The Stance on the Cluster Munitions Ban

U.S. Philosophy Explained

UN (Mark Garten)

Four undetonated cluster bombs await removal by UN peacekeepers in Lebanon

By DONALD L. HINTON

This article provides an unclassified explanation of why the United States still needs the military capability provided by cluster munitions (CM). This need exists in spite of the fact that many countries signed a treaty agreeing to ban CM use and/or production. The primary manufacturers of such munitions—the United States, Russia, China, Pakistan, India, and Israel—did not participate in these negotiations and did not sign the treaty. This article also provides an overview of the general types of CM that the United States has in its arsenal, followed by principles of CM targeting that point to their absolute necessity on today's battlefield.

CM have one common element—a canister or other means to carry and deliver submunitions. Canisters are delivered via aircraft, cannon, ground-launched rocket, missile, or naval vessel. The canisters are gravity-driven, ballistic, or glide guidance-controlled as they progress toward the intended target. The canister's main functions are to provide an easy packaging of the submunitions prior to release/launch, and then once released or initiated from the launch platform, to maintain control of the submunitions until expected parameters in space, time, or conditions are met, at which point submunitions are dispersed from the canister.

Submunitions that have an explosive/incendiary charge associated with their attack against a target are of international and nongovernmental organization (NGO) concern. Currently, most submunitions do not

Donald L. Hinton is a Senior Analyst at Analytic Services, Inc.

have sensors or guidance and are activated on impact. Individual submunitions guidance is largely experimental. Each submunition type has a set capability that provides the military commander with flexibility when considering the attack of a specific area target. CM are not all the same in capability, characteristics, or attributes, and it is misleading to conflate all types into one category.

Cluster munitions are versatile and can be used against almost any target type. Examples of exceptions are hardened sites or underground facilities. Reports of the use of CM during the recent events in Gaza seem rather unlikely, since the targets attacked do not fall under the most common categories for cluster munition targets, which include aircraft on runways and revetments, trucks/tankers/vessels, heavy armor, air defense radars, artillery, and surface-to-air missile defense sites (mobile/fixed), to name a few. That said, CM can be used against a wide breadth of targets. CM missions can be described as degrading sensor capability, delaying or breaking momentum and force cohesiveness, cutting depot and resupply operations, keeping a force suppressed to limit its return fire, counterbattery fire to attack ground-based artillery, sealing gaps in nonlinear battlelines, or disrupting command and control.

Cluster munitions provide the warfighter with a weapon that can be employed to quickly address a target area and reduce the assets needed to protect or cover areas, thus providing economy of force. CM enable our forces to minimize exposure to hostile fire and can be quickly employed to protect forces coming under attack from an overwhelming force. They address multiple targets with one weapon or strike, and distribute munition effects over the target area more evenly than unitary warheads.

Beginnings

Before we can understand how, when, where, and why CM are used, we should first examine their genesis. The first cluster bombs were used by the Germans in World War II and were often referred to as butterfly bombs. They were used to attack both civilian and military targets. The technology was developed further by the United States, Russia, and Italy. CM in a wide variety of forms are now standard for many nations. Reportedly, 34 countries produce them and at least 23 countries use them. In 1945, there was widespread acceptance of the targeting of civilian populations in Hiroshima and Nagasaki. At that time, 85 percent of the U.S. public approved of the bombing, according to polls.[1] If such a poll were taken today, the numbers would likely be reversed.

