



EDGEWOOD

RESEARCH, DEVELOPMENT & ENGINEERING CENTER

U.S. ARMY CHEMICAL AND BIOLOGICAL DEFENSE COMMAND

ERDEC-TR-269

**LIGHT VEHICLE OBSCURATION SMOKE SYSTEM (LVOSS)
PARTICIPATION IN THE 1994
INFANTRY COMMANDERS' CONFERENCE (ICC)
ADVANCED WARFIGHTING EXERCISES (AWE)
AT THE DISMOUNTED BATTLESPACE BATTLE LABORATORY (DBBL)
FORT BENNING, GA
10-11 MAY 1994**



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CONCURRENT SCIENCE AND ENGINEERING DIRECTORATE

September 1995

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FORWARD

The following U.S. Army Edgewood Research, Development and Engineering Center personnel conducted the Light Vehicle Obscuration Smoke System demonstration at Dismounted Battlespace Battle Laboratory.

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SPC Stephen Gwyn, 598th Maintenance Company, Fort Benning, GA, served as the demonstration vehicle driver.

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PREFACE

The work described in this report was authorized under Project No. 10463627DE79-08, Smoke/Obscurants, LVOSS. This work was started in April 1994 and completed in May 1994.

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10-11 MAY 1994

1. OBJECTIVE

This report describes the U.S. Army Edgewood Research, Development and Engineering Center (ERDEC) Light Vehicle Obscuration Smoke System (LVOSS) program participation in the Dismounted Battlespace Battle Laboratory (DBBL) Exercises at Fort Benning, GA, 9-11 May 1994. These exercises consisted of the Advanced Warfighting Exercise (AWE) and Red Cloud Live Fire Exercise (LFX) portions of the Infantry Commanders' Conference (ICC) Warrior Future Operational Capabilities of the United States Infantry. The objective of the participation was to gain insight and input on the LVOSS design requirements from the user community.

2. LVOSS BACKGROUND/SYSTEM DESCRIPTION

The objective of the LVOSS program is to develop and field a grenade launcher with accompanying grenade for light vehicles that is capable of providing obscuration in the visual and infrared (IR) portion of the electromagnetic spectrum. The LVOSS is intended to serve as the standard obscurant projecting/generating system for the Highly Mobile Multipurpose Wheeled (HMMWV) family of light vehicles. Other light vehicles may be considered. Currently unarmored light vehicles are particularly vulnerable to enemy direct, indirect fires, and counterfires.

The LVOSS program is currently in the concept exploration/definition phase of the life cycle. The concept will use a design to incorporate a combination of old and new technology. The LVOSS smoke screening grenade launcher could be mounted on the front, rear, or on the top of a light vehicle. The design may use the existing vehicle bumpers, a modified, or a redesigned bumper. The smoke grenade will be developed to provide the required screening.

Operational needs for the LVOSS have been identified for HMMWV Scouts in support of armor and mechanized operations, HMMWV tube-launched (optically tracked) wire-guided missile (TOW) variants for antitank support, artillery survey and forward observation teams, and military police (MP) versions. As much as possible, each variant will retain its combat load and operational capabilities in transportability, mobility, firepower, and communications when configured with LVOSS. At the current stage of LVOSS development, there are two different LVOSS launcher configurations. One configuration is an integrated bumper/launcher assembly that replaces the standard front bumper on HMMWVs not equipped with winches. The second configuration is for winch-equipped HMMWV's and uses two mirror-image (left and right) halves to mount

