The Armored Fighting Vehicle Identification Trainer

by Captain Mark Lee and Captain Jeffrey Schamburg

The first requirement in warfare is the ability to distinguish friend from foe.[1]

-Recognition Pictorial Manual, FM 30-30 (June 1943)

The ability to distinguish friend from foe on the battlefield is absolutely critical. As we have witnessed in many of the conflicts which we have fought during this century, this positive identification of friendly forces did not always occur and often resulted in fratricide. Most recently, U.S. forces deployed during Operation DESERT STORM experienced only 615 battle casualties, 148 of which resulted in the death of a soldier. What is perhaps more startling is that 35 deaths (24% of all deaths) were caused by friendly fire. Of the 467 non-fatal battle casualties, 72 (15%) were caused by friendly forces.[2]

Fratricide is not new to our military. We experienced our first documented case of fratricide during the French and Indian Wars in 1758 and have lost soldiers to friendly fire in every major conflict since then.[3] The military has conducted extensive research on this subject in an effort to capture the causes of fratricide. As a result of the studies, the military has identified the following five types of fratricide:

- Fratricide due to accidents
- Fratricide due to command and control failures
- Fratricide due to fire discipline failures
- Fratricide due to navigation failures
- Fratricide due to identification failures[4]

Although the military recognizes the fact that fratricide normally results from a combination of several of the factors above, the Armored Fighting Vehicle Identification Trainer (AFVID) focuses on the identification aspect of fratricide. This article will address the purpose for the trainer, its operational concept, and potential future extensions.

The primary purpose of this trainer is to enhance a soldier's current level of expertise in identifying armored vehicles. Based upon our recent experiences as tank and infantry company commanders, we feel the current level of proficiency of the average soldier in this area is poor.

The potential consequences of incorrect vehicle identification are often costly, specifically in terms of manpower and actual dollar figures. Consider, for example, one of the 35 cases of fratricide that occurred during Operation DESERT STORM. On February 27, 1991, six of our soldiers were killed and 25 were wounded when five M1A1 tanks and five Bradley Fighting Vehicles engaging enemy forces were incorrectly identified at night with limited visibility and engaged by other M1A1 tanks.[5] In this case, we suffered unnecessary losses in terms of human life and dollars because of the inability to distinguish friend from foe.

Many of us recognize that combat, particularly at night, is often confusing and life-threatening. In an attempt to help reduce fratricide that results from misidentification, we have developed an elementary training aid that can be enhanced to train our soldiers under realistic conditions.

The trainer's underlying model is an expert system. One definition of an expert system is: *"a model and associated procedure that exhibits, within a specific domain (subject area), a degree of expertise in problem solving that is comparable to that of a human expert."*[6] We chose to use an expert system for several reasons. First, there is a distinct difference in the performance and level of training between the experts (Master Gunners or military intelligence personnel) and the average soldier. Second, vehicle identification requires identification and classification of symbolic features which make it approachable by an expert system. Third, the subject area or domain is relatively stable in that new armored vehicles are not being introduced around the world frequently enough to render the trainer obsolete. Lastly, the expert system mimics the manner in which an expert uses filtering and pruning techniques to quickly and accurately identify vehicles.

Before we review the actual operational concept behind the trainer, let us first review several assumptions that we made in developing this initial prototype. First, we felt an ideal training environment was most appropriate for the first system. For example, the fog of war, such as limited visibility, and actual sounds associated with combat are not included. As mentioned earlier, the primary purpose of this trainer is to reinforce the soldier's basic identification skills, such as recognizing turret shapes, the location of the bore evacuator, and whether the vehicle's track is supported or non-supported. More advanced features could be addressed in future expansions of this system. Second, the vehicles in the system are primarily those taught at the Armor School and also found in *Armor Fighting Vehicle Identification,* FKSM 17-224, March, 1991.

Because of limited development time, we narrowed the vehicles contained in the system to 38. However, an unlimited number of vehicles can actually be incorporated in the system. Third, the vehicles are presented to the user exactly as they are presented in current lesson plans and training manuals. For example, minor modifications to the M48 are not considered. Lastly, we assumed the user will have received two to three hours of basic vehicle identification prior to using the trainer.