The U.S. Government is aware of the humanitarian concerns expressed by many countries and NGOs over CM, but it also understands that it has an inherent responsibility to ensure its own national security as well as that of its allies. The recent adoption of the "Department of Defense [DOD] Policy on Cluster Munitions and Unintended Harm to Civilians" is a clear indicator that the U.S. Government understands and accepts the need to change. While the United States believes that the new policy will provide better protection of civilians and civilian infrastructure following a conflict, it also allows for the retention of this legitimate and useful weapon. This policy makes it clear that the United States recognizes the need to minimize unintended harm to civilians and their infrastructure. Submunitions provide distinct advantages against a range of targets, and their use may even reduce risks to U.S. forces, which is why military commanders often prefer them over unitary bombs, which can require many sorties to achieve an equivalent effect. While CM may cause unintended harm to civilians during combat, the damage will still be far less than that from the required number of unitary weapons needed to suppress the same target. Unitary weapons would destroy the entire target, while CM would minimize negative consequences for civilians and still achieve the military consequences desired.

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CM permit a smaller force to engage a larger adversary and are considered by some an economy of force weapon. Many CM rely on simple mechanical fuzes. They arm the submunition based on its rate of spin and explode on impact or after a set time delay. Newer generations of sensor-fuzed submunitions are being introduced, and they have been shown to improve munition and submunition accuracy, and to reduce the large number of residual unexploded submunitions. These sensor-fuzed submunitions are designed to sense and destroy vehicles without creating an extensive hazard area of unexploded submunitions.

When a properly delivered submunition fails to function, it is designated *unexploded ordnance* (UXO). Depending on the submunition, a self-destruct mechanism may render a UXO submunition safe in seconds or minutes. Some early designs did not have self-destruct features and posed a UXO hazard on the battlefield. The UXO may be armed or unarmed. While any UXO is undesirable, unarmed UXO poses a reduced hazard. Armed UXO may or may not pose a hazard, depending on design. If the armed UXO contains a stored-energy device, such as a spring that has not been released or a battery that has not discharged, then it poses a definite hazard if moved or handled.

Many misconceptions about cluster munitions exist:

- CM are an outdated weapon.
- Impact after use is not taken into consideration prior to targeting and planning.
- CM are used solely for large areas.
- CM are indiscriminate and inaccurate.
- CM present significant and complex UXO and explosive remnants of war conditions.
- DOD can use unitary and precision weapons just as effectively.

Last summer, a DOD policy on CM was signed by Secretary of Defense Robert Gates. This is a clear indication that DOD understands the concern over these weapons. This policy means that almost none of our existing stockpile can be retained, and an almost complete turnover of our stockpile will take place over the next 10 years. The United States has very strict rules in place for the targeting of CM, so it is highly unlikely these weapons will be used unless absolutely needed.

While CM constitute the vast majority of the U.S. Armed Forces' indirect tactical fires, they actually compose a small portion of the total threat to humans presented by unexploded aerial bombs, artillery shells, and other conventional munitions. Some parties claimed that unexploded CM constitute a major category of postconflict hazard and that they warrant new mechanisms beyond those that already exist in Amended Protocol II and

Protocol V of the Convention on Conventional Weapons (CCW). This group became known as the Cluster Munitions Coalition (CMC). The United States and other CM-producing states participate in the CCW but not the CMC, which signed a treaty in December 2008. Since the CMC does not include the major producers of CM, the formation of this coalition is thought to be merely a political gesture.

While both air- and ground-based fire support have proven invaluable, they have struggled to deal with the extreme complexity, density, and constraints of the urban environment. It is in this area that precision munitions have proven their worth. The Army has recently taken huge steps in the field of precision munitions and is in the midst of its own precision munitions revolution in field artillery capabilities.[2] The integration of these newly fielded capabilities into the joint fight not only will strengthen U.S. military capability but also will pose a challenge to commanders, planners, and fire support coordinators, making it difficult for them to choose the right weapon for each job.

The table lists the quantity of U.S. cluster munitions and their reported reliability figures. While not 100 percent, reliability is generally very high and improving. The table also shows which CM have a self-destruct feature built in.

