ordnance Technology Consortium (DOTC) / National Armaments Consortium (NAC)

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