Report 2318

DECOY AND DECEPTION TECHNIQUES

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U.S. ARMY MOBILITY EQUIPMENT
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This report is a compilation of decoy designs and deception techniques developed and/or evaluated by the US Army Mobility Equipment Research and Development Command during the period 1970-79. It includes descriptions of the various decoy items, an evaluation of their effectiveness where available, and a current status statement.

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PREFACE

This investigation was conducted under the authority of Department of the Army Project 1L162733AH20CC during the period January - October 1980.

The data in this report were compiled and analyzed by Edward P. Leland, General Engineer, and Terilee Hanshaw, Physical Scientist, under the supervision of Kenneth J. Oscar, Branch Chief. The overall superisor was Henry R. Atkinson, Chief, Research Technology Division of the Camouflage and Topographic Laboratory.

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DECOY AND DECEPTION TECHNIQUES

I. INTRODUCTION

1. **Purpose.** This report is a compilation of the various decoy designs and deception techniques developed and/or evaluated by the US Army Mobility Research and Development Command during 1970-79 and is intended as a demonstration-type handbook to be used as a means of educating the Department of Defense users (e.g., the Army's Training and Doctrine Command (TRADOC) in the technological state-of-the-art in deception. By use of decoys and deception techniques, the user can deceive the enemy's most advanced sophisticated surveillance equipment and techniques. .

2. **Background.** The use of the decoys is apparently as old as warfare. Their repeated use over such a span of time attests to their military effectiveness. The question of decoys is not will they be used but, rather, when, where, and at what level of sophistication. The story of the Trojan Horse is a very old recounting of deception where the Trojans believed the horse was a gift from the departing Greek Army, whereas actually it was a ruse to get soldiers inside the impenetrable walls of Troy.

In England in WW II, entire air fields were decoyed.[1] The decoys included runway lamps (Q lights), simulated landing of aircraft, artificial fires, and dummy bomb craters. These decoy airfields were highly effective against repeated German attacks and even fooled British airmen who attempted to land on the fake fields in emergencies.

Also in England during WW II, an entire army consisting of two corps was successfully decoyed so that the Germans were convinced of a potential Allied invasion into Norway. The decoys included those of tanks, tank tracks in the soil, troop barges, landing craft, aircraft, radio traffic, etc.

In the North African campaigns both the Germans and the Allies made extensive use of decoys of tanks, artillery, supply points, etc., with devastating effects on both sides. Decoys included dragging dust disturbers behind trucks to simulate moving tanks.

Since WW II, the US Army has not emphasized deception although training

[1] Seymour Reit, "Masquerade - The Amazing Camouflage Deceptions of World War II." Hawthorne Books, Inc. (1978).

and doctrine manuals [2] [3] [4] include varying levels of decoy information. At present, the applicable unit commander is responsible for his deception effort, which has to be at a level of field-fabricated capability since there is no deception materiel in the current inventory.

The fighting Army needs a significant deception capability to survive on the modern battlefield. This report, although far from being all inclusive, is intended to show some of the things that can be done in the deception materiel area.

II. FULL-SCALE VISUAL AND MULTISPECTRAL DECOYS

3. Inflatable Decoys.

a. **HAWK Assault Platoon Decoy Set.** This decoy set of nine modules (improved platoon command post, continuous-wave acquisition radar, high-power illuminator, three 60-kilowatt generators, and three missile launchers) was developed by a private German contractor for the Federal Republic of Germany Army. The U.S. Army version is modified for the U.S. 60-hertz electrical system and U.S. Army generators. The set is inflated by means of nine small commercial vacuum cleaners used as blowers for each of the nine modules. There is a pressure control system that turns the vacuum cleaners on and off and also permits pressure venting as needed. The control system thus maintains pressure to assure safe and adequate inflation regardless of ambient temperatures or solar heating. Figure 1 illustrates the real HAWK equipment.

The decoy set is full-scale (Figure 2) and includes a capability of simulating the metallic radar signatures of the real HAWK modules and the thermal IR signature of an operating generator. In addition, the antenna of the decoy continuous-wave acquisition radar (CWAR) is powered to rotate. Figure 3 shows the decoy set in tactical deployment. As a complement to the German set, a decoy radar signature emitter of the CWAR was designed and built by the Raytheon Corporation, the prime HAWK contractor, for the Air Defense School (ADS) at Ft. Bliss. The emitter duplicates the active radar signature but at a lower power level.

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[2] TM 5-200, "Camouflage Materials." Hq, Department of the Army, Washington, DC (19 Apr 68).

[3] FM 5-20, "Camouflage." Hq, Department of the Army, Washington, DC (20 May 68).

[4] FM 90-2, "Tactical Deception." Hq, Department of the Army, Washington, DC (2 Aug 78).

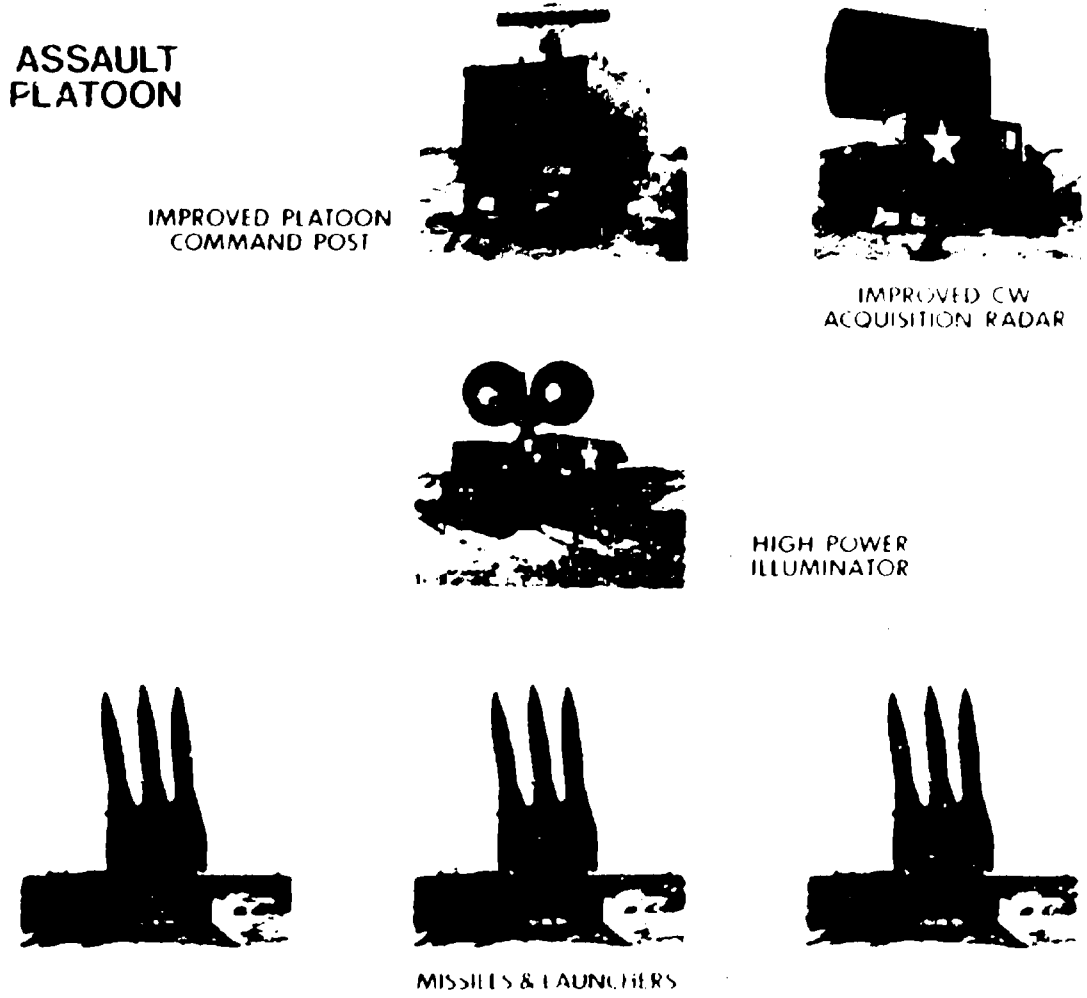

Figure 1. Real HAWK equipment of the detachable assault platoon.

Figure 2. Inflatable decoy of the launcher with three missiles.

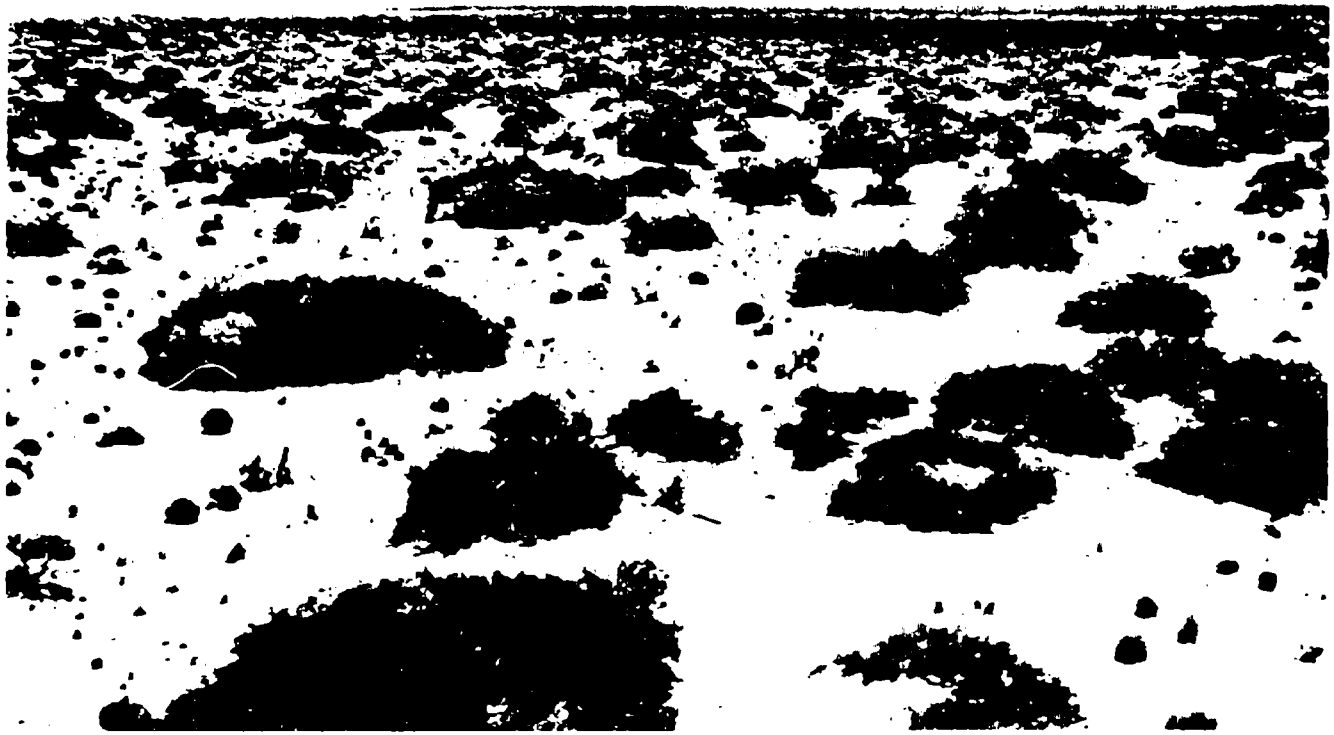

Figure 3. HAWK decoy set in tactical deployment.