The operational concept of the AFVID trainer is generally straightforward. Once the software has been properly loaded on an IBM-compatible computer with a Windows environment, the soldier can begin training. One of the 38 vehicles contained in the system is automatically randomly selected and presented on the screen of the computer. The soldier is then asked to properly identify and classify the key characteristics of the presented vehicle. Having captured the heuristics or "rules of thumb" that experts use to

identify armored vehicles, we have the user respond to a finite number of questions that describe the presented vehicle.

In essence, the system prompts the soldier for answers to a minimal number of questions that the expert would actually answer when presented with a similar vehicle. This trains the soldier to look for the key characteristics of a vehicle, such as the shape of the hull or turret location. If the soldier does not understand a particular question, he can select the "Help" button on the screen with the mouse or go to the "Question" menu and select "Explain Question." Using either of these two methods, the soldier can get assistance with such things as understanding what a muzzle brake is, or the shapes of turrets, just to name a few.

Once the soldier has identified the key characteristics of the presented vehicle, he is asked to identify it by nomenclature. The trainer will determine if the soldier correctly described the vehicle's characteristics and correctly determined its nomenclature. The main concept behind the trainer is to ingrain in the soldier the critical characteristics used to accurately identify armored vehicles. We can accomplish this by requiring him to repetitively respond to the questions generated by the expert system. Over time, the soldier will be able to properly identify a presented vehicle based upon just a few characteristics.

The AFVID trainer has been evaluated, in a limited sense, by instructors and cadets at the University of Virginia Army ROTC unit and by a group of instructors at the Armor School at Fort Knox.[7] The ROTC personnel provided us with recommendations on how to make the trainer more "user friendly" and with general comments on its potential as a future Army training aid. Similarly, a group of Armor Officer Basic Course instructors provided comments indicating that this initial prototype can be used in the field today and, with some modifications, can be a realistic training aid in the Army's effort to reduce fratricide due to misidentification. As previous company commanders, we would have gladly welcomed such a basic trainer in our unit training program. The trainer in its current state can be used for such tasks as CTT and TCGST training. Instead of the company Master Gunner presenting a company-level AFVID class as train-up to the test, an individual soldier can now have access to this expertise in vehicle identification through the use of a computer.

There are several viable future extensions for this trainer. One advanced feature would change the system from being completely deterministic. One recommendation was to randomly place a "black box" over portions of the presented vehicle so that the soldier is no longer presented with an entire vehicle. As an advanced feature, this would help train soldiers for situations where an entire vehicle may not be visible.

Another extension would be to include actual footage of stationary and moving vehicles in various conditions. With the increased capability of personal computers, the technology exists for this to be accomplished. Not only would this add realism to the trainer but it would also help us train for situations where the "fog of war" has blanketed the battlefield. We could then train the scenarios which resulted in fratricide during Operation DESERT STORM in an attempt to reduce the unnecessary loss of life in the next war.

As technology continues to evolve, we foresee the ability to use methodologies such as expert systems and neural networks to accurately identify armored vehicles and confirm intelligence templates. However, before we can incorporate these advanced features we must first get back to the basics. That is the purpose of our trainer.

The difficulties associated with accurate vehicle identification are not new. On the other hand, the increased accuracy of our weapon systems have come to exceed the range at which the human eye, or even instruments, can now accurately identify friend from foe.[8] As a result, our soldiers must become much more disciplined and skilled in the critical task of armored fighting vehicle identification. The answer to the problem of fratricide is not to be found in computers or "black boxes" alone. Unfortunately, incidents of friendly fire will continue to occur whether you are training at NTC, CMTC, or in actual combat. However, the introduction of new training aids such as our trainer may help in reducing the number of such incidents. At least we hope so.

Notes

[1]*Recognition Pictorial Manual*, War Department Field Manual 30-30 (June 1943), p. 1.

