

Introduction, Findings, Issues for Congress

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America's recent combat in the Persian Gulf War brought new attention to an old problem: fratricide, or "friendly fire," that is, casualties from U.S. or allied weapons fired at U.S. or allied military personnel. Twenty-four percent of all U.S. combat fatalities in the war were caused by friendly fire. This figure seemed much higher than in previous wars and caused a sudden focus on avoiding fratricide in future wars.

The U.S. military and the American public are becoming increasingly sensitive to the human costs of military involvement, especially for contests of less than national survival. The United States has invested much in energy and equipment to keep casualties low. The high fraction of deaths in the Persian Gulf War due to fratricide was much higher than the nominal two percent rate frequently cited in the military literature. Broad-based data on fratricide rates are not available; but, a recent review of long-extant casualty surveys from World War II and the Vietnam War shows that fratricide estimates of 2 percent are unrealistic and 15 to 20 percent may be the norm, not the exception. Thus, one reason that fratricide seemed unusually high in the Persian Gulf War is that total U.S. casualties were low but another important reason is that past rates of fratricide have been systematically and substantially underestimated. If these rates are, indeed, typical, then reducing casualties from fratricide deserves the same kind of attention as reducing casualties from any other major source.

Beyond numbers of killed and wounded, fratricide has a compounding effect on combat effectiveness. Weapons aimed at friends are not aimed at the enemy. Friends killed by friends are not able to fight the enemy. Moreover, the psychological effects of friendly fire are always greater than from similar enemy fire. Combatants expect to be shot at by the enemy, but being shot at

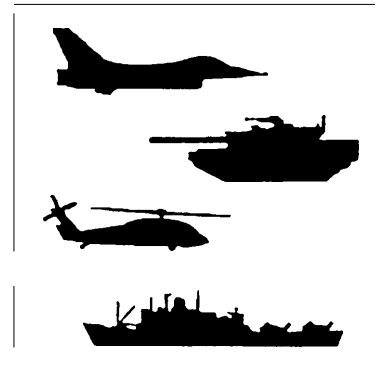


Table 1-1—Detrimental Effects of Fratricide

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- Hesitation to conduct limited visibility operations
 - Loss of confidence in unit's leadership
 - Increase of leader self-doubt
 - Hesitation to use supporting combat systems
 - Oversupervision of units
 - Loss of initiative
 - Loss of aggressiveness during fire and maneuver
 - Disrupted operations
 - Needless loss of combat power
 - General degradation of cohesion and morale
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SOURCE: Center for Army Lessons Learned.

by friends corrodes cooperation and morale; shooting at friends also destroys morale and can cause commanders to be overly cautious in combat. See table 1-1.

The Persian Gulf experience has concentrated the attention of the military Services on the problems of fratricide. Several new antifratricide programs were started within the Department of Defense, and existing programs have been accelerated, reoriented, or brought under new management control. New emphasis has been given to the fratricidal implications of other programs—such as those to improve communication—not explicitly or primarily intended to reduce fratricide. Doctrine and training are also being reexamined with a view to minimizing the risk of fratricide.

FINDINGS

Fratricide may be a significant source of casualties. Twenty-four percent of U.S. combat fatalities in the Persian Gulf War were caused by friendly fire. This seemed extraordinarily high compared to past conflicts. Several reasons have been presented for why the fraction should have been so large:

1. total U.S. losses were very low, thus the percentage of fratricides appeared abnormally high;
2. the war was so short that U.S. troops did not have a chance to gain much experience, reduce fratricide, and get the average down;