The decoy set was evaluated by the Air Defense Board in 1976.[5] The Board concluded that the decoy set was effective against surveillance/attack threats but that the durability needs to be improved for soldier use in the field. This system lacks an R&D requirement document. The ADS has prepared a new draft Letter Requirement (LR) to support standardization of the HAWK inflatable decoy set. The LR does not call for active radar simulators for the CWAR or the Illuminating Radar.

The initial single inflatable decoy set cost $53,000 in 1975. Future costs will probably be higher and are highly dependent on the quantity bought. The complete packaged decoy set is transportable in the cargo bed of an extra long wheel base 2½-ton truck. The set is erectable by a 7-man team in 1 hour and 17 minutes. Each module is erectable by one man except for the CWAR which requires 2 men. Two men are required to handle each packaged decoy when placing it in or removing it from the cargo bed of the truck. Two men can also carry a packaged decoy module for short distances. The deployed decoy set can be recovered and made ready for march order in 60 minutes by a 7-man team.

b. **LANCE Missile Inflatable Decoy.** One full-scale demonstration-feasibility-model inflatable decoy of the LANCE missile was developed. This model includes metallic signature material and has rigid fins. It is easily handled by two men and is illustrated in Figures 4 and 5. The TRADOC user has not expressed a need for a LANCE decoy system.

4. **Skeletal Structure Decoys.**

a. **Bungee Cord Family of Decoys.** This type of decoy consists essentially of segmented tubular aluminum framing (turret and chassis), nylon cover, and rigid gun barrel (in the case of an M-60, Figure 6). The components for the M-60 decoy weigh approximately 100 kilograms and collapse to a packageable volume of 3.5 cubic meters. By virtue of interlocking tubular segments, the framework can be rapidly deployed and struck (Figure 7). The segments each contain elastic cord (bungee cord) which is connected to quick-disconnect joints attached to the ends of the segments. The decoy is erected by first spreading the framework out and then lifting it into an upright position. The frame in the upright position is maintained rigidly by the elastic tension cord acting through the tubular segments. The connecting joints have a feature that permits the locking of the individual segments. Disassembly is accomplished by unlocking the quick-disconnect joints and collapsing the framework. Generally, this decoy was effective in deceiving airborne observers at ranges as near as 500 meters. It

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[5] Final report, "(U) Phase I of Concept Evaluation of the Air Defense Decoys," TRADOC Project No. 3-I 6-I-00005-08, U.S. Army Air Defense Board (Dec 76).

Figure 4. Full-scale inflatable decoy of LANCE missile.

Figure 5. LANCE missile decoy combined with foam decoy of APC to simulate LANCE missile carrier.

Figure 6. M60 Tank decoy made from tubular framing, nylon cover, and elastic cord.

Figure 7. Tubular framing of the M60 Tank decoy showing quick-connect/ quick-release elastic cord (bungee cord) connections.

has capabilities only in the visible spectrum. The TRADOC user has not expressed a need for this type of decoy.

b. **Field Expedient Decoys.** Field expedient decoys are intended to be built in the field by troops of an organization having need from them and are to be built with material normally available at the unit's location. To demonstrate such a capability, designs were prepared for three types of helicopters.[6] Field handbooks were prepared as guides for the fabrication of each of three types of helicopters (the UH-1 (Huey), AH-1 (Cobra), and OH-58 (KIOWA)). The prototypes of these helicopter decoys were evaluated and proved to be successful against air observation. They were time consuming to build and once fabricated were heavy and could not withstand the stresses of being moved. The framing of the design is illustrated by Figure 8, the complete initial design of a UH-1 is shown in Figure 9. The TRADOC user has not expressed a need for this type of decoy or the associated field handbooks to allow troops to construct such decoys.

5. **Plastic Foam Decoys.**

a. **Flexible Foam Decoys.** Plastic foam decoys because of their inherent light weight and high-volume expansion are attractive from a low logistics viewpoint. One approach to a plastic design was a feasibility investigation of full-scale flexible-type foam plastic decoys. The feasibility model (Phase I) was that of a 400-gallon trailer-mounted water tank (Figure 10). In Phase II, the concept was advanced to that of an M113 Armored Personnel Carrier (APC).[7] The design is that of a high-fidelity visual decoy.

The foam is a flexible polyurethane type which is molded to form the external surfaces of the APC. This foam plastic is supported on a structural framework of aluminum alloy. Cross members of the framework are hinged at their ends and center so that side panels and tracked wheel assemblies can fold from a deployed width of 9 feet to less than 9 inches. End panels and the top panels are attached to the main assembly with quick-acting link-lock fasteners. The unpacking, erecting, and completed assembly of the APC decoy can be seen in Figures 11-13. The packaged decoy in its wooden shipping box occupies a volume of 102 cubic feet, approximately 1 x 6 x 17 feet. This volume is one-tenth that of a real APC, 1016 cubic feet. When the decoy

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6 Brunel et al. "Development of Field-Expedient Helicopter Decoys." Contract DAAK02-73-C-0438, Battelle Columbus Laboratories, Columbus, OH (30 Nov 73).

7 Final Report. "Prototype Countersurveillance Advanced Development of Simulation Devices (Prototype Simulator for APC) (U)." Contract DAAK02-73-C-0520, Brunswick Corporation, Marion, VA (31 Jan 75).

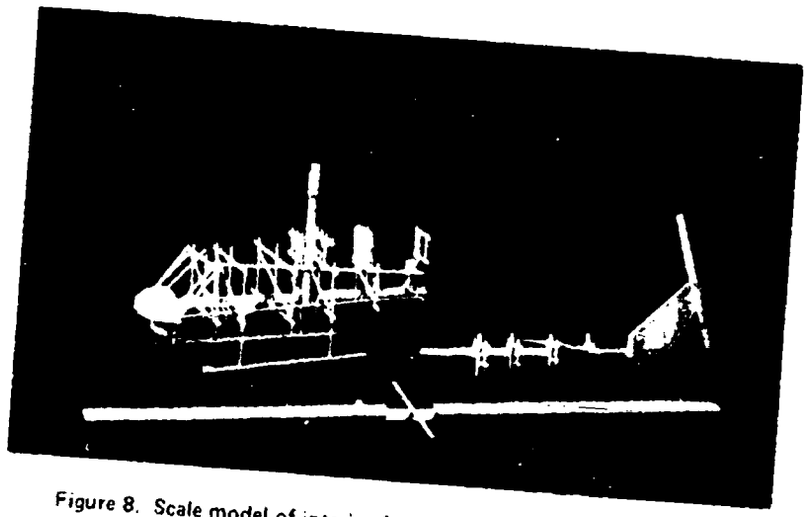

Figure 8. Scale model of interior framing of a field-expedient wooden decoy of a UH-1 (Huey) helicopter.

Figure 9. Initial design of the field-expedient wooden decoy of the UH-1 helicopter.

Figure 10. Flexible foam decoy of a 400-gallon, trailer-mounted water tank.

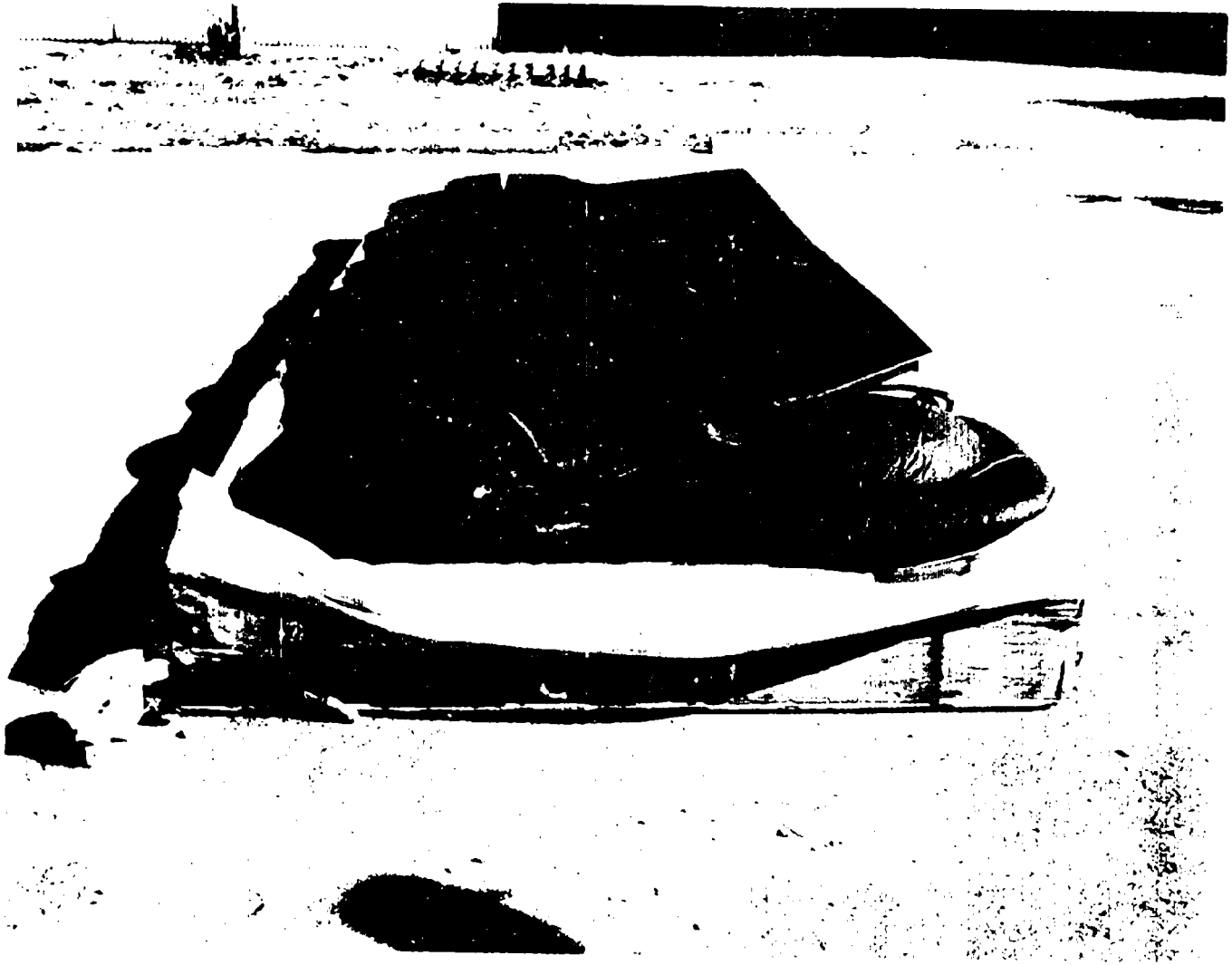

Figure 11. Packaged flexible foam decoy of the M113 APC in its shipping box.