two tubes to the frame on either side of the winch (See Figure 1). Both configurations consist of four 66-mm smoke grenade launcher tubes, brackets for mounting these tubes to existing HMMWV features, wiring for connecting the launchers to the vehicle battery, and a control box. For the configurations with winches, there is a 45° spread among the four launcher tubes. For the configurations without winches, there is a 90° spread among the four launcher tubes. Aluminum tubes from an M257 type standard smoke grenade launcher are used in both configurations. Due to safety, environmental, and toxicity problems with existing smokes, ERDEC is using a new smoke as part of LVOSS. The terephthalic acid-based (PTA, Type 3) grenade is a soft launched, nonfragmenting, pyrotechnic smoke dispenser (See Figure 2). Three dual-ported, core-burning, smoke canisters are ejected from an integral 66-mm aluminum cartridge that is inserted into any standard 66-mm grenade launcher. Each of the canisters contain a pyrotechnic mixture weight of 185 g. Each grenade round will also contain a starter mixture (18 in. of quick match and one electric match). The electric match used in this smoke grenade is resistant to initiation by stray electrical current and radio-frequency (RF) energy up to 1 ohm. The terephthalic acid smoke composition used in the PTA, Type 3 cartridge, is similar to that in the M83 Smoke Grenade.

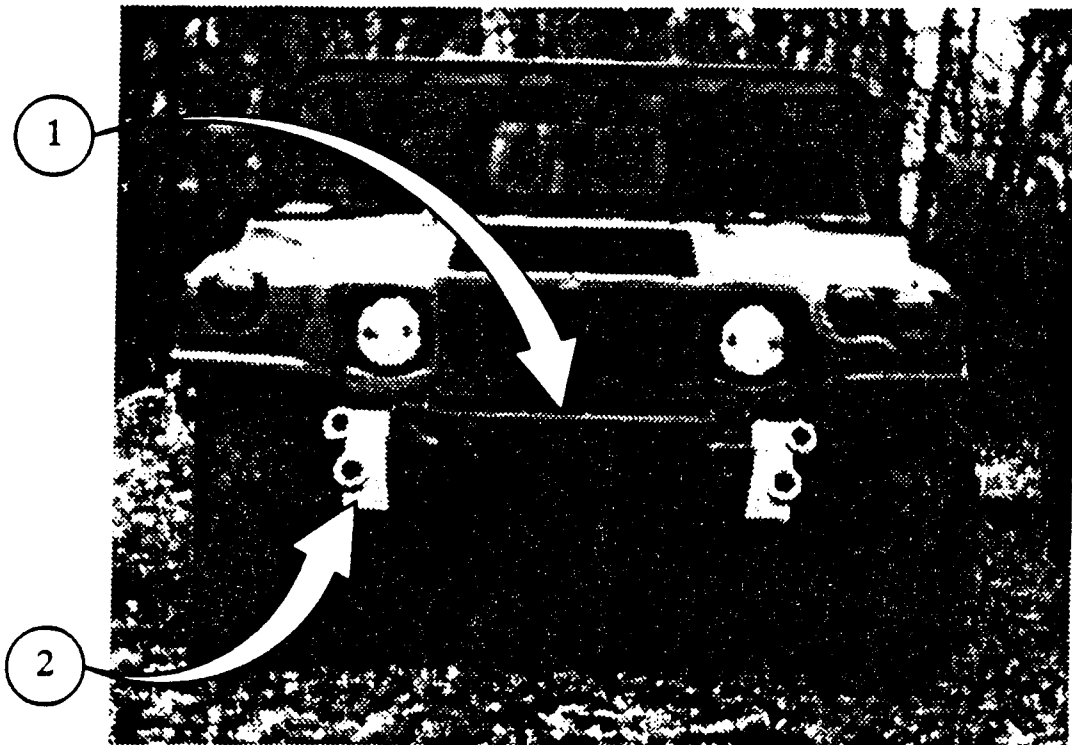


Figure 1. HMMWV with Both Styles of Launchers: 1) Integrated Bumper/Launcher and 2) Mirror Imaged Winch-Launchers