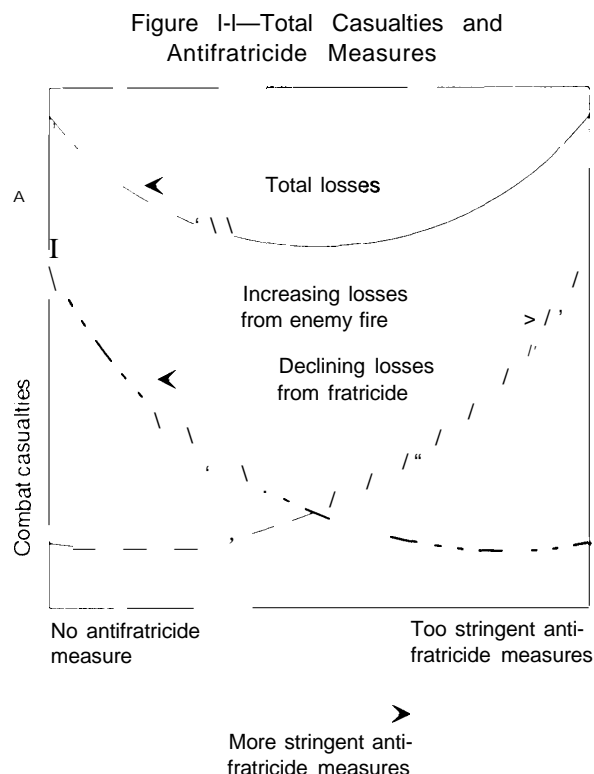
3. near-absolute dominance of the battlefield by the U.S. meant that only U.S. rounds were flying through the air and if a soldier got hit by anything, it was likely to be from a U.S. weapon; and
4. the unique characteristics of many U.S. weapons, for example, the depleted uranium in the M-1 tank round, made the fratricide that did occur undeniable.

Some of these reasons will apply to a range of possible future military engagements. Whether or not fratricide in the Persian Gulf was particularly high compared to past wars, it may be representative of future conflicts.

The fourth point above deserves careful consideration. While military historians have frequently used two percent as a notional fratricide rate, the figure has been higher in all of those cases for which good data are available. A recent review of medical records from World War II, the Korean War, and the Vietnam War show fratricides to account for 12 percent and more of total casualties in those cases for which data are available. Perhaps the Persian Gulf War was not so unusual.

Reducing fratricide is desirable and feasible, but eliminating it is not. Although programs to reduce fratricide are certainly needed, setting a goal of eliminating fratricide is unrealistic and probably even counterproductive. Overly restrictive rules of engagement, for example, may so reduce combat effectiveness that casualties inflicted by the enemy increase more than friendly fire losses are reduced. See figure 1-1.

The new global military environment requires a reevaluation of antifratricide efforts. Any technical goals established during the days of the Cold War need to be reexamined. Past directions will not be completely reversed, but priorities among technical direction may change. For example, during the NATO-Warsaw Pact confrontation, which type of weapon was on which side was clear-cut. Today, noncooperative identification based on type of weapon or plat-



SOURCE: Office of Technology Assessment, 1993.

form will be more difficult in a world in which enemies and allies may own the same hardware. Also, future alliances, like that in the Persian Gulf, may be more ad hoc, making planning for and sharing of identification technology more difficult. On the other hand, some tasks should be easier to accomplish since few potential enemies will be as sophisticated as the former Soviet Union or possess the sheer numbers.

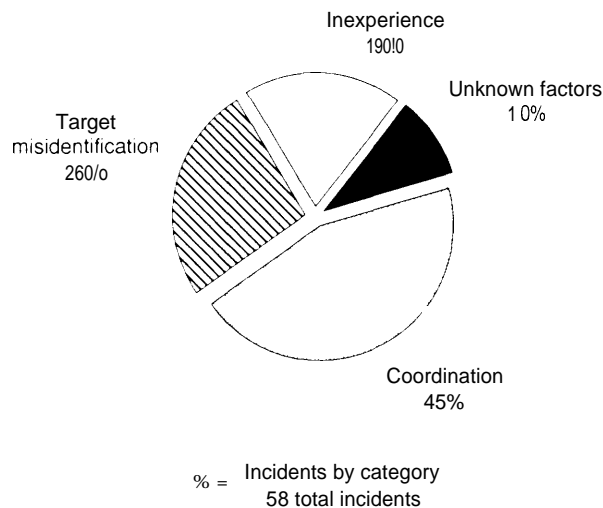
Fratricide results from multiple causes. Friendly fire is often thought of as due primarily, or exclusively, to misidentification. Investigation of particular cases usually reveals that the fratricide was in fact the last link in a chain of mistakes. That is, faulty navigation; poor communication, command, and planning; lack of fire discipline; and occasional malfunctioning equipment are responsible at least as often as misidentification. See figure 1-2.