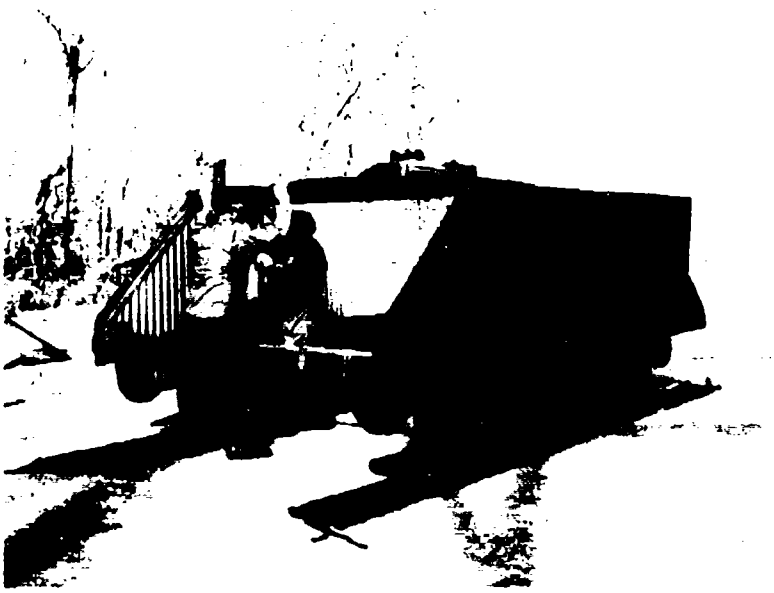

Figure 12. Assembly of flexible foam decoy of APC.

Figure 13. Flexible foam decoy of APC.

components are being boxed, a light vacuum is drawn to assure compression of the components which are contained in vacuum bags.

The decoy is designed for a minimum of five erections and takedowns and extended exposure to weathering has shown it to be quite durable. The TADOC user has not expressed a need for such a decoy system.

b. **Compressible Foam Decoys.** Another approach to a low logistics plastic foam decoy is that of a full-scale compressible foam type. The feasibility model (Phase I) was that of a 45-kilowatt trailer-mounted generator (Figure 14). In Phase II, the concept was advanced to that of an M114 Armored Command Reconnaissance Carrier.[8] The design is that of a very high-fidelity decoy which can be constructed in large quantities in the field.

The foam for the molds was a rigid polyurethane type; the decoy foam was a compressible polyurethane type. The larger of the two shipping boxes is used to form a structural platform supported by eight support legs. The foam components are then mounted on or attached to this platform assembly (Figures 15-17). Each foam component is vacuum-bagged to facilitate compressibility inside the boxes. The TRADOC user has not expressed a need for this type of decoy.

c. **Rigid Plastic, Field-Constructed Decoys.** In the late 1960's, the Army user expressed a need (QMR) for a capability to field fabricate tactical decoys. The concept was that a rear-echelon facility could be formed to make hard-shell plastic decoys. In this operation, thin sheets of plastic material could be molded under a vacuum to form sections of decoys (Figure 18). The initial feasibility item was the Jeep (Figure 19). A subsequent item which is now used as a demonstration piece is the towed 155-millimeter howitzer (Figures 20-21). The molded decoy sections are lightweight and are bolted or riveted together to form very-high-fidelity decoys. The complete decoys are sturdy and capable of withstanding the stresses of wind, rain, snow loads, and movement from one deployment site to another. Undesirable characteristics are the difficulty of assembly and disassembly and the relatively large number of pieces required to achieve the high fidelity. The Army user changed his mind about the need for a field-fabricated set of decoy devices and the QMR as originally approved was invalidated in the early 1970's.

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[8] Namsick et al, Report 19-978, "Simulator, Foam-M114, Phase II (U)." Contract DAAK02-73-C-0519, Goodyear Tire & Rubber Co, Akron, Ohio (Mar 75).

Figure 14. Left to right: water tank decoy, real water tank, real 45-kW generator, compressible foam decoy of generator, wooden decoy of HAWK illuminating radar.

Figure 15. Uncrating of sections of compressible foam decoy of M114, ACRC.

Figure 16. Tracked section of compressible foam decoy of M114, ACRC.

Figure 17. M114 ACRC (left) and M114 decoy (right).

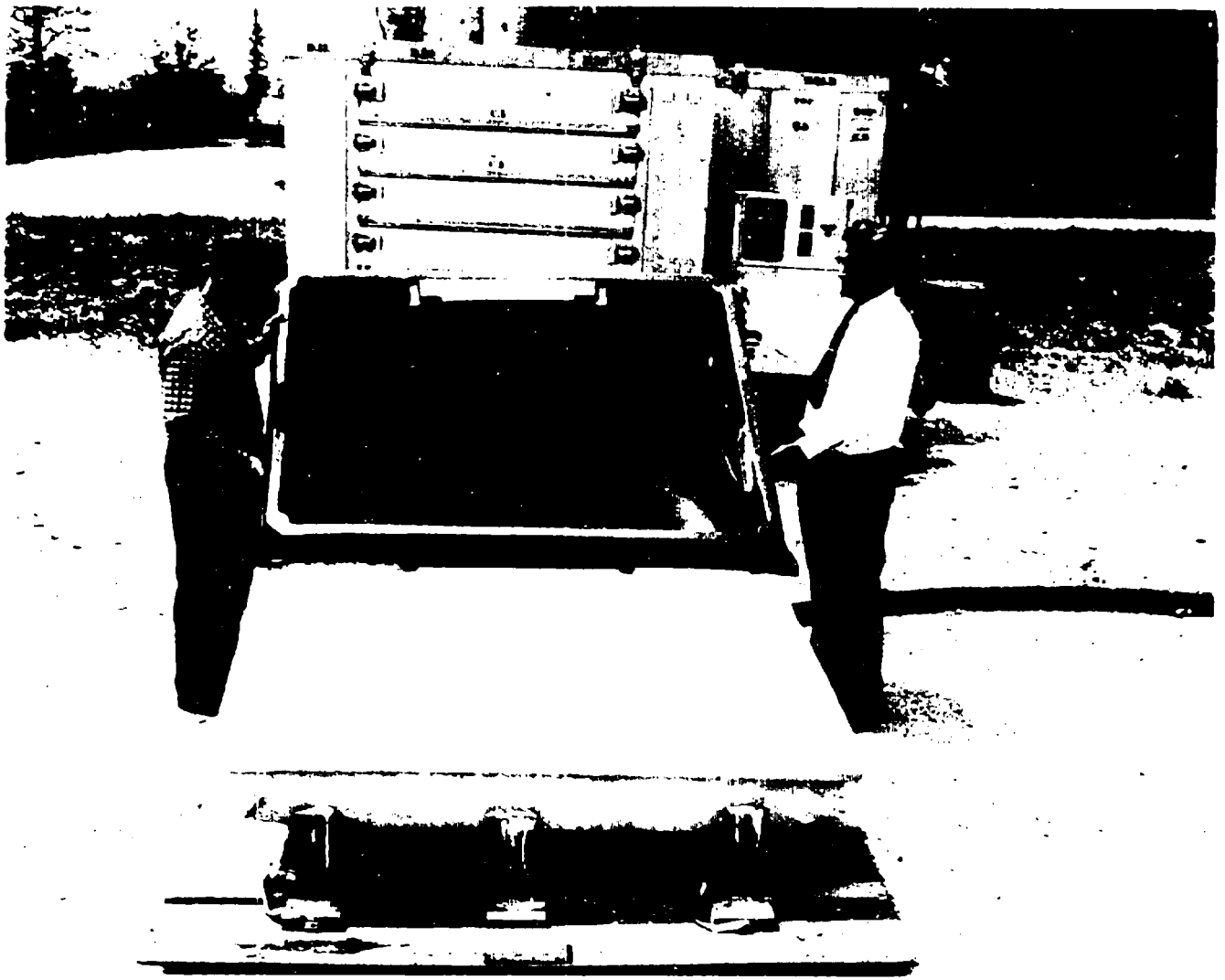

Figure 18. Molded hood for rigid plastic jeep decoy.

Figure 19. Real jeep (left) and rigid plastic decoy jeep (right).

Figure 20. Barrel component of rigid plastic decoy of 155-mm howitzer.

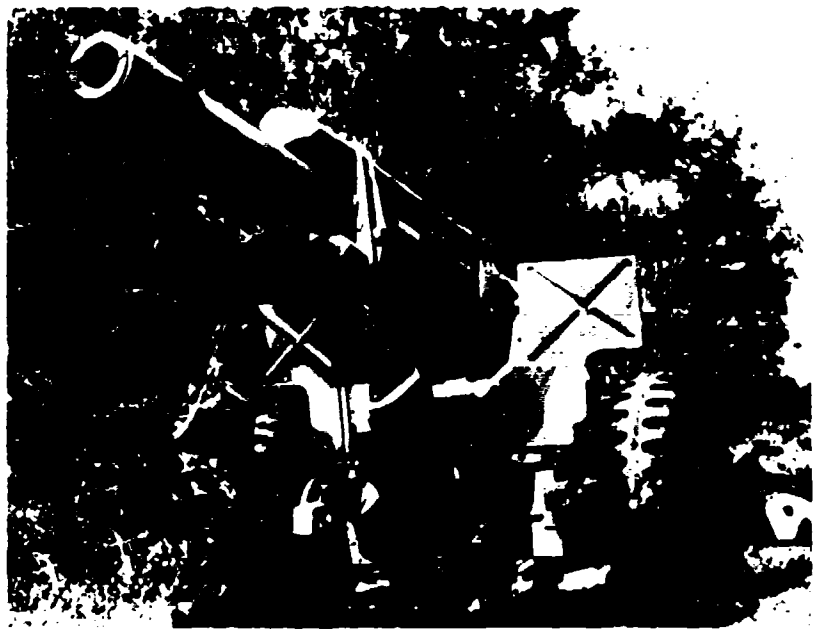

Figure 21. Rigid plastic decoy of a towed 155-mm howitzer.

6. **Wooden Decoys.** Plywood HAWK decoys were developed as mockups for use in a program to develop camouflage concepts for the HAWK missile system. Real HAWK equipment was not available for loan on the program so that mockups were needed. The fabrication of these decoys showed a capability to make decoys predominantly from plywood, but they were not designed as decoys and are heavy and cumbersome to move (Figure 22). The mockups were made of five HAWK modules (launcher and four radars). The TRADOC user has no need for these devices but is interested in a inflatable system (see paragraph 3).

III. SINGLE SPECTRAL-BAND SIGNATURE DECOYS

7. **Thermal Infrared (IR) Signature Decoys.**

a. **Thermal IR (Hot-Target) Decoy.** This decoy is designed to simulate hot targets such as large vehicles or gas-turbine electrical generators. Its main purpose is as a counter to air-to-ground missile.

The feasibility model shown in Figure 23 is 10 feet on a side. The outside tubes for support are, at present, inflated with nitrogen. The black sides and top materials are made of a Dupont Kapton capable of withstanding 1000° F. The model burns solid propellant rocket fuel which gives off a large black body heat signature in 1 to 1½ seconds. The design has been evaluated in a field test and determined to give distinct "hot spot" signature. Considerable effort remains before the design can be optimized for tactical use. It has a potential for use with a number of valuable Army targets, but the TRADOC user has not expressed a need.

b. **Thermal Infrared Simulator of a Jeep.** This design was conceived to demonstrate a capability of duplicating the thermal signature of Army tactical targets to deceive enemy infrared sensors. A jeep design was selected only for feasibility purposes.

The system (Figure 24) consists of a heated module, module top, module bottom, control unit, timing and programming elements, fuel supply and fuel control elements, electrical power and control elements, and cables and tarps. This infrared signature simulator has been designed with maximum flexibility in mind. The programmer can be changed to provide different generating cycles. The control circuit can be changed to provide a variety of signature temperatures with respect to ambient. The system will operate with different numbers of heated modules to provide flexibility in simulation of different signatures. The latest design uses propane fuel. The unit has timer elements to turn itself on and off at preselected times (Figure 25). At present, the TRADOC user has not expressed requirements for a thermal decoy.