Cartridge, Smoke

LVOSS

PTA, Type 3

NSN: 1330-00-D00-9140

Lot# PLF94B000E001

TYPE OF FILL: Terephthalic Acid Smoke

COLOR OF SMOKE: White

TIME OF SMOKE PRODUCTION: 30 Seconds

NUMBER OF SMOKE CANISTERS: 3

AMOUNT OF SMOKE MIX PER CANISTER: 185 grams

Cartridge, Smoke, LVOSS, PTA, Type 3

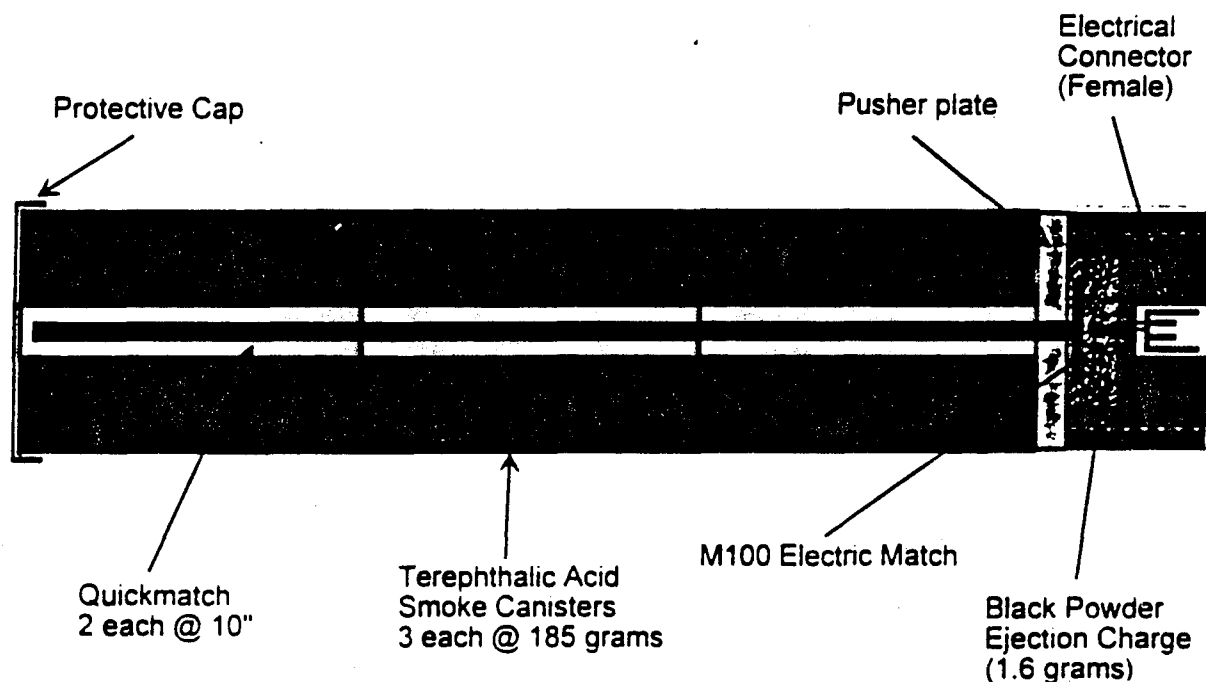


Figure 2. Ammunition Description Sheet, Cartridge, Smoke, LVOSS, PTA, Type 3

When launched, the height of the LVOSS smoke grenade will be approximately 10 m, with a distance of 30 m. The three canisters within each grenade land within 3 m of each other. The smoke canisters burn at a relatively low temperature in comparison to hexachloroethane (HC) type smoke grenades. This low burning temperature has been shown to have a low probability of causing field and/or grass fires. The canisters will be cool enough to touch within 30 min. The approximative safety fan (radius, distance) for the launcher area is 180° by 100 m.

3. AWE OBJECTIVE/BACKGROUND

The objective of the AWE portions of the ICC was to contribute to warfighting across Doctrine, Training, Leadership, Organization, Maneuvering, and Soldier System (DTLOMS). In addition, the AWE was to demonstrate (in a force-on-force environment) survivability, lethality, battle command, mobility, and sustainability in selected DTLOMS. Generally, the AWE involved insertions of early entry forces to seize an air head (night) followed by a linkup with mechanized forces (day). The night AWE concentrated on developments in airborne insert simulation, air assault, obstacle breaching, Military Operations or Urbanized Terrain (MOUT), and hasty defense. The day AWE concentrated on developments in defense, linkup, passage of lines, and a mounted attack with dismounted overwatch.