With multiple links in a chain of causes, there are multiple solutions to the problem of fratricide

by strengthening any of the links. For example, outfitting tanks with compasses will improve navigation, helping units to be where they are supposed to be and not to stray into fields of friendly fire. Improved radios allow the transmission of more of this navigation information. Improved displays within the tank would allow clearer representation of that information. And, of course, better sensors would allow better recognition of fiends seen through the sights of the gun. Each of these measures could reduce fratricide.

Some approaches to reducing fratricide have other benefits. For example, improved communication and navigation allow better command and control of combat units, more flexible tactics, and more efficient allocation of combat resources. All of this together could improve combat capability significantly while also reducing fratricide. An improved identification device will mostly reduce fratricide with much smaller side benefits. Thus, only the appropriate fractions of the costs of systems should be compared when considering their relative efficiency in reducing fratricide.

Figure 1-2—Causes of Fratricide: Direct Fire Fratricide in World War II, Korea, and Vietnam



SOURCE: U.S. Army

U.S. ARMY



Wreckage of a U.S. armored vehicle destroyed by friendly fire in the Persian Gulf War. The effectiveness of modern weapons makes identification mistakes deadly.

No single technical approach to target identification will be perfect. Identification techniques can be roughly divided between cooperative and noncooperative approaches. In general, cooperative techniques can provide positive identification of friends. Failure to respond to a cooperative identification query could be *assumed* to identify a putative target as an enemy, but in most circumstances, most shooters would be hesitant to use the lack of response as a justification to fire. Cooperative techniques could, however, categorize targets as either friends or unknowns and then noncooperative techniques could identify the foes among the unknowns.

The technology for avoiding fratricide of land surface targets lags behind the technology important **to avoiding** aircraft fratricide. Avoiding fratricide requires good navigation, communication, and identification. Yet multimillion-dollar U.S. tanks do not have compasses. Simple magnetic compasses will not work inside a 60-ton steel box and tanks are only now being fitted with radio-navigation equipment. Question-and-answer IFF systems, developed for aircraft a half century ago in World War II, are only now being developed for land combat vehicles. Programs to reduce ground combat fratricide will need special

support for several years just to get up to where aircraft systems are today.

Coordination among the U.S. military Services and among U.S. allies is essential. Programs to develop technology to reduce fratricide must be coordinated among Services and allies from the beginning. The U.S. military emphasizes “combined arms” operations where the strengths of many different types of weapons are brought to bear simultaneously against an enemy. This approach presents many opportunities for friendly fire among aircraft, artillery, land vehicles, surface-to-air missiles, and so on. Fratricide reduction, as much as any other DoD effort, needs some central coordination, either from Office of the Secretary, the Joint Chiefs of Staff, or other special joint-Service organization. The Services realize the importance of coordination, and their ongoing multi-Service efforts should be encouraged and monitored.

Future conflicts are likely to be allied operations—as much for political as military reasons—and coordination of antifratricide technology development with allies must be maintained from the beginning. The utility in allied operations is one criterion by which prospective technology must be judged. For example, if technology being pursued for identification of friend and foe is so sensitive that it cannot be released to allies, especially ad hoc allies as we had in the Persian Gulf War, then the usefulness of the technology will be limited. This does not mean that these approaches are worthless, but the need for allied cooperation should be included as a program goal.