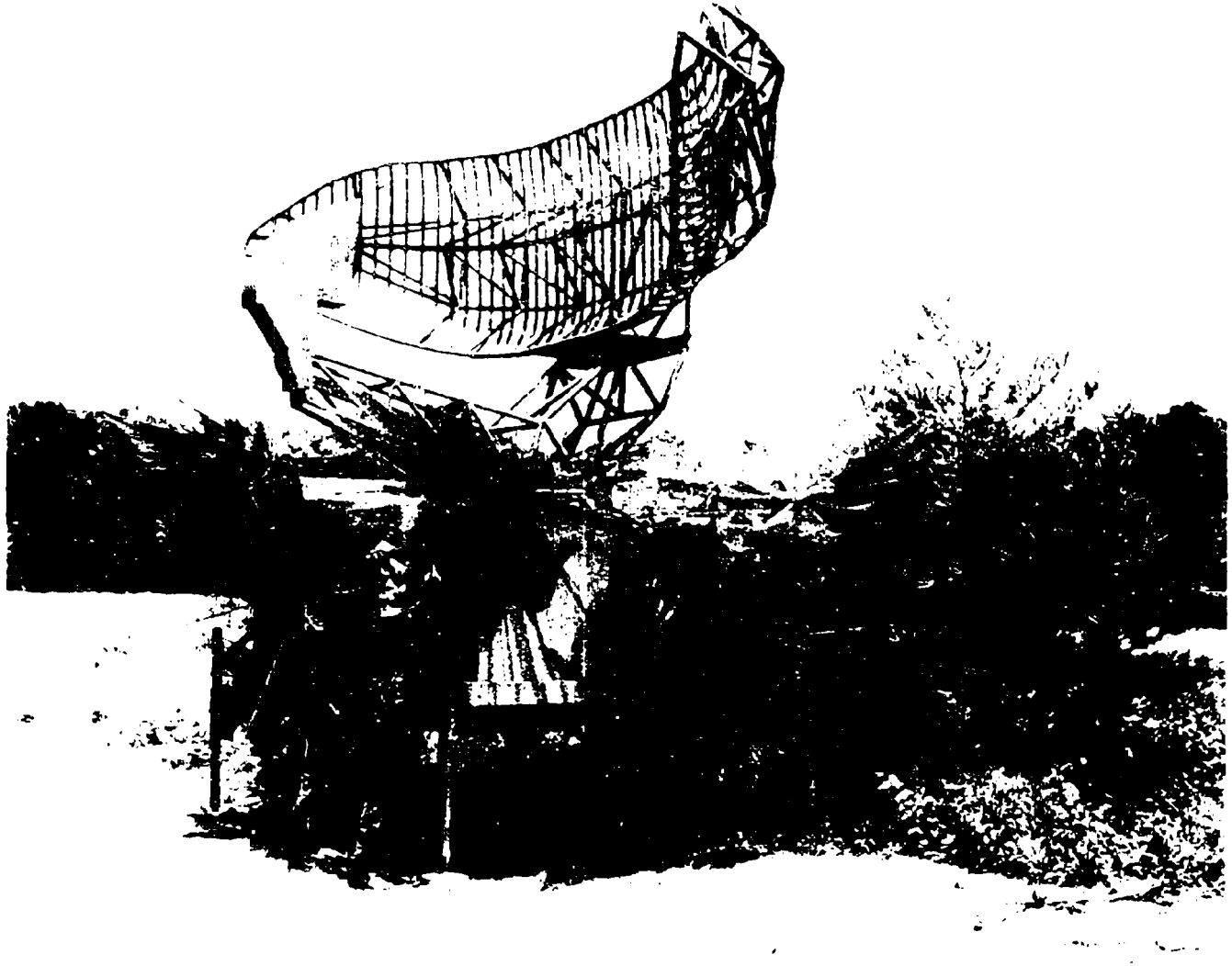

Figure 22. Plywood decoy of a HAWK pulse acquisition radar.

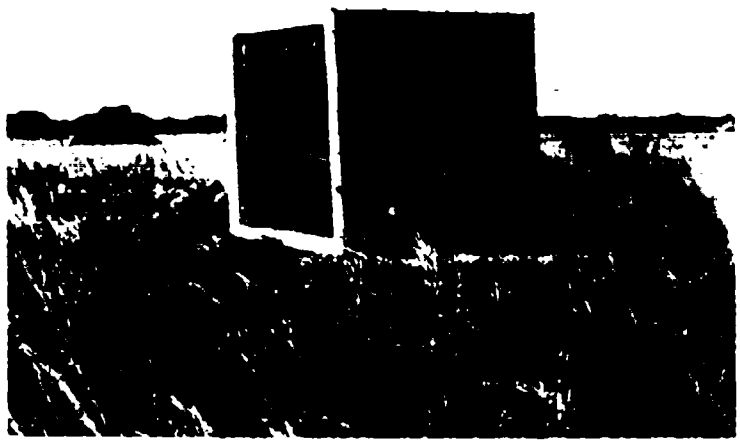

Figure 23. Infrared signature simulator.

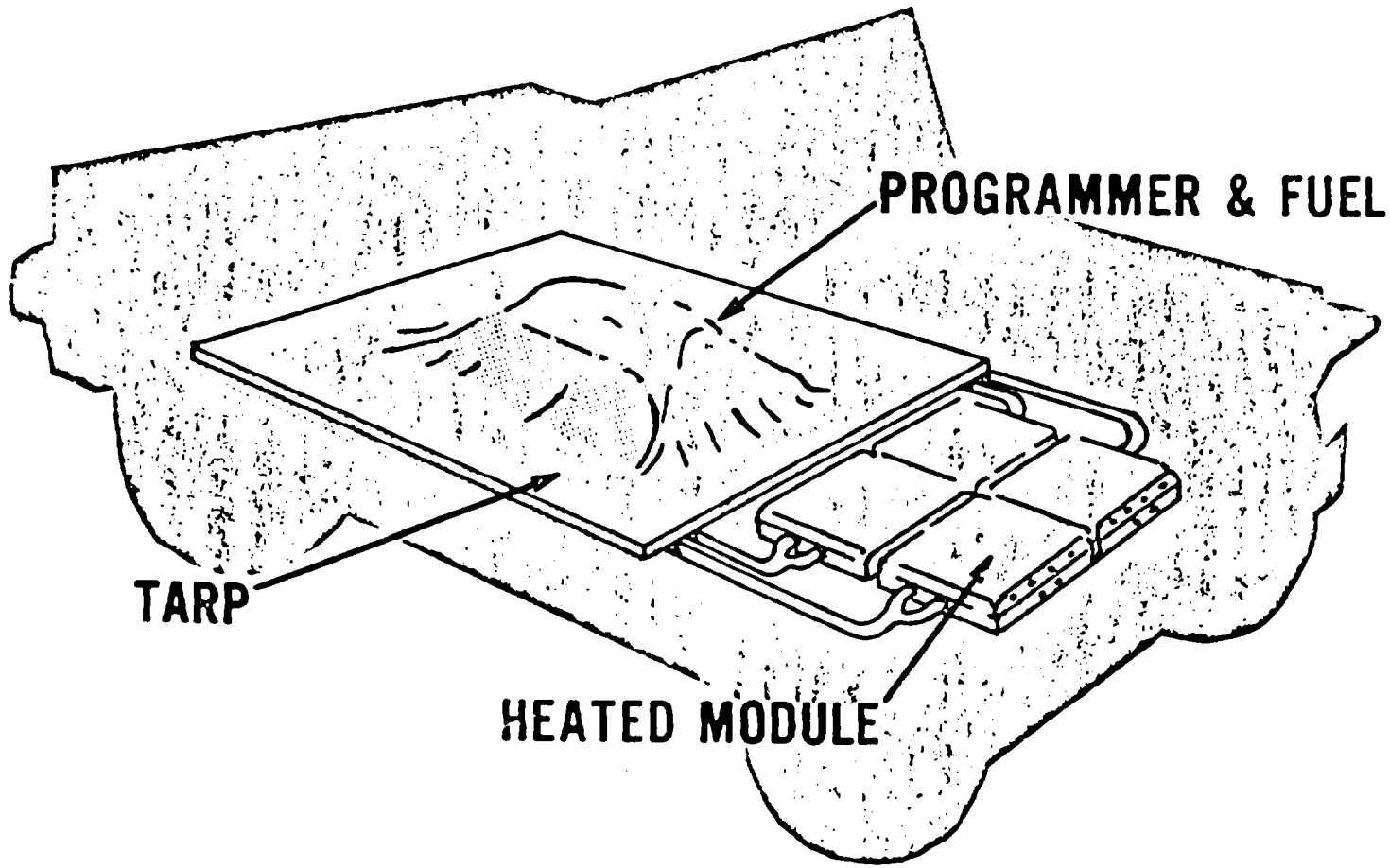

Figure 24. Concept of a system to simulate the thermal signature of a jeep.

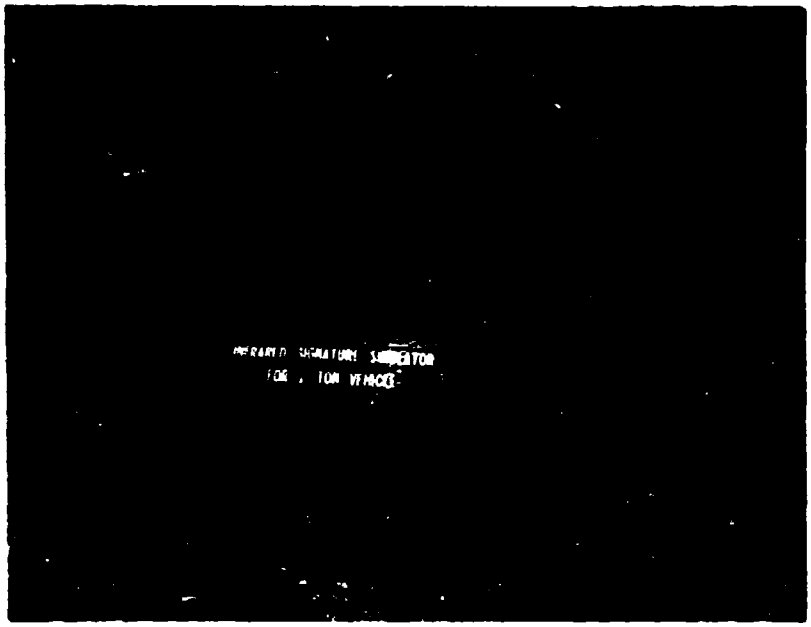

Figure 25. Thermal infrared signature simulator for a jeep.

8. **Microwave (Radar) Signature Decoys.**

a. **Ribbon Bridge Radar Signature Decoy.** This decoy is a lightweight, cost-effective system capable of duplicating the radar signature of the tactical ribbon bridge. The design has been developed only to the feasibility stage and is illustrated in Figures 26 and 27. The feasibility model consists of corner reflectors mounted on inflated truck inner tubes and connected with tie ropes. The corner reflectors are made of aluminum tubing and nylon mesh, weigh approximately 1 pound, and cost (in 1977) $40. They are folded like an umbrella for transport and, when erected, form a tetrahedron, 4 feet square and 3 feet high. The mesh is silver metallic coated. Corner reflectors can be made in various sizes and with varying mesh spacing to reflect different frequency radars. A single corner reflector gives a radar return equivalent to a tank or other large vehicle.