Recent Conflicts

The term *explosive remnants of war* (ERW) refers to all abandoned and unexploded weapons in an area—that is, unexploded artillery shells, grenades, mortars, rockets, air-dropped bombs, and antivehicle landmines as well as dud CM. ERW exclude antipersonnel landmines, and include weapons that did not detonate as designed or were abandoned (and can still detonate as designed). ERW often contain powerful explosives and metal fragments that become shrapnel. Laos, Cambodia, Kosovo, Eritrea, Iraq, Afghanistan, and now Lebanon have experienced ERW casualty levels on a scale similar to those caused by landmines.

Iraq. Iraq Body Count's research shows that 27,000 civilian deaths from violence were reported in 2006.[3] This represents a huge increase compared to preceding years: 14,000 killed in 2005, 10,500 in 2004, and just under

U.S. Cluster Munitions: Quantity and Reliability

Designation	Submunition	Quantity	Designed Effect	Reliability (percent)	Self-destruct Feature
CBU–87/B	BLU–97/B	202	Antipersonnel Anti-materiel	94	no
CBU–89A/B	BLU–91B	72	Antitank	93	yes
	BLU–92B	22	Antipersonnel		yes
CBU–97B	BLU–108B	10	Antitank/-materiel	97.3	yes
MK–20	MK–118	247	Antitank	98	no
CBU–99	MK–118	247	Antitank	98	no
CBU–100	MK–118	247	Antitank	98	no
CBU–103/113	BLU–97B	202	Antipersonnel Anti-materiel	94	no
CBU–104	BLU–91B	72	Antitank	93	yes
	BLU–92B	22	Antipersonnel		
CBU–0105/115	BLU–108B	10	Antitank/-materiel	97.30	n/a
CBU–107B	Nonexplosive penetrator rods	202	Antipersonnel	100	n/a
CBU–116	BLU–97B	202	Anti-materiel	94	n/a
CBU–117	BLU–97B	202	Anti-materiel	94	n/a
CBU–118	BLU–97B	202	Anti-materiel	94	n/a
ATACMS Block 1	M74	950	Antitank	98	no
ATACMS Block 1A	M74	300	Antitank	98	no
M26	M77	644	Anti-materiel	95	no
M26A1A2 ER–MLRS	518 XM85	518	Anti-materiel/personnel	97	no
M483/M483A1 DPICM	M42 and M46	88	Anti-materiel	97	no
M864 ER–DPICM	M42 and M46	72	Anti-materiel	97	no
M261 MPSM	M73	9	Anti-materiel/personnel	94	n/a

12,000 in 2003 (7,000 during the actual war and invasion, and another 5,000 during the "peace" that followed). One measure by which the 2006 figures quickly exceeded those of 2005 was the major ground-based bombing attacks that each killed more than 50 civilians (and sometimes far more). Altogether, there have been 49 of these attacks since 2003, killing 4,454 to 4,632 civilians, and probably more.

F/A–18 Super Hornet aircraft deploy cluster bombs onto smoke targets below

U.S. Navy (Gary Prill)

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The death tolls from these large-scale incidents are well reported: on average, each incident received 33 independent media reports, including updates to the death toll, ranging up to 92 reports for the largest incident. Even so, these attacks leave out many wounded, some of whom may have died from their injuries after the last of these reports were collected. The total number of mine casualties over the years in Iraq is not known. Handicap International reported that landmines caused approximately 13,832 casualties, cluster submunitions 110, and ERW 20; the rest are unknown (over 7,500 records).[4]

Afghanistan. In 2006, the International Committee of the Red Cross recorded 796 mine or ERW casualties (98 killed and 698 injured). "Within the total, 194 [24 percent] casualties were caused by antipersonnel mines, 91 [11 percent] by anti-vehicle mines, 22 [3 percent] by cluster submunitions, and 424 [53 percent] by other ERW," according to Landmine Monitor.[5]

According to the United Nations Mine Action Center for Afghanistan, 160 casualties were caused by antipersonnel mines (24 percent), 92 by antivehicle mines (14 percent), 16 by cluster submunitions (2 percent), and 401 by other ERW (60 percent). Data from both NGOs confirm that CM caused a relatively small portion (2–3 percent) of the overall number of casualties in Afghanistan.