Nonmaterial changes will also reduce fratricide. Some cases of friendly fire in the Persian Gulf War could have been avoided by different pre-war training. For example, since the war the Army intentionally includes occasional stray friendly vehicles in training exercises and maneuvers to let soldiers practice “don’t shoot” situations. Simulators are an increasingly important part of training. In the past, these have not fully reproduced opportunities for fratricide; this lack is now being addressed.

The rules of engagement strongly affect the likelihood of fratricide. The Services train warriors and train them to be aggressive. But in many potential future conflicts, the conditions of the Persian Gulf War may recur: the U.S. was able to outrange, outsee, and outgun the enemy by a substantial margin. This capability could allow (but not demand) different rules of engagement. Many Persian Gulf fratricide occurred when a target was engaged quickly yet the shooter was in no imminent danger and could have been more deliberate. In situations where U.S. forces have clear weapons performance superiority, more conservative rules of engagement may reduce overall U.S. casualties. This is a very complex issue that is without a simple answer (e.g., if the United States had fought more slowly battle-by-battle, perhaps the overall envelopment of Iraqi forces would have failed), however, it at least deserves consideration.

ISSUES FOR CONGRESS

I Allocation of Resources

Reducing fratricide will require new technology and equipment. That, in turn, requires funding, which then requires allocations within a finite defense budget. There is, as always, competition between efforts to reduce fratricide and other military needs. Having combat superiority helps to keep casualties down, so even if minimizing casualties is the goal, spending less on offensive weapons and more on avoiding fratricide is not automatically the answer. Two issues, however, suggest that the relative emphasis on fratricide prevention should increase: first, most military analysts interviewed by OTA for this assessment agree that antifraticide efforts, especially related to land combat, have not received sufficient attention in the recent past. Second, the experience of the Persian Gulf suggests that fratricide may be a relatively greater cause of casualties in future conflicts than has been appreciated in the past.

Each of the Services has IFF and antifraticide programs, and Congress will be asked to allocate resources among these. One of the findings of this report is that technology to help prevent fratricide of land surface targets is least developed and Congress may consider giving relatively greater weight for a few years to programs supporting these technologies.

Resources must also be allocated among various technical approaches to reducing fratricide. When comparing these costs, Congress may want to consider the potential multiple benefits of many approaches. Specifically, an IFF system will reduce fratricide by improving identification, but has only limited additional applications, while improvements in communication and navigation can reduce fratricide and have compounding benefits to overall combat effectiveness.

■ Short-Term v. Long-Term Goals

After the Persian Gulf friendly fire losses, the Services decided—with some prompting from Congress—that an accelerated antifraticide program was needed. The Army developed a plan for both “near-term” (less than 5 years) and “far-term” (7 or more years) solutions. The general technical approach for the near-term solution is fairly well determined to be a millimeter wave question-and-answer system. This has the advantage of being available to troops in the field within just a few years, although it is not the ideal long-term solution. The degree of pressure from Congress is part of the calculus by which the Services determine their allocation of effort between near- and long-term solutions. Congress may wish to make clear to the Army the extent of its urgency:

- should the Army get a less-than-ideal system in the field quickly so soldiers have something in the event of a new Persian Gulf-like conflict, or
- should the Army take a longer-term approach to get a better system while risking

that a conflict within *5 years* or so may result in too many friendly fire losses?

■ Cross-Service Coordination

There is probably no better example of an effort where inter-Service coordination is needed than the development of antifratricide technology and equipment. The Services now have a General Officers Steering Committee that seems quite successful in assuring coordination among various Service antifratricide programs. Congress may want to pay special attention to Service coordination in future years to ensure that it is

maintained at every level. Past experience is not uniformly encouraging.

One technical aspect of Service coordination is the compatibility of various IFF devices. Not every weapon can effectively fire at every other weapon; for example, fighter/interceptor aircraft and tanks cannot fire at each other. Is it really necessary that they be able to query each other's IFF devices? Yet fighters can fire at ground-attack aircraft and ground attack aircraft can fire at tanks. If they do not all have the same IFF systems, will ground-attack aircraft need two systems operating in parallel?