The feasibility system has been tested to determine that it does simulate the signature of the ribbon bridge. It has not been optimized to determine minimum spacing of the corner reflectors. The TRADOC user has not expressed a need for bridge signature decoys.

b. **Corner Reflectors.** The corner reflectors used in the Ribbon Bridge Decoy (above) can also be used in multiple to increase the background clutter so that the extent and type of military target cannot be individually distinguished.

A recent design of a corner reflector (Figure 28) is a slotted corner reflector with diode phase shifters to create the characteristic of motion. It is a rigid prototype design that appears to a radar as a large moving target. In its present configuration, it is neither cheap nor convenient to deploy in large quantities. However, it can be made cheaper and collapsible for easier deployment. The user has not expressed a need for this type of decoy.

9. **Flash/Noise/Dust Signature Decoys.** A decoy of the Antitank Missile System is designed to simulate the firing signature (Figure 29), including the dust cloud, of an antitank missile system such as DRAGON, TOW, etc. The intent is to draw fire against a false target while the real system has time for a good shot or additional shots.

To date, only a breadboard device for a TOW decoy has been made. It is an adaptation of the standard artillery ground burst simulator and includes an electrical firing capability. The decoy weighs 1.4 pounds (3 kilograms) and is a 3-inch diameter cylinder 8 inches long. This device was developed based on TOW signature

Figure 26. Pulling a corner reflector from its folded position into its functioning trihedral position.

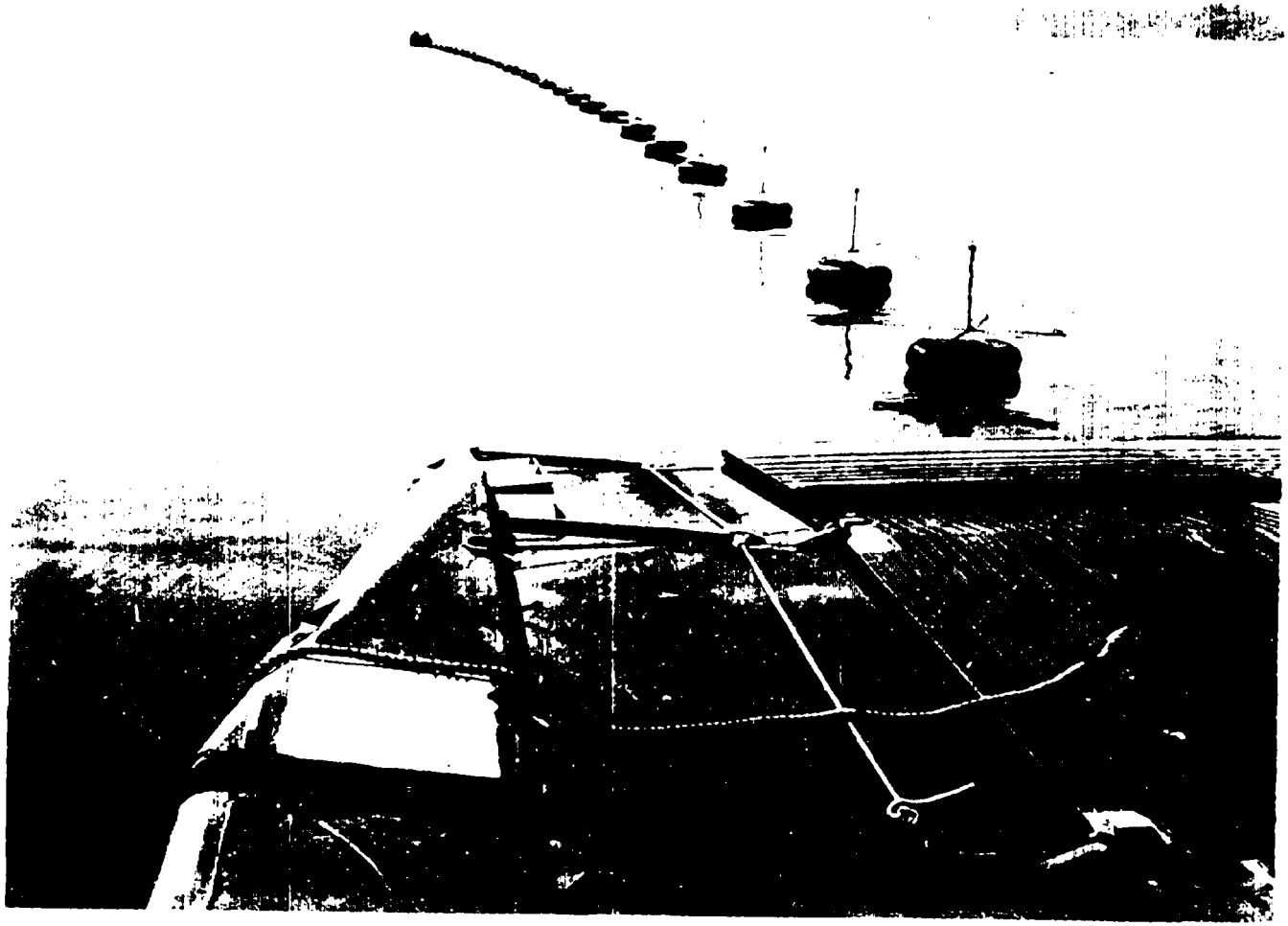

Figure 27. Radar signature decoy of the tactical ribbon bridge.

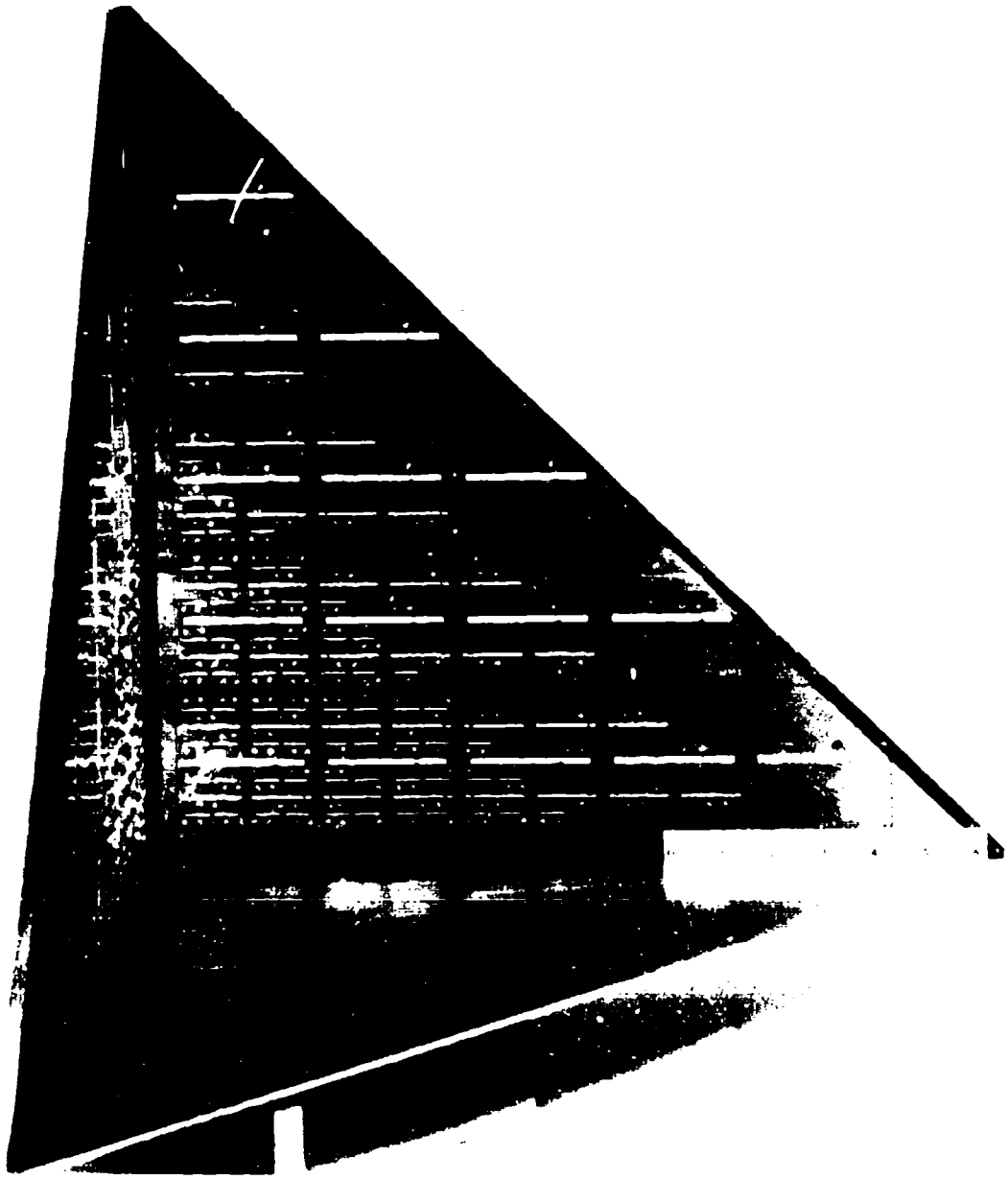

Figure 28. Slotted corner reflector.

Figure 29. Tactical use of decoys of an antitank missile system to draw counter-fire. Feasibility model device is shown at upper left.

data obtained through the Infantry School.[9] Smoke and dust are the long lasting components of the signature and allow the attacking tanker to traverse his turret and pick up the exact location of the launch site within the small field of view of the tank gunner's sight.

Although computer simulations of red and blue force combat situations indicate a significant improvement of anti-tank device's effectiveness when decoys are used, the TRADOC user has not expressed a need for antitank missile decoys.

IV. BLEND/DISGUISE/DECOY TECHNIQUES

10. Blend/Disguise/Decoy.

a. **Vehicle Disguise.** The concept is to make high-value targets look like low-value targets, make low-value cheap vehicles look like high-value targets, or disguise vehicles to make them easier to decoy (Figure 30).

Many high-value units have distinctive signatures. For example, the nuclear capable LANCE missile system is the only unit to have the longbed 5-ton truck. With simple canvas and support tubing, many of these high-value targets can be made to look like ordinary common vehicles. This tactic is useful when tactically deployed but is most effective when vehicles are in convoy. When tactically deployed a unit has many camouflage and deception options, but when on the move in convoy this is one of the few good techniques to provide low-cost, passive protection.

Although illustrated herein as a concept, simple canvas and tubing "tarps and bows" have been used in the recent past in just such a manner. The TRADOC user has not expressed a need for such a capability.

b. **Blend/Disguise/Decoy (B/D/D) Kits.** This concept essentially is a variation of the shell-pea game; i.e., the signature of the real equipment is degraded to the point where it is easy to duplicate that signature by a simple decoy. Examples are:

(1) **OH58A (KIOWA) Helicopter.** In a feasibility B/D/D design for this helicopter (Figures 31-33), it was impossible to differentiate visually the real equipment (with disguise) from the decoy at ranges as close as 300 meters. The decoy kit [10] weighs

9 Technical Report 76-15, "TOW Anti-Tank Missile Launch Development Program," Contract DAAG53-75-C-0283, The BDM Corporation, McLean, VA (20 Aug 76).

10 Report CTR-41, "Complementary Blending/Disguise/Decoy System for the OH-58 (KIOWA) Helicopter (Phase I)," Battelle Columbus Laboratories, Columbus, OH (15 Oct 75).