The objective of LVOSS in the AWE was to provide obsuration for a Hunter-Surrogate Vehicle within the Rapid Force Projection Initiative (RFPI) Hunter-Standoff Killer Concept. In this case, LVOSS concealed the "Magic Warrior" vehicle after completing its mission and before moving to another location. This is a Department of the Army (DA) Advanced Land Combat Initiative, which combines the effect of advanced forward deployed sensors (hunters) and long range advanced weapon systems that can be deployed with light divisions.

The capabilities/specifications for this RFPI killer concept are as follows.

- Hunter-Surrogate consists of the following 8 major subsystems: electro-optic sensors, power, radar, operator console, 10-m pneumatic mast, processor, vehicle, and communication.

- Enhanced Fiber Optic Guided - Missile (EFOG-M) consists of 6-8 fiber optically guided rounds, with a imaging IR seeker, to allow guidance and feedback to the gunner for battle damage assessment and day/night capability. It can engage moving and stationary targets at ranges of up to 12 K.

- Automated Fire Support Element (AFSE) is a hardware/software command tool that uses SINGCARS radio for communication and a HMMWV with a 10-K generator as an alternate power source.

4. LVOSS TEAM PREPARATION FOR THE AWE

Preparation for the AWE began in early February 1994, a 3 mo schedule was developed with the major areas of launcher concepts, arm and fire device, and safety release preparation.

Under launcher concepts, bumper/launchers were designed, fabricated, and tested before use in the AWE. As mentioned in the LVOSS system description, there were two bumper/launcher designs. In conjunction with this, the arm and fire device were developed and fabricated. A standard arm and fire system currently in the government system was eventually used. Bi-weekly meetings were held to ensure that proper progress on the hardware design and fabrication was achieved.

The U.S. Army Test and Evaluation Command (TECOM) generated a Safety Release on the system for the LVOSS team to participate. For the safety release to be written, TECOM requested the following list of information: Initial Health Hazard assessment, Toxicological Studies, Material Safety Data Sheets, Interim Hazard Classification Guide (for shipping), Safety Assessment Report, Training Package, Written description of the hardware and ammunition, and any available reports, tapes, etc., on the LVOSS. TECOM personnel also had to witness a test shoot of LVOSS hardware and ammunition. All of this information was either generated or obtained by various LVOSS team members. The safety release effort turned out to be the driving element in the schedule. When the LVOSS Team left for Fort Benning, the safety release was not complete. However, the safety release was completed and forwarded to Fort Benning shortly after LVOSS Team arrival there. Before starting the AWE, the safety release was completed and therefore did not affect the AWE schedule.

The Pyrotechnics Team, ERDEC, handled the ammunition design fabrication and testing. The Center worked on a separate schedule and ensured that ammunition was available for the test shoots and the AWE. There were 24 rounds of ammunition fabricated for the AWE.

Also, the LVOSS Team mounted hardware (bumper/launchers) on an ERDEC HMMWV that was used as a static display vehicle on site at the ICC. Personnel from ERDEC delivered this vehicle to Ft. Benning via commercial transportation.

5. LVOSS PARTICIPATION IN THE AWE

Even though the AWE did not take place until the 10-11 May 1994, the LVOSS Team members were required to be on site for 3 weeks, beginning 27-28 April 1994 for training and rehearsals. The ERDEC personnel delivered the equipment on 27-28 April 1994; and upon arrival, they met with one of several AWE point of contacts. The ERDEC personnel were informed that the LVOSS was to be mounted on the vehicle called the "Magic Warrior," and it was scheduled to arrive on 29 April 1994. At this time, it was not yet determined on how the LVOSS would be used within the scenario for the AWE. On 29 April 1994, ERDEC personnel met with the U.S. Army Chemical Biological and Defense Command (CBDCOM) Technical Liaison at DBBL to obtain details for the AWE and

the conference. The Technical Liaison point of contact informed ERDEC personnel that there were three separate demonstrations at the conference. The AWE was designed into day and night performances and there was the Red Cloud LFX. This gave the LVOSS possibly two exercises to participate in during the ICC (Day AWE and Red Cloud LFX).