[2]*Who Goes There: Friend or Foe?*, U.S. Congress, Office of Technology Assessment, OTA-ISC-537 (Washington, D.C.: U.S. Government Printing Office, June 1993), p. 26.

[3]*Who Goes There: Friend or Foe?*, p. 7.

[4]*Who Goes There: Friend or Foe?*, pp. 9-18.

[5]*Who Goes There: Friend or Foe?*, p. 27.

[6]James P. Ignizio, *Introduction to Expert Systems*, (New York: McGraw-Hill, 1991), p. 12.

[7]We would like to thank SFC Michael A. Lee and his fellow AOB small group instructors for taking time to review our initial prototype.

[8]*Who Goes There: Friend or Foe?*, p. 30.

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Captain Jeffrey Schamburg is a 1986 graduate of the U.S. Military Academy. He is a graduate of the Infantry Officer Basic and Advanced Courses and the Combined Arms and Services Staff School. He served as an infantry line platoon leader, infantry company executive officer during Operation JUST CAUSE, and S1 in 3-6 Inf, 5th ID. During Operation DESERT STORM, he was an assistant S3 for 2-187, 101st Airborne Division (Air Assault). He has also served as the commander of A Company, 2-187 and is now attending graduate school enroute to the Systems Engineering Department at West Point.

VEHICLE CHARACTERISTICS

There are several characteristics which one attempts to identify when classifying a vehicle. The prominent features of wheeled vehicles, armored personnel carriers, field artillery pieces, main battle tanks, and air defense vehicles are summarized below.

Wheeled Vehicles:

1. Tires: the number of tires on a wheeled vehicle are often the primary distinguishing feature.

2. Spacing between tires: some vehicles have distinct, identifiable gaps between some of its wheels.

3. Location of troop access doors: many of the wheeled vehicles in use today have access doors in different positions on the vehicle. One can often use this feature to distinguish between two very similar vehicles.

4. Location of the turret: turrets are positioned forward, center, and to the rear of the vehicle.

5. Shape of the turret: most Soviet wheeled vehicles have a cone-shaped turret.

6. Shape of the hull: the most identifiable feature on a Soviet-made wheeled vehicle is its boat-like hull.

Armored Personnel Carriers (tracked):

1. Shape of the hull: Soviet APCs are easily identifiable by their boat-like hull.

2. Skirt design: the German Marder has serrated skirts while Soviet APCs do not have any skirts.

3. Roadwheels: the number of roadwheels on a vehicle often determines the classification of the vehicle once other significant features have been considered.

4. Location of the turret: turrets are positioned forward, center, and to the rear of the vehicle. Soviet APCs have turrets positioned either forward or center of the vehicle.

Field Artillery Pieces (tracked):

1. Muzzle Brake: the presence of a muzzle brake is perhaps the single most distinguishable feature on artillery pieces.

2. Location of the turret: most artillery pieces have turrets located at the rear of the vehicle.

3. Length of the cannon: one can distinguish some artillery pieces by the fact that the cannon extends over the front slope of the vehicle.

4. Supported versus non-supported track: this characteristic allows one to easily further classify a vehicle based upon this distinguishing characteristic.

Main Battle Tanks:

1. Shape of the turret: all Soviet tanks have an egg-shaped turret while the tanks of other countries have a wide variety of shapes.

2. Location of the bore evacuator: one can use the location of the bore evacuator to help distinguish among different tanks. For example, the T-54/55 is the only tank with the bore evacuator at the end of the gun tube.

3. Length of the cannon: a few tanks are equipped with an unusually short cannon. An example of this is the M551.

4. Location of the searchlight: one can use the location of the searchlight, when present, to distinguish tanks. For example, the T-64 has a searchlight on the left while the T-72 has it on the right.

5. Number of roadwheels: the number of roadwheels on the vehicle can be used to distinguish vehicles when other characteristics are similar.