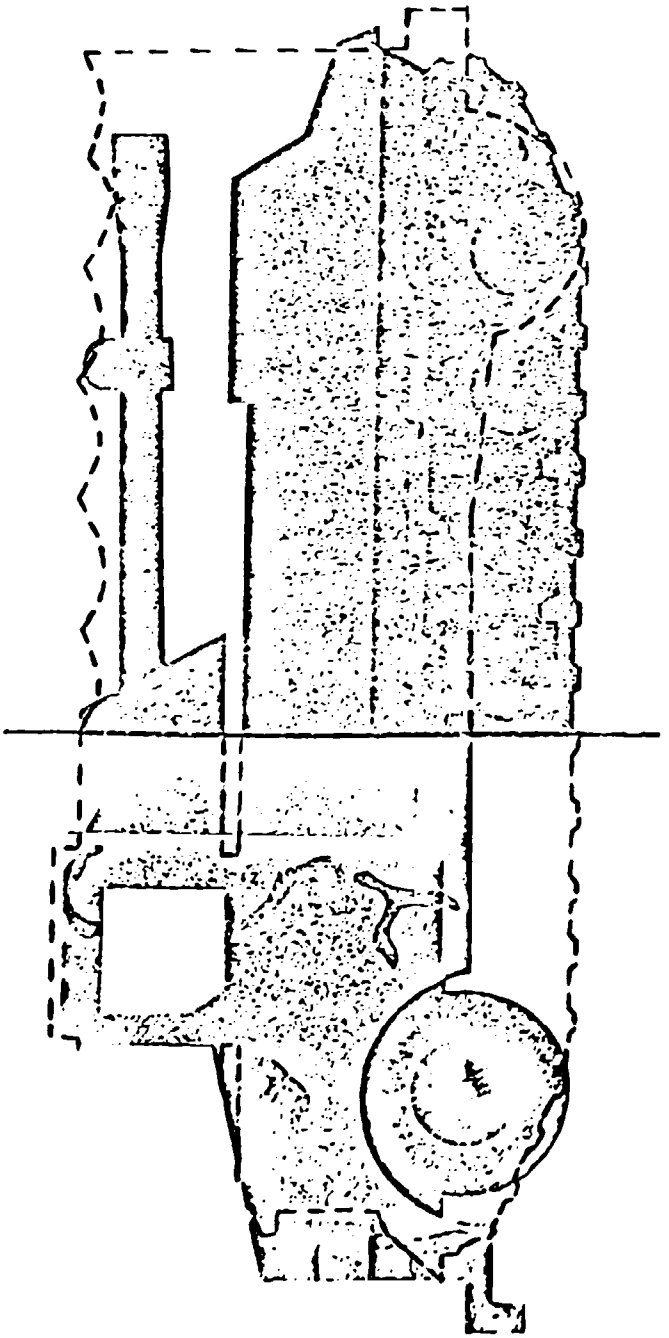

Figure 30. Concept of how a tank could be disguised as a truck.

Figure 31. Left to right: Real KIOWA helicopter, disguised KIOWA helicopter, and decoy of a KIOWA helicopter.

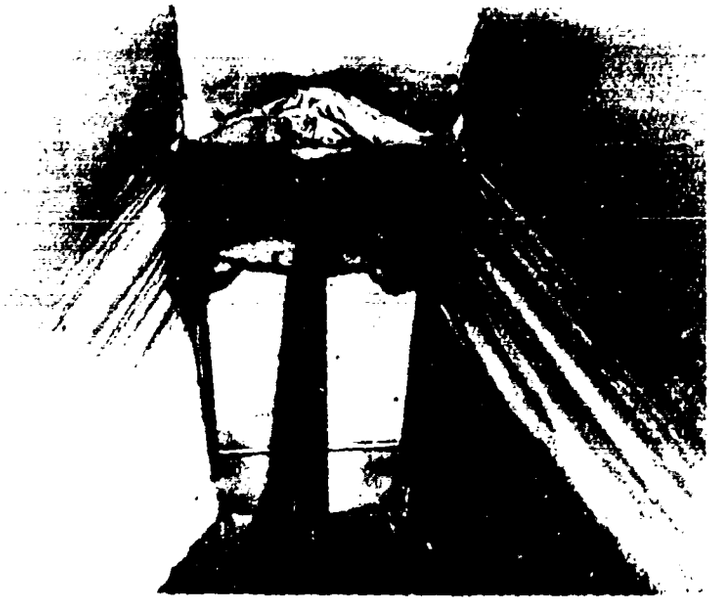

Figure 32. Interior view of decoy of KIOWA helicopter

Figure 33. Disguise kit stowed in cargo area of KIOWA helicopter.

34 pounds (15.3 kilogram) and occupies a packaged volume of 1.5 cubic feet (0.04 cubic meter), while the disguise kit weighs 14 pounds (6.15 kilogram) and occupies a volume of 9.5 cubic feet (0.24 cubic meter). Estimated production costs for the decoy kit is $381 (1975) and for the disguise kit, $250 (1975). Both devices are stowable in the helicopter and can be deployed and repacked in 10 minutes.

(2) M109A1 Self-Propelled 155-millimeter Howitzer. Another B/D/D design was created for the M109 Howitzer. The disguise kit consists of a gun barrel shape disrupter and separate covers for the deck, turret, and tracks (Figures 34-35). The decoy is a tent-like structure with tiedowns. The disguise and decoy kits[11] respectively, weigh 170 pounds (78 kilograms) and 86 pounds (39 kilograms) and occupy packaged volume of 16.6 cubic feet (0.48 cubic meter) and 22 cubic feet (0.61 cubic meter). Estimated production cost for the disguise kit is $484 and for the decoy kit, $671 (1976). The decoy kit can be deployed in 18 minutes.

(3) M60 Tank and M102 155-Millimeter Towed Howitzer. Thirty disguise and decoy concepts for the M60 tank and M102 howitzer were synthesized, evaluated, and described using systems engineering methodology.[12] After evaluation, 15 of the tank concepts and 6 of the howitzer concepts were selected as preferred. Design-to-specifications were prepared for all concepts, priority development was recommended for 6 tank concepts and 1 howitzer concept. This effort was a paper analysis which identified potentially rewarding solutions to problems. No hardware was specifically developed as a direct result of this investigation, but it did lead to effort for decoy/disguise of the M109 howitzer and KIOWA helicopter. The TRADOC user has not expressed a need for any of the blend/disguise/decoys.

11. **Lightweight Camouflage Screen (Net).** The Army standard net can be used as a decoy by erecting it over an empty space to simulate the concealment of a valuable target. The net system consists of two components (Figure 36): a net and a support system of poles, caps, and stakes. There are different net modules for each of three terrain backgrounds: woodland, desert, and snow. All three modules are available from stock. The screen gives the same spectral response in the near infrared as foliage (Figure 37) and contains small metal fibers to defeat radar.

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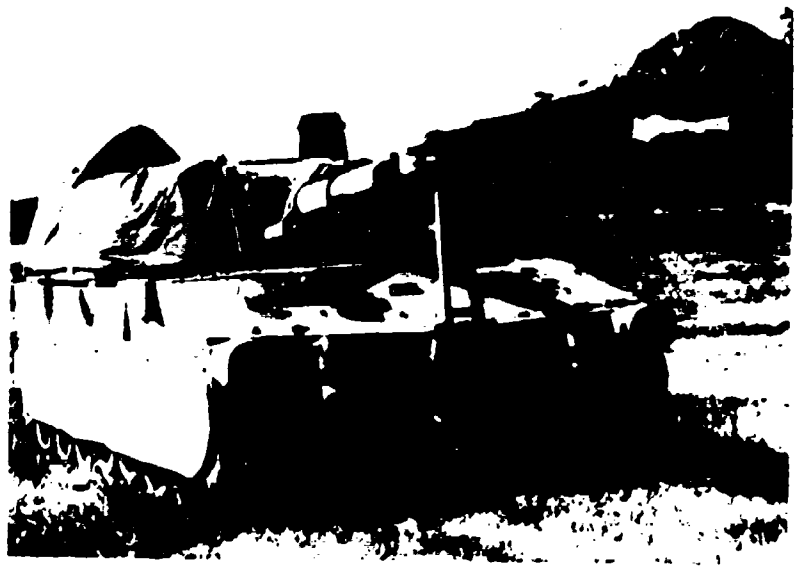
11 Report CTR-45, "Complementary Blending/Disguise/Decoy System for the M-109A1 Self Propelled Howitzer." Contract DAAK02-73-C-0438, Battelle Columbus Laboratories, Columbus, OH (30 Sep 76).

12 Report CTR-15, "Disguise and Decoy Concepts for the M60 Tank and the M102 Towed Howitzer." Contract DAAK02-73-C-0438, Battelle Columbus Laboratories, Columbus, OH (24 May 74).

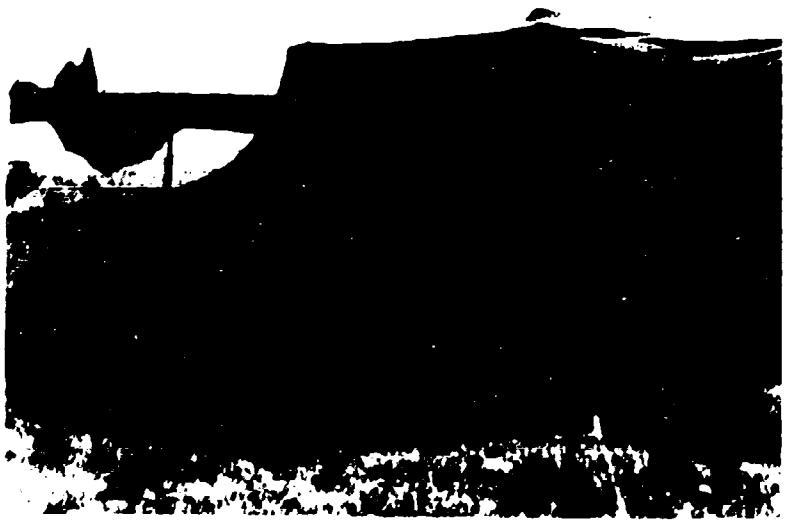


(Right Front)

(Left Rear)

Figure 34. Disguise kit for M109 howitzer.

(Right Front)



(Left Rear)

Figure 35. Decoy kit for M109 howitzer.