Once the "Magic Warrior" vehicle arrived and was located, LVOSS hardware was not mounted due to stabilization outriggers. A meeting was then held among ERDEC and AWE personnel to determine the application of the LVOSS for the day AWE. A decision was made to mount the LVOSS onto a support HMMWV that DBBL provided as an "add in" to the scenario. This was an ideal solution, because in normal deployment the "Magic Warrior" is escorted by a support vehicle. Once this was determined and the support vehicle located, ERDEC personnel met with the vehicle operator and installed the LVOSS hardware.

On 2 May 1994, ERDEC and EOD personnel met to track the location of the LVOSS ammunition. Also, ERDEC personnel met with the vehicle operator and decided that training would be conducted on 3 May 1994. Later, ERDEC personnel met with a representative from the office of the Director of Combat Developments (DCD), and at that time, they were told that they would not participate in the Red Cloud LFX scenario. However, there would be a slotted space at Red Cloud Range for the ERDEC static display vehicle. At that time, ERDEC would probably have an opportunity to conduct an "off-line" demonstration of the LVOSS following the actual LFX.

On 3 May 1994, ERDEC and EOD personnel located the LVOSS ammunition. The ERDEC personnel trained the vehicle operator on the operation of LVOSS (training included ammunition and both types of launchers). In addition, an operators manual and a copy of the Safety Release were provide to the vehicle operator. The operator fired eight rounds (2 volleys) of inert ammunition during the Day AWE walk-through rehearsals and four rounds (1 volley) of live ammunition during the DAY AWE full speed rehearsal. There were no misfires; and the smoke cloud, produced during the rehearsal, was near perfect. Weather conditions were ideal with high humidity and little or no wind.

On 4 May 1994, ERDEC personnel met with the vehicle operator at the Leader Reaction Course, where the Troop Leadership Procedures (TLP) rehearsals took place before the AWE. The TLP rehearsals demonstrated and displayed the equipment that was used in the AWE. It gave the VIPs the opportunity to see the equipment close up before the AWE. A short description of the system was prepared and provided to the vehicle operator to use during the TLP rehearsal. After the rehearsal, ERDEC personnel met with the DCD. The static display vehicle location was obtained and details of the "off-line" demonstration were discussed.

The ERDEC personnel attended a DAY AWE walk-through rehearsal that was conducted on 5 May 1994. During the rehearsal, synchronization within the scenario was worked on. Also, ERDEC personnel arrived at Fort Benning with the static display vehicle.

The static display vehicle was delivered to Red Cloud Range on 6 May 1994. The ERDEC personnel attended a DAY AWE full speed rehearsal. Once again, the LVOSS was successfully employed with no misfires. However, the wind was gusting and in the wrong direction; thus, the smoke cloud did not last very long.

On 9 May 1994, ERDEC personnel registered for the conference. They met with EOD personnel to obtain release of the ammunition and met with a DCD representative. The DCD POC notified ERDEC personnel that the LVOSS "Off-line" demonstration would occur approximately 1 hr following the LFX at Red Cloud on 10 May 1994. Therefore, ammunition for this demonstration was transferred from the AWE site to Red Cloud Range. Also, ERDEC personnel met with the vehicle operator, which informed them that the rehearsals over the weekend went well. There were no misfires and the smoke cloud sufficiently concealed the "Magic Warrior" vehicle.

On 10 May 1994, several ERDEC personnel attended the conference, while others worked on transferring four rounds of LVOSS ammunition from the AWE site to Red Cloud Range so the "off-line" demonstration to be conducted later in the day. Also, the LVOSS static display was set-up at Red Cloud Range. After the LFX, all ERDEC personnel were stationed around the LVOSS static display as the ICC VIP attendees walked thru the display line. Several contacts were made, which included a Brigadier General with the Military Police, 6th Infantry Brigade, and a contractor for the "Magic Warrior" Vehicle. In general, the personnel viewing the LVOSS demonstration/static display vehicle liked the concept of smoke on a HMMWV but provided no specific user requirements. However, there were comments made concerning the LVOSS design, because the grenade launcher is integrated into the bumper. The concern was that this may cause problems, because the HMMWV bumper is used to knock down trees in the field. However, there was no specific guidance provided on where to integrate the launcher if not into the bumper. The General invited the LVOSS to participate in a Brigade field exercise, which is in the planning process at ERDEC. The Center will coordinate with the "Magic Warrior" contractor toward incorporating the LVOSS in the exercise.