6. Number of support rollers: in some cases, one may use the number of support rollers to further identify a vehicle.

Air Defense Vehicles:

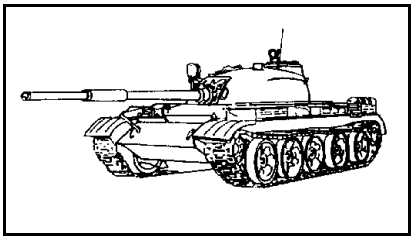
1. Number of pairs of anti-aircraft guns: one can distinguish among air defense vehicles by the number of pairs of guns the vehicle has. For example, the ZSU-23-4 is easily identifiable by the four guns on the turret.

2. Location of the radar dish: the position of the radar dish is also a key feature to use in classifying air defense vehicles. The Gepard, for example, has a radar dish on top of the turret and in the center of the two guns.

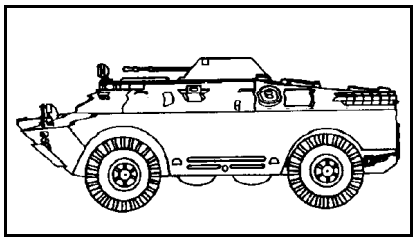
3. Type of hull: the type of hull used for the vehicle is also a distinguishing feature. The ZSU-57-2 uses the hull of the T-54/55, and the Gepard uses the hull of the Leopard 1.

Note: The key characteristics summarized here are not all-encompassing. Similarly, our trainer may not ask the user for a response to each of these characteristics. The trainer will attempt to classify the selected vehicle using the minimal number of characteristics needed.

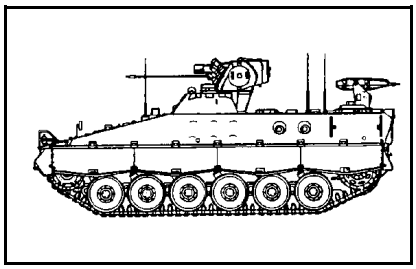
EGG-SHAPED TURRET



CONE-SHAPED TURRET



SERRATED SKIRT



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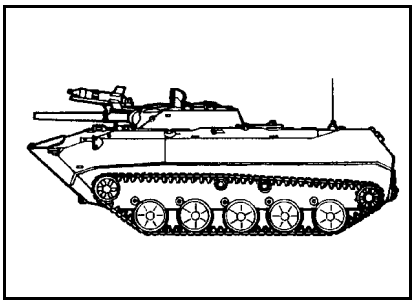

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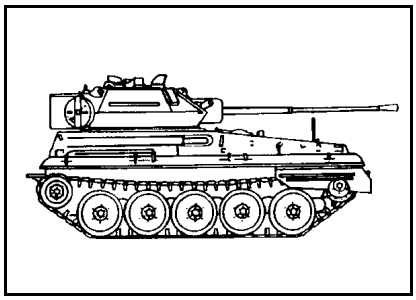

At left, the chart illustrates some of the filtering and pruning criteria that help experts identify armored vehicles.

Twelve examples from the program follow on the next two pages. Answers appear on Page 49.

The AFV Identification Trainer - Some Examples

Answers on Page 49 (back of LETTERS)

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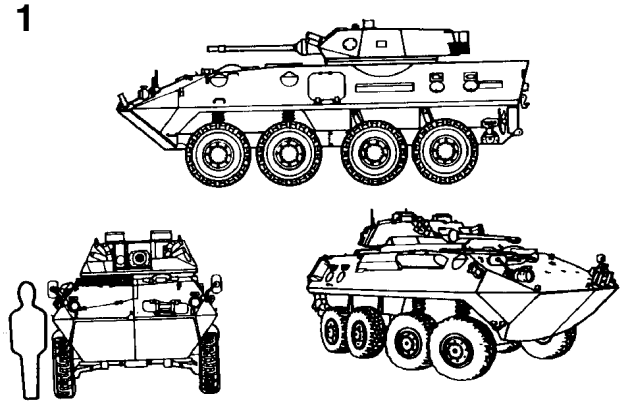