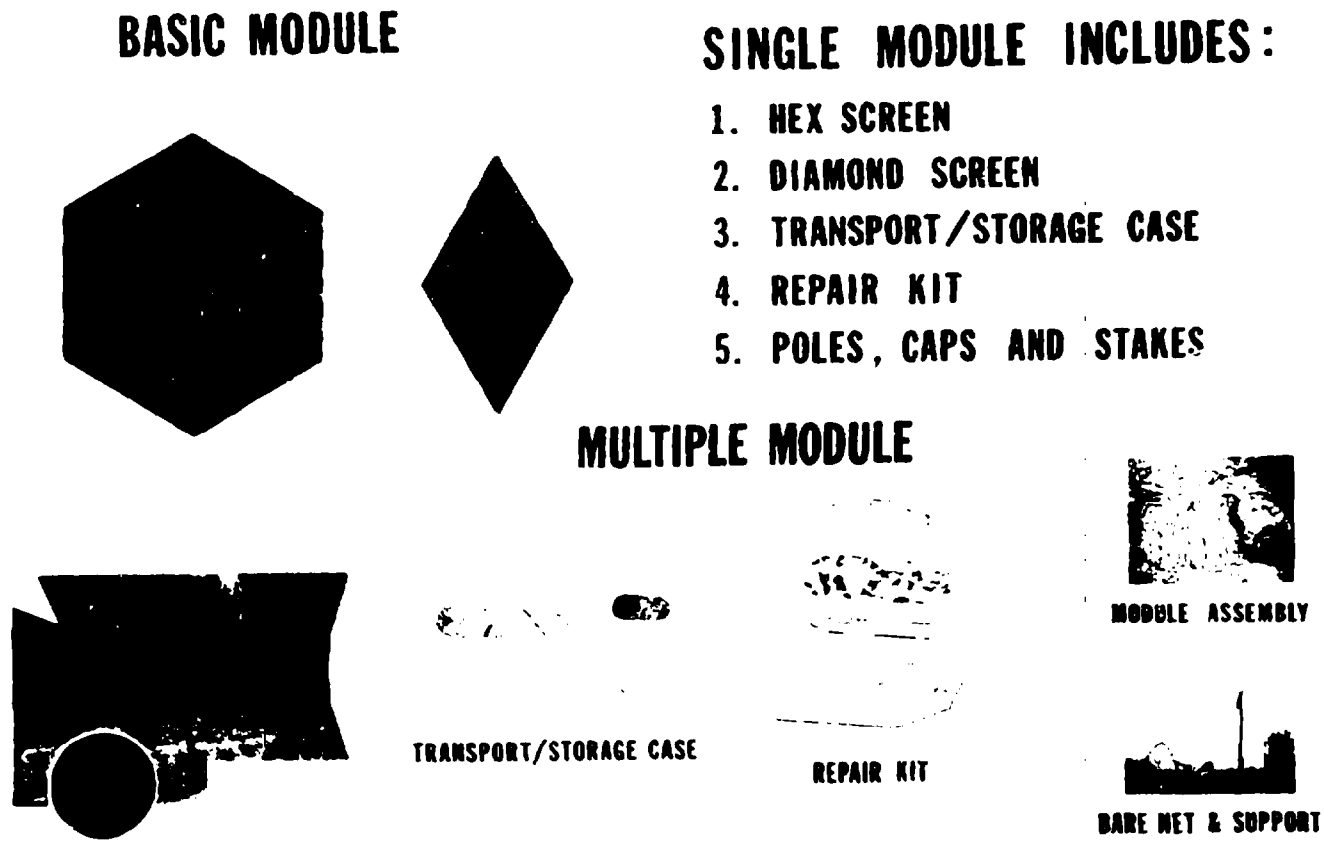


Figure 36. Lightweight camouflage screening system.

Figure 37. Camouflage net deployed in vegetation background.

12. **Mirror Imaging.** By mirror imaging, an observor can be convinced that what he sees is entirely local terrain whereas in actuality a man-made item is concealed by a mirror.

This technique exists in two forms. The first is the use of a mirror or mirrored sheeting placed between the item to be concealed and a potential observer (sensor). It is set at an angle which does not reflect bright sky and sun and with care to either avoid straight mirror edges or to obscure them. The observer will see only the terrain reflected in the mirror and, since it will generally conform to the surroundings in contrast, the installation will have a high probability of remaining undetected. The item itself is hidden behind the mirror (Figure 38).

The second form involves mirroring the item surface itself where potential observation angles are such that only the surrounding terrain will be seen. Curved surfaces will distort the reflected surroundings and not produce suitable reflections.

In many cases, the viewing of objects from the air and at long range will not greatly reduce the effectiveness of the technique. Applied to radar frequencies, a mirror can be made of open mesh wire screen which is optically transparent. Such screens may be useful against ground radars and shield activity from MTI radars.

Both plastic sheet mirrors in a window blind configuration and as applied directly to equipment have been experimented with over a considerable time. The MASSTER Program evaluated the use of the window blind type in recent years and found them useful in limited circumstances.[13] Experiments with missile models have also indicated good concealment potential under special circumstances. The TRADOC user has not expressed a need for such a deception technique.

13. **Cover System.** The Rapidly-Erectable-Structure concept is to rapidly create a structure from a small package which can be used to hide a target, blend a target, or create a false target.

A new lightweight, folding, geodesic-type structure has been developed in various sizes and configurations to fill an Army need for rapidly emplaceable, easy-to-handle screening as a temporary camouflage measure. These structures, varying from walls or panels to hemispherical domes, will support camouflage materials such as nets, garnishing, thermal-attenuating fabrics and other similar materials. They have

[13] "Camouflage Through Reflection of the Natural Environment," Limited Warfare Laboratories (1972).

Figure 38. Mirror screen used for concealing tank.

unique attributes such as: free standing when erected, self-locking, requiring no tools or pins for erection, and expanded-to-packaged ratio of over 300 to 1. They can usually be erected by one man in less than 5 seconds. Figures 39-40 illustrate how this structure design can be used to create a decoy (false) target.

14. **Shape Disrupters for Camouflage and Disguise.** Disrupters permit quick reaction camouflage of equipment and sites under more circumstances than are possible or practical with screens or other existing means; especially in a fire fight requiring frequent movement. Disrupters can be used with most items of TOE tactical equipment, especially armor and air defense units.

They are typically expandable and retractable devices capable of attachment to selected locations on military equipment or are capable of free-standing use. One common type of disrupter consists of a center support pole and radial ribs which support the garnishing material (like an umbrella).

Disrupters are deployed on and serve to conceal equipment corners and other characteristics geometrical contours (e.g., dish antennas, wheel wells, gun barrels, and spotlight lenses). More than one disrupter is generally required to achieve the desired camouflage effect. Since complete hiding or blending of the equipment is not usually practical with disrupters, planning must go into their location, shape, size, and orientation. This planning must include consideration of the probable nature of the threat (unfriendly observation); e.g., low-level or high-level aerial observation or ground observation.

Many different types of disrupters have been developed for camouflage and disguise. Figure 41 shows the Universal Camouflage Disrupter System (UCADS). This is a MERADCOM-developed device which originated as an item for use in camouflaging the HAWK missile system. Deployed UCADS can be seen in Figure 22. This item was evaluated in desert terrain in comparison with a clam-shell-type camouflage net support system for the HAWK missile system.[14] The evaluation was somewhat inconclusive although both designs were partially effective in concealing the HAWK. Another type of umbrella disrupter has been developed by a commercial company in Sweden. This design (Figure 42) is a more elaborate design than the UCADS and is larger and more costly.

These shape disrupters can be used as deception materiel by employing them over targets of little value leading to a conclusion by the enemy that a high-value target may be concealed under the disrupters.

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[14] Test Report, "(U) Concept Evaluatation Program Improved HAWK Camouflage Support System," TRADOC Project T-CI-P012, US Army Air Defense Board, Ft. Bliss, TX (Aug 78).

Figure 39. Deployment of rapidly erectable structure.

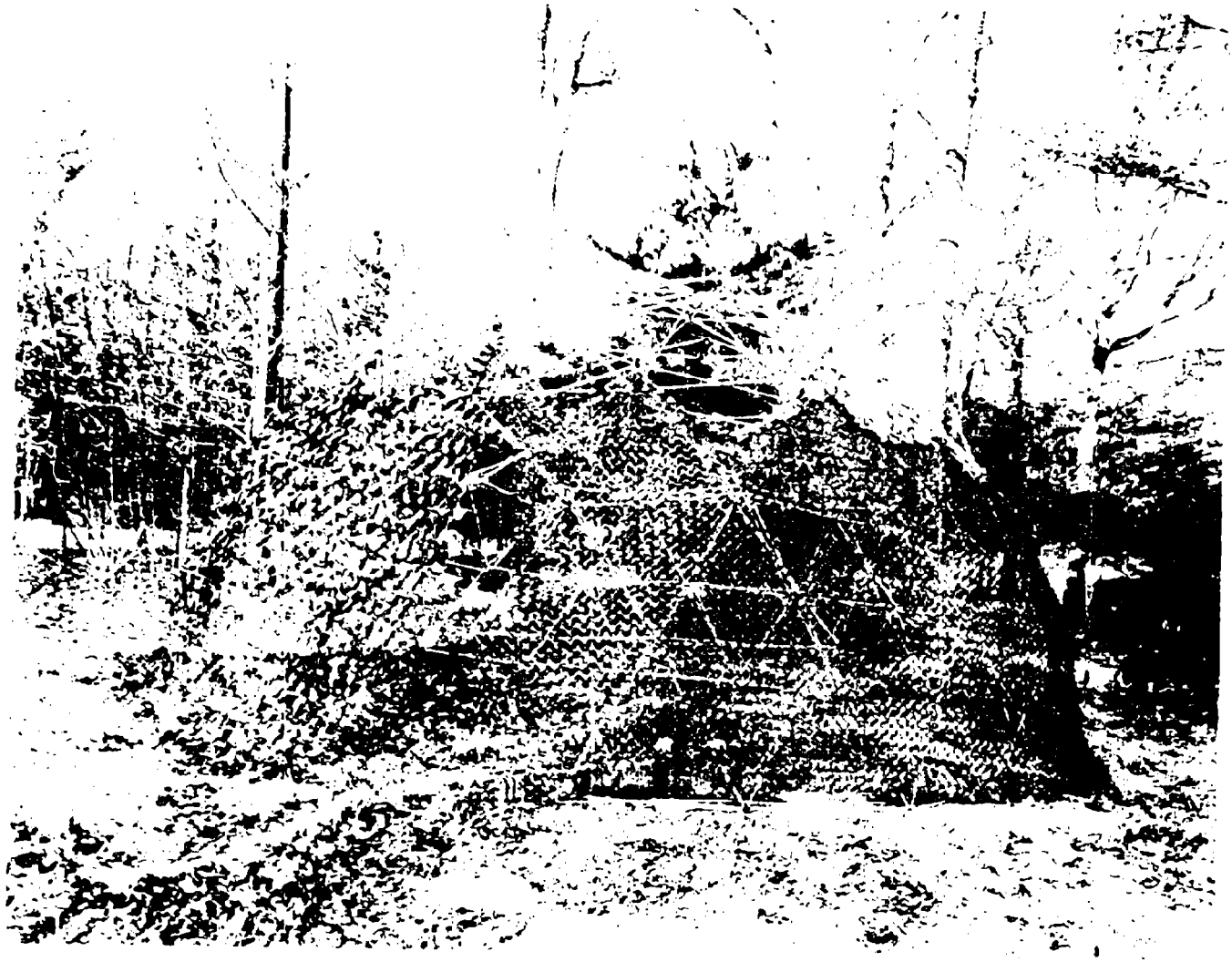

Figure 40. Use of rapidly erectable structure to create a decoy (false) target.