Kosovo. No landmine or cluster submunition casualties were reported in Kosovo in 2006.[6] However, there were 11 casualties in 7 ERW incidents: 1 person was killed and another 10 were injured. In 2005, 11 cluster submunitions and ERW casualties were recorded. CM have caused at least 152 postconflict casualties to date. Most of these casualties occurred in the few months immediately after the bombing. According to Handicap International, CM were responsible for 31 percent of total reported casualties from 1999 through 2005.[7] Mines caused 52 percent of the casualties. The impact of CM in Kosovo was reduced by one of the largest humanitarian operations (the International Kosovo Protection Force) ever undertaken, including one of the best-resourced mine action projects ever mounted. According to the Kosovo Protection Corps Coordinator, from June 1999 to the end of 2006, 533 casualties were recorded (111 people killed, 422 injured).[8]

Lebanon. The best information on dud rates is based on approximate figures. The estimated number of CM, according to Observer Group Lebanon, is 4 million fired. The expected number of CM in the field is therefore 400,000 (10 percent failure rate based on these figures). The number found to date is approximately 200,000 (5 percent of the total fired).[9] The original estimate from the Lebanon Mine Action Centre was 1 million CM in the field, which would equate to a 25 percent failure rate; the Mine Advisory Group's operations manager in Lebanon believes this to be grossly overestimated. As the find rate is closer to 5 items per 1,000 square meters, given that the estimate for contamination is 40 million square meters, that would equal 200,000 CM; adding to that the 100,000 cleared in the emergency phase and the 50,000 cleared by private agencies would bring the figure to 350,000. With only 10 million square meters left, the expected find rate would be 50,000 CM, balancing out at 400,000 CM in the field.

Israel is reported to have fired 160,000 artillery projectiles during the conflict, and it is reasonable to assume that 10 to 20 percent contained CM. Israel also dropped more than 1.2 million cluster bombs into Lebanon. CM accounted for nearly 11 percent of the casualties prior to July 12, 2006, increasing to 13 percent after the conflict.[10] As of May 31, 2007, 904 cluster bomb strike locations had been recorded. The United Nations further estimated that, in addition to CM, approximately 15,300 other items of UXO fell on the ground in South Lebanon. This ordnance includes air-dropped 500- to 2,000-pound bombs (found in residential areas), artillery rounds, air-delivered rockets, and some 1,800 rockets fired from multiple-launch rocket systems.[11]

Targeting

Cluster munitions present significant and complex UXO and ERW conditions; however, the United States continues to spend heavily on research and development. Much of this effort focuses on minimizing the risk of UXO and ERW by developing more reliable self-destruct fuzes and alternative warheads.

A *target* is an entity or object considered for possible engagement or action. It may be an area, complex, installation, force, equipment, capability, function, individual, group, system, or behavior identified for possible action to support the commander's objectives, guidance, and intent.[12] The joint force commander establishes these objectives, consistent with national strategic direction, to compel an adversary to comply with specific requirements or otherwise modify behavior. Targets may relate to strategic, operational, or tactical objectives. Forces will usually conduct continuous target development to support planning and to ensure a range of options for commanders. They may choose to engage targets specifically to create effects that help to attain the commander's objective. Every target has distinct characteristics that define how it will be targeted. Characteristics form the basis for target detection, location, identification, and classification for future surveillance, analysis, strike, and assessment. In general, there are five categories of characteristics by which targets can be defined: physical, functional, cognitive, environmental, and time.