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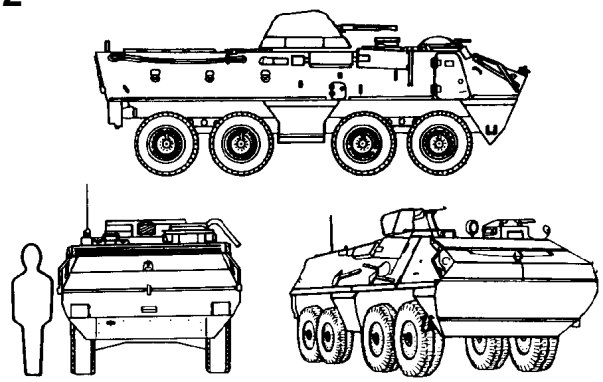

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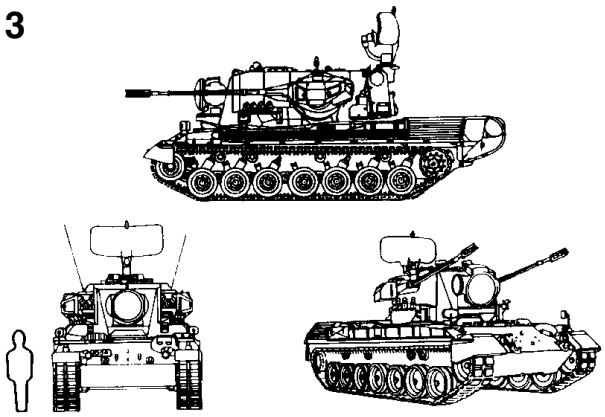

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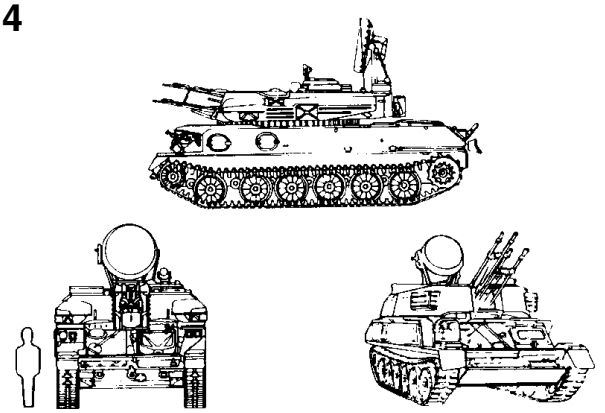

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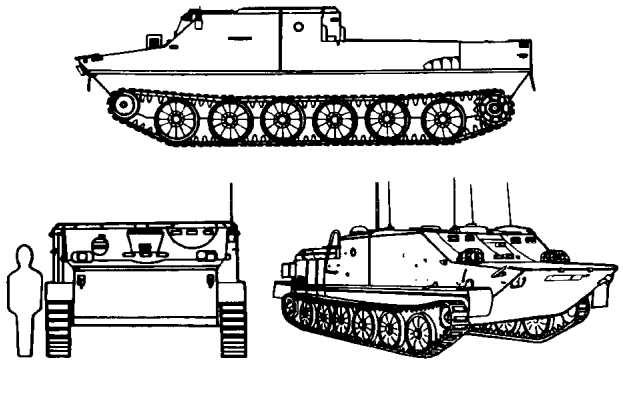

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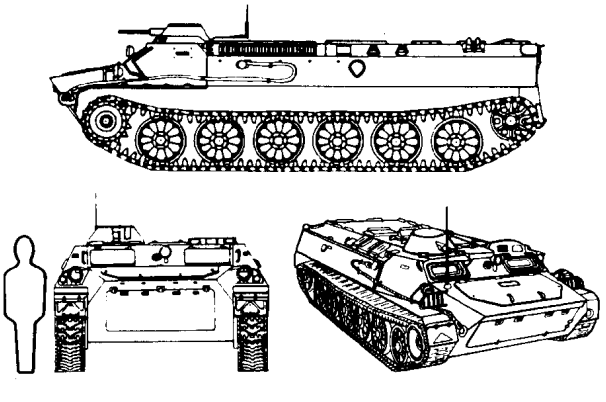