After the LFX display walk-through, ERDEC personnel conducted the LVOSS "Off-line" demonstration for personnel from the Armor School, DBBL, the Mounted Battle Laboratory, Ft. Knox, KY, and the Directorate of Combat Developments, U.S. Army Infantry School, Ft. Benning, GA. There was one misfire, which was attributed to water in the launch tube. However, the personnel that witnessed the demonstration were impressed with the LVOSS and did not seem concerned about the misfire. They stated that there is definitely a need for a system with this capability.

Over 400 contractors, civilian, and military personnel were in attendance on 11 May 1995 when the AWE was conducted. The LVOSS experienced no misfires, and the "Magic Warrior" vehicle was concealed so that one could not view its movement out of the area. After the exercise, a symposium was held to address comments, questions, or concerns about the equipment demonstrated during the AWE. There were no comments generated concerning the LVOSS. Later in the day, ERDEC personnel removed the hardware from the DBBL vehicle, disassembled the LVOSS display, and loaded the ERDEC vehicle for

shipment. Also, ERDEC met with EOD personnel to ensure proper disposal of the misfired LVOSS round at the Red Cloud Range.

6. PROBLEMS ENCOUNTERED

Several problems were encountered during the exercises. The LVOSS hardware could not be installed on the "Magic Warrior" vehicle. Another vehicle had to be obtained for the LVOSS to participate in the exercise. The LVOSS was not included in the Red Cloud LFX scenario, and the LVOSS mounting hardware for the control box had to be reworked during installation of the LVOSS. In general, there was a lot of confusion and lack of communication throughout the preparation for the ICC.

7. SUMMARY/LESSONS LEARNED

The Light Vehicle Obscuration Smoke System (LVOSS) Team participation in the 1994 Infantry Commanders' Conference, Advanced Warfighting Exercises, conducted by the Dismounted Battlespace Battle Laboratory, Ft. Benning, GA, was a good experience. The LVOSS capabilities were successfully demonstrated several times. Although some useful information was obtained, it was determined that large conferences/demonstrations are not effective for obtaining user feedback. In the future, the LVOSS Team should concentrate on field exercises with the purpose of training soldiers. Also, for future exercises and display opportunities, a more elaborate display of the LVOSS needs to be built; provide a one page handout on the LVOSS capabilities; and provide business cards to attendees. With the addition of these items and considerations, the LVOSS Team will display and demonstrate the LVOSS more efficiently, so potential customers/users will take notice and provide more useful information on the design of LVOSS.

GLOSSARY OF ACRONYMS

AFSE	Automated Fire Support Element
AWE	Advanced Warfighting Exercises
DA	Department of the Army
DBBL	Dismounted Battlespace Battle Laboratory
DCD	Director of Combat Developments
DTLOMS	Doctrine, Training, Leadership, Organization, Maneuvering, and Soldier System
EFOG-M	Enhanced Fiber Optic Guided - Missile
EOD	Explosive Ordnance Disposal
ERDEC	Edgewood Research, Development and Engineering Center
HMMWV	Highly Mobile Multipurpose Wheeled Vehicle
ICC	Infantry Commanders Conference
LFX	Red Cloud Live Fire Exercise
LVOSS	Light Vehicle Obscuration Smoke System
MOUT	Military Operations on Urbanized Terrain
MP	Military Police
RF	Radio-Frequency
RFPI	Rapid Force Projection Initiative
TLP	Troop Leadership Procedures
TOW	HMMWV Tube-Launched, Optically Traced, Wire-guided Missile