In urban areas, considerations of the effects required and of those to be avoided are multiplied by the complexity and congestion of the environment. Targets can vary from the destruction of a small building to removing a sniper from a civilian apartment building

cluster munitions offer the military commander the flexibility to use the firepower necessary to achieve the desired result

without harming friendly troops, noncombatants, cultural buildings, or infrastructure. Historical studies show that approximately 90 percent of all urban engagements occur where friendly and enemy forces are in close proximity to each other. A stray munition or unintended effect can have great repercussions because troop density for offensive missions in urban areas can be as much as 3 to 5 times greater than for similar missions in open terrain.

U.S. operations in the cities of Iraq have generated a change in thinking about munitions capabilities in terms of size. Whereas the focus in Cold War operations was on weapons with larger blast, fragmentation, incendiary, or area effects, which are useful in full-scale conventional warfare, the collateral damage effects of standard munitions (for example, the 2,000-pound Mk-84-class bombs) make them largely unusable in limited combat in the urban operational environment. Field artillery systems have an excellent standoff capability that generally exceeds that of fixed-wing aircraft. This capability is a crucial factor when considering the implications of artillery employment, such as risk.[13] The operations that the Air Force conducts demand smaller munitions and an ability to focus weapons effects. CM offer the military commander the flexibility to use the firepower necessary to achieve the desired result. Today's CM should not be confused with those used in Laos, Kosovo, or even in the first Gulf War—they are far more sophisticated, and they provide the warfighter with the ability to quickly address a specific target or to address multiple targets at the same time.

Army Tactical Missile System was highly successful in Operation *Desert Storm*

Lockheed Martin

Accuracy is only as good as the target coordinates and the signal received from satellites. For this reason, a global positioning system (GPS) munition that can obtain a circular error probable of 3 meters under optimal circumstances may perform worse under conditions involving signal interference. Some GPS munitions have backup inertial measuring units or inertial navigation guidance systems, and all of the munitions suffer a decrease in accuracy in these modes. With GPS as a primary guidance source, there are definitive issues that affect signal accuracy, both in determining coordinates of the target and in guiding the ammunition to those coordinates. Among these issues are target location error, datum accuracy, space weather impacts, visibility and geometry, and signal bounce.[14] Another area of concern deals with GPS jammers affecting targeting and weapon accuracy. All joint fires staffs, operators, and

personnel should understand these limitations if planning and execution of missions using GPS are to be successful.

Law of Armed Conflict

While targeting may differ depending on whether it is being conducted by the Army or Air Force, one thing remains consistent: it is DOD policy that the Armed Forces must comply with the law of armed conflict. Four basic principles apply when making targeting decisions:

- military necessity
- preventing unnecessary suffering
- discrimination
- proportionality.

Military necessity acknowledges that the target is a valid military objective. The principle of unnecessary suffering means that weapons are to be as humane as possible. All conventional weapons in the U.S. inventory are deemed to meet this requirement by design. Discrimination or distinction means that we distinguish between combatants and noncombatants, with the goal of prohibiting indiscriminate attacks. Proportionality is often the most contentious of these principles. By meeting the requirement of proportionality, the military is stating that it is taking into consideration anticipated incidental loss of civilians and their property. This requires planners to think deeply about the results of planned attacks in or around civilian communities.

Protecting against collateral damage may necessitate more precision, and this may come about through GPS solutions and other employment methods. Varying a munition's fuze setting can drastically alter the effect it has on a target. Delayed fuze settings usually mean that bombs will bury themselves into the ground before detonation, thus controlling and limiting the blast, fragmentation, and incendiary effects. U.S. planners operate under strict rules of engagement and must take collateral damage into consideration when choosing a munition for a specific target.[15] Our enemies know that we operate under strict rules, and will purposely use civilians as human shields in order to deter attacks. Self-defense is the trump card when choosing which munition to use. Missions in Iraq caused many changes to targeting practices.[16]

Guided Multiple Launch Rocket System is capable of delivering cluster munitions

U.S. Army (Rick Rzepka)

The use of artillery during Operation *Iraqi Freedom* provides an example of the usefulness of smaller munitions. In the battle for Fallujah, for instance, proximity-fuzed artillery was effective against rooftop threats, and missions dangerously close to civilian targets were the rule and not the exception. The 155mm and 120mm fires were routinely within 200 meters of friendly forces.[17] Using larger munitions for fires in proximity to friendly forces would require increased distances and could result in the destruction of the buildings beneath the blast.