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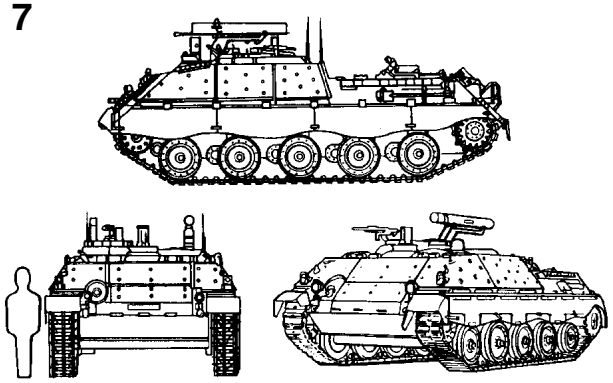

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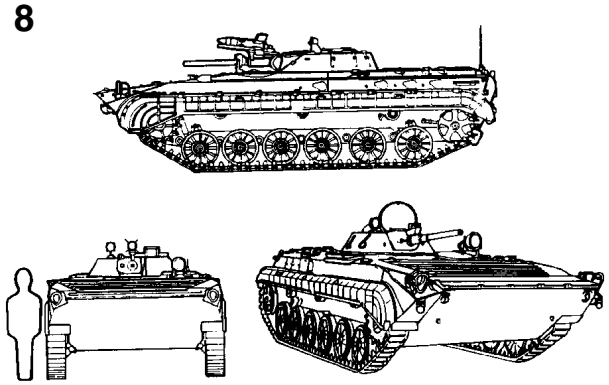

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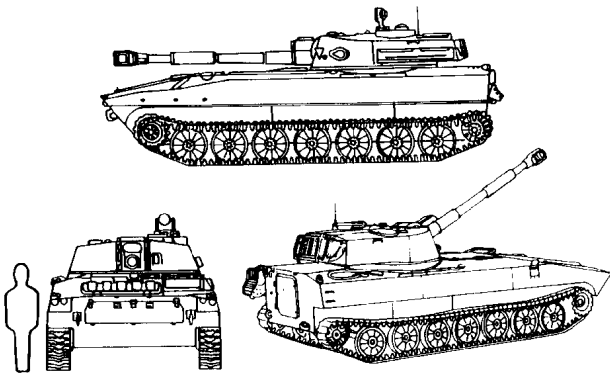

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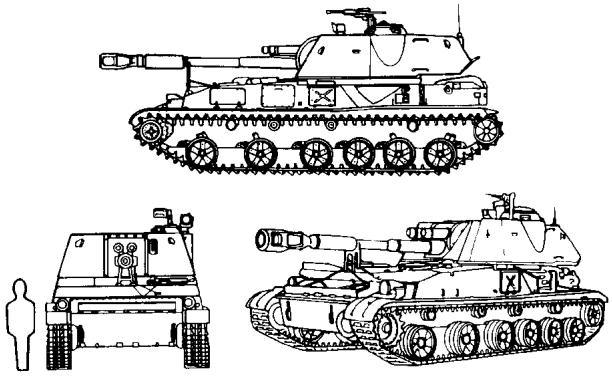

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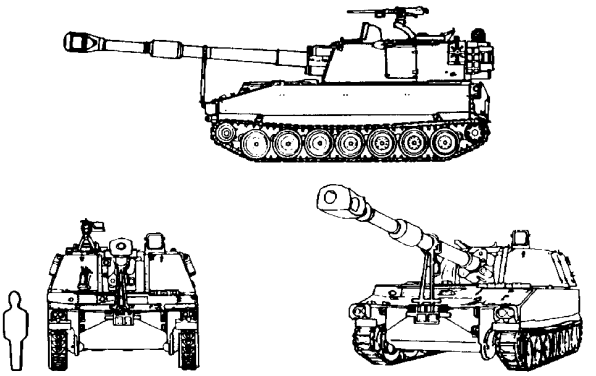

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