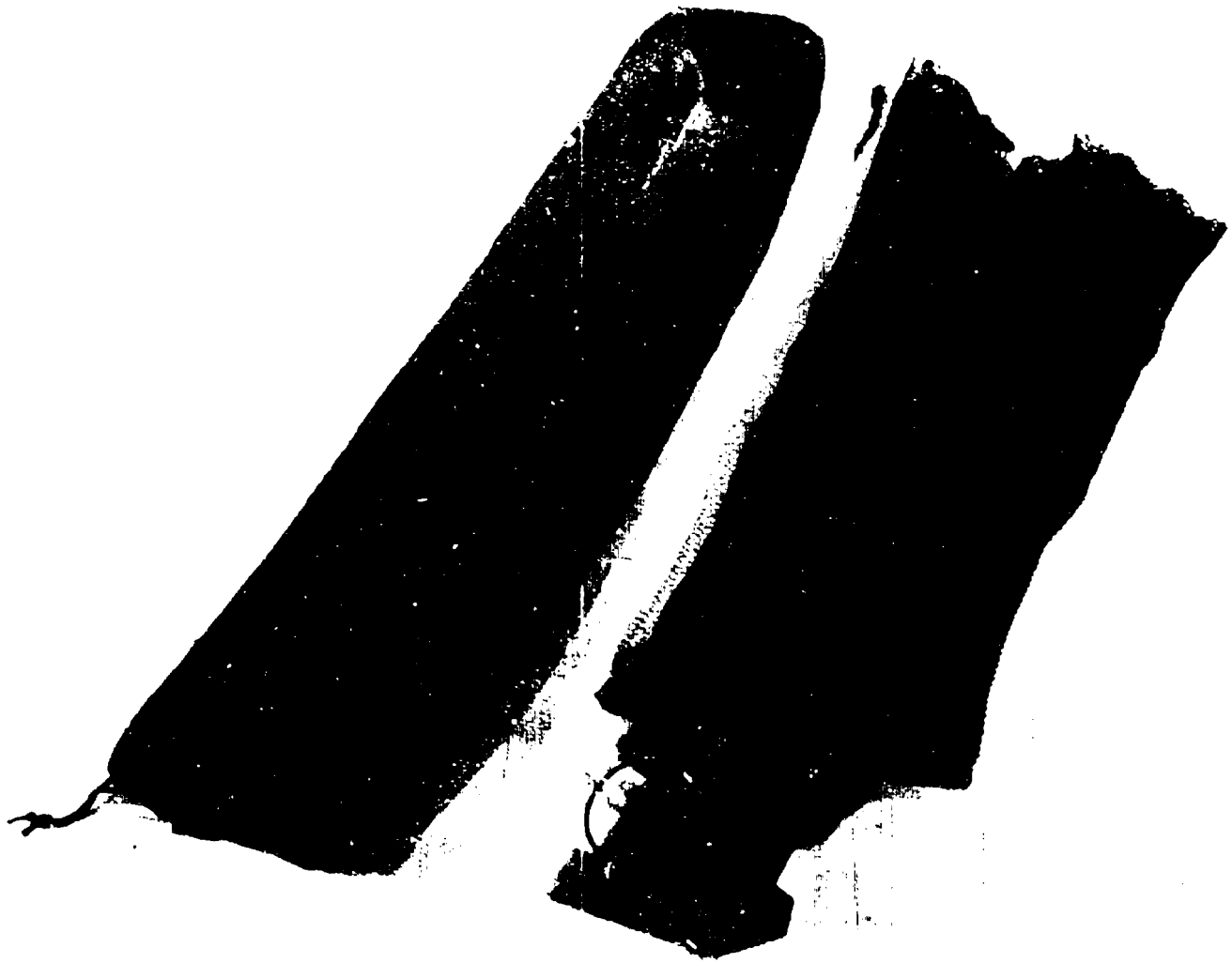

Figure 41 Umbrella type Universal Camouflage Disrupter System (USACDS) in folded position with storage/carrying bag.

Figure 42. Swedish-made umbrella-type shape disrupters employed on a gun emplacement.

TRADOC has a draft LR on UCADS, but it is a low priority effort currently being retained by Combined Arms Center and has not been assigned to any individual school for responsiblity.

15. **Noise Deception.** One decoy and deception concept presently being considered is to remotely create the perception of noise in the heads of personnel by exposing them to low-power, pulsed microwaves. Enemy ground patrols are a threat to many high-priority, low-density Army units. The unit's noise from electrical generators, trucks, air conditioners, electronic vans, people, and other items is a big aid to the enemy in both locating and attacking such units. A consolidated camouflage, decoy, and deception scheme may be a low-cost way to increase the unit's survivability by reducing the signature of the targets (camouflage), increasing the signature level of the background (clutter), creating false targets (decoy), and distorting the perceived target value (disguise).

The concept of microwave-induced noise deception (MIND) may increase the background clutter to mask the location of the true target, create false targets, and deceive the enemy as to the correct identification and location of targets. The MIND phenomenon occurs when people are illuminated with properly modulated low-power microwaves. The sensation is reported as a buzzing, clicking, or hissing which seems to originate (regardless of the person's position in the field) within or just behind the head. The phenomena occur at average power densities as low as microwatts per square centimeter with carrier frequencies from 0.4 to 3.0 GHz.

Work has been conducted at MERADCOM to understand the theory behind the MIND phenomenon, characterize the perceived loudness as a function of input microwave parameters, develop recognizable sounds, and investigate the safety aspects of the problem.

Several papers and reports[15] have been published by MERADCOM which indicate that the phenomenon is caused by the microwaves thermally inducing elastic stress waves. Further experimental work has successfully created recognizable sounds including speech at average power levels of only 1/100 the present US safety standard. Other experimental work at MERADCOM has shown that such exposure increases local cerebral blood flow and metabolism.

Work is continuing in several areas to assess the military application of the MIND concept.

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[15] Final report, "A Psychophysical Study of the RF Sound Phenomenon," Contract DAAK02-71-C-0213, AD747-684, Randomline, Inc., Willow Grove, PA (Jun 72).

V. SUMMATION

Over the past 10 years, MERADCOM has pursued a program of trying to show the fighting Army what can be done technically in the deception area. We have developed or evaluated single and multispectral decoys that can be used in many ways to completely deceive the enemy.

Although the compilation in this report is not all inclusive, it does give a broad spectrum of the types of materials that can be used for varying decoy needs. It is hoped that this compilation will be employed by the field user to educate himself in the deception area so that tactical uses of decoys can be realized through generation of appropriate requirements documents for deception material.

GLOSSARY

ACTIVE -- Capable of acting or reacting especially in some specific manner; the opposite of passive.

BACKGROUND – The natural, physical, or material conditions that form the immediate setting against which something is viewed or sensed.

BLEND – To cause a target to appear as an element of its surroundings.

CAMOUFLAGE – The use of concealment (of truth) to minimize the probability of detection and/or identification of troops, materiel, equipment, and installations.

CAMOUFLAGE MEASURE – Actions undertaken to achieve a state or condition of camouflage.

CAMOUFLAGE METHOD – One of the four broad means of achieving camouflage: hide, blend, disguise, and decoy.

CAMOUFLAGE SENSITIVITY – Designation of an item or system as needing camouflage to reduce perceptibility.

CAMOUFLAGE TECHNIQUE -- A specific set of designs, constructions, and actions to achieve a camouflage capability.

CD – Camouflage detection (photographic) film. (Color infrared type)

CLUTTER – Permanent echoes, cloud, or other atmospheric echo on radar scope, or contact has entered scope clutter.

CONCEALMENT – The intentional denial to surveillance of an object, signature, signal, or other evidence normally through blending, hiding, and disguising.

CONTRAST – A comparison in respect of differences. The ratio of maximum and minimum luminances in a scene.

COUNTERMEASURE – That form of military science which by the employment of devices and/or techniques has as its objective the impairment of the operational effectiveness of enemy activity.

CUE – A characteristic or feature acting as an indication of the nature of the object or situation perceived.

DECEIVE – To cause to believe the false, to purposely cause incorrect conclusions based upon presentation of false evidence.

DECOY – An imitation in any sense of a real person or object displayed so as to deceive enemy surveillance and detection.

DETECTABILITY – An awareness of an object suspected of having military value. One of the four elements of survivability.

DETECTION – Discovery of an existence or presence.

DISGUISE – Alteration of identity cues of an item, signal, or system sufficient to cause misidentification.

EMISSIVITY– The ratio of radiation of an object within the infrared spectrum. A black body has an emissivity of 1.0; all other objects radiate less than 1.0.

EVALUATION – A subjective determination, accomplished jointly by the several major subordinate commands of the utility; that is, the military value, of a hardware item/system - - real or conceptual - - to the user.

FIELD TRIAL – The execution of a test or evaluation in the field as opposed to a laboratory or facility.

HIDING – Choice of position or materials to obstruct direct observation.

IDENTIFICATION – Some level of comprehension in terms of categorizing an item or situation; e.g., military or nonmilitary, friend or foe, vehicle or tank, threat versus no threat, etc. Normally a rather high degree of confidence or assurance is implicit.

INTELLIGENCE – The product resulting from the collection, evaluation, analysis, integration, and interpretation of all information concerning one or more aspects of foreign countries or areas, which is immediately or potentially significant to the development of plans, policies, and operations.

IR – Infrared. That portion of the electromagnetic spectrum between 0.7 and 1000 μm in wavelength (between the visible and microwave regions). The military significant regions are the Near Infrared and the Thermal Infrared.

LINE OF SIGHT – The line between the target and the aiming reference.

MICROWAVE – That portion of the electromagnetic spectrum between 10^{-3} and 10^{0} meters in wavelength.

NEAR IR – That portion of the electromagnetic spectrum between 0.7 and 2.5 μm in wavelength.

PASSIVE – Without either active participation or resistance of the individual affected, without interference to the act of observation (surveillance)

PERCEPTIBILITY – The characteristic, state, or quality of an item or system which causes it to be subject to detection, identification, and/or location by surveillance means.

PLATFORM – A base or support for a sensor

RECONNAISSANCE – A mission undertaken to obtain, by visual observation or other detection methods, information about the activities and resources of an enemy or potential enemy.

REMOTE SENSING – Perceiving from a distance directly through the senses and indirectly through sensors which extend the innate sensing capabilities.

REMOTE SENSING THREAT – The detection (recognition) and hitability threat posed by enemy intelligence systems utilizing remote sensors, sensor platforms, data links, and enhancement means.

REQUIREMENTS DOCUMENTS – Letter of Agreement (LOA), Letter Requirement (LR), or Required Operational Capability (ROC).

RESOLUTION – The act, process, or capability of rendering distinguishable the individual parts of an object, closely adjacent optical images or sources of light, nearly identical wavelengths of light, particles of nearly the same energy or mass, or events occurring at nearly the same time.

SENSOR – A technical means to extend man's natural senses; an equipment which detects and indicates terrain configurations, the presence of military targets, and other natural man-made objects and activities by means of energy emitted or reflected by such targets or objects.

SIGNATURE – The characteristic pattern of the target displayed by detection and identification equipment.

SURVEILLANCE – The systematic observation of aerospace, surface, or subsurface areas, places, persons, or things by visual, aural, electronic, photographic, or other means.

SURVIVABILITY – That characteristic of personnel and materiel which enables them to withstand (or avoid) adverse military action or the effects of natural phenomena which would ordinarily and otherwise have resulted in the loss of capability to effectively continue the performance of the prescribed mission.

TARGET ACQUISITION – The detection, identification, and location of a target in sufficient detail to permit the effective employment of weapons.

TEST – A process by which data are accumulated to serve as a basis for assessing the degree that a system meets, exceeds, or fails to meet the technical or operational properties ascribed to the system.

THERMAL IR – That portion of the electromagnetic spectrum between 2.5 and 0.15 μm in wavelength. Also known as the Far Infrared Region.

THREAT – The capability of a potential enemy to limit or negate mission accomplishment, or to neutralize or reduce the effectiveness of a current or projected organization or materiel item.

THREAT ASSESSMENT – The process by which a specific threat is determined.

VISIBILITY – The horizontal distance at which a large dark object can just be seen against the horizon sky in daylight.

VULNERABILITY – The characteristics of a system which causes it to suffer a definite degradation (incapability to perform the designated mission) as a result of having been subjected to a certain level of effects in an unnatural (man-made) hostile environment.

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