Army artillery fusing and trajectory options generally have the same application in urban areas as fixed-wing munitions; however, some munitions capabilities are more varied. The Army Tactical Missile System (ATACMS) has trajectory shaping, but no proximity or delay fuze option. The high-precision Guided Multiple Launch Rocket System (GMLRS) unitary weapon currently has no trajectory-shaping option or proximity fuze, while Excalibur, one of the newest munitions, has all of these options. Smart bombs are guided projectiles designed to deliver maximum damage to the target while minimizing both collateral damage and the risk of being intercepted by the enemy. Upgrades to GMLRS unitary and ATACMS will expand these capabilities by "shaping their trajectories to provide a nearly vertical attack angle, as well as adding tri-mode fusing options (proximity or airburst, point detonating and delay)."[18]

There is a dramatic increase in the lethality of weapons available to hostile elements. The United States must cope with advanced technology that reinvents itself almost overnight. The Army now faces a dangerous new world where the foe does not always have a face. At this time, the Army is often caught between a doctrine that has

been successful in the past and a desire to prepare for unknown adversaries. These adversaries will not hesitate to take advantage of the Army's limitations under the law of armed conflict.

Both the Air Force and the Army increasingly rely on GPS as a primary guidance source for much of their modern precision munitions capabilities. Although any weapons system has factors that affect accuracy, such as operator training or hardware limitations, GPS-aided munitions are unique in various ways. They are subject to the accuracy of fixed target coordinates, and they rely on a space-based guidance signal, the influence of which is largely outside the control of the operator and can significantly affect performance. The Air Force and the Army use multiple systems to obtain target coordinates, which are derived from GPS.

While the care taken in targeting shows U.S. concern for potential civilian casualties, the Pentagon placed these casualties in the larger context of the war on terrorism: "We're now being threatened with weapons that could kill tens of thousands of people. We're trying to avoid killing innocent people, but we have to win this war and we'll use the weapons we need to in this war," then–Deputy Secretary of Defense Paul Wolfowitz said in response to a question about cluster bombs.[19] When asked about the civilian casualties caused by cluster bomb units, Pentagon officials stated that they were more concerned about the thousands who were intentionally killed on September 11, 2001. This is a clear indication that the military sees a distinction between the intentional targeting of civilians and civilian deaths caused as an unintentional side effect of war.

Inclusion of a provision articulating the legal rules governing CM use would confirm that CM may in fact continue to be used. The new Office of the Secretary of Defense policy on CM is an alternative to the complete ban proposal generated by the Oslo Process. The CCW, unlike the Oslo Process, includes all the nations that produce and use CM, making any agreement reached there much more practically effective. Second, taking advantage of technology, we can continue to maintain, produce, stockpile, and, when required, use CM, but do so in a manner that significantly reduces the impact these munitions have on civilians. Our policy on CM continues to protect our national security and reduce the impact on civilian populations. Following the new policy guidelines will come at significant expense. A 1 percent UXO rate is not 1 percent in testing, but requires a 1 percent UXO rate for actual use during combat operations, across the range of operational environments in which we intend to use that weapon. Since almost none of our existing stockpile meets the new policy, an almost complete turnover of the existing cluster munition stockpile will take place.

While the policy provides for a 10-year transition period to achieve this 1 percent standard, those years will be required to develop the new technology, get it into production, and substitute, improve, or replace our existing stocks. To account for possible use during the next 10 years, the policy has placed the approval authority with the combatant commander, who is a four-star general or admiral.

Issues dealing with CM are complex and require a great deal of study and analysis; this short-term study finds that the Office of the Secretary of Defense is taking the proper steps to meet the challenges of not only U.S. security concerns, but also those of humanitarian organizations. CM are designed to be lethal, and current efforts will lessen the dangers after hostilities have ended.

The 2008 CM policy is a good indicator that the U.S. Government seeks to protect civilians and civilian infrastructure. Some radical groups have been known to use civilian shields for suppressing fires on military targets. In such an instance, unitary weapons would destroy the entire target, while CM can minimize negative consequences to civilians and still meet the desired military consequences. Also, historical studies prove that "90 percent of all urban engagements occur where friendly and enemy forces are within 50 meters of each other, and that urban engagements using supporting arms occur with less than 250 m between the same."[20] Ultimately, CM is still needed on the battlefield, but their uses and the collateral effects are still being studied. Now that they have been introduced as a weapon, they cannot be taken out of the inventory, or they will only be in the hands of our adversaries. Cluster munitions use has not been banned under U.S. and international law. Until we find a viable alternative, the United States will continue to use them in a judicious manner. **JFQ**

NOTES

[1] Lawrence S. Wittner, *Rebels Against War: The American Peace Movement, 1941–1960* (New York: Columbia University Press, 1969), 128–129.

[2] Craig A. McCarty, *Urban Joint Fire Support: Air Force Fixed-Wing and Army Field Artillery Precision Munitions Capabilities for Urban Operations* (Fort Leavenworth, KS: Army Command and General Staff College, 2007).

[3] Iraq Body Count records the violent civilian deaths that have resulted since the 2003 military intervention in Iraq. Its public database includes deaths caused by U.S.-led coalition forces and paramilitary or criminal attacks by others.

[4] Database provided to Handicap International for data analysis and research on April 25, 2007.

[5] Landmine Monitor, "Afghanistan," available at <www.icbl.org/lm/2007/afghanistan#footnote-1081-110-backlink>.

[6] Landmine Monitor, "Kosovo," available at <www.icbl.org/lm/2006/kosovo.html>.

[7] Landmine Monitor, "Kosovo," available at <www.icbl.org/lm/2007/kosovo>.

[8] Handicap International, "Circle of Impact: The Fatal Footprint of Cluster Munitions on People and Communities," May 2007.

[9] Email from Llewelyn Jones, Mines Advisory Group, to author, August 5, 2008.

[10] Handicap International, *Fatal Footprint: The Global Human Impact of Cluster Munitions*, Preliminary Report, November 2006, 34–37, available at <www.mineaction.org/downloads/1/Fatal_Footprint_HI_report_on_CM_casualties.1.pdf>.

[11] Mine Action Coordination Centre, Southern Lebanon, "Unexploded Ordnance Fact Sheet," September 23, 2006.

[12] Joint Publication (JP) 3–60, *Joint Targeting* (Washington, DC: Joint Chiefs of Staff, April 13, 2007), vii, available at <www.dtic.mil/doctrine/jel/new_pubs/jp3_60.pdf>.

[13] Center for Army Lessons Learned Newsletter 03–32, "Weapons Effects in Urban Operations" (Fort Leavenworth, KS: U.S. Army Combined Arms Center, n.d.).

[14] Ibid., 55.

[15] Major Douglas Thiess, Air Force F–16 pilot and targeteer, interview with author, August 28, 2008.

[16] Ibid.

[17] See "Battle for Fallujah After Action Report Excerpts," available at <www.cannonartillery.com/combat_ops/battle_for_fallujah/fallujah_aar_excerpts.cfm>.

[18] McCarty, 53, quoting Scott R. Gourley, "Precision Brings Artillery Back into the Fight," *Army* 56, no. 12 (December 2006), 58.

[19] Deputy Secretary of Defense Paul D. Wolfowitz, interview with the *Sunday Telegraph* (London), Department of Defense news transcript, October 28, 2001.

[20] Ibid., paragraph 17.