



## What if America Runs Out of Bombs?

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Everyone knows the United States has the most powerful military in the world. No one else comes close to Washington's ability to hunt down its enemies and quickly drop bombs on them from halfway across the world.

But what if America runs out of bombs?

The Ukrainian city of Avdiivka is a cautionary tale. On February 17, the city fell to a Russian assault because the defenders ran low on ammunition. Although Ukrainian authorities claimed they were overseeing an orderly withdrawal, the fighters faced a harrowing ordeal. One group of soldiers fled in a beat-up car, which limped to safety after a Russian rocket blew out a tire, French war correspondent Guillaume Ptak reported. Troops filmed themselves passing by an iconic landmark, a sign that reads "Avdiivka is Ukraine," with Russian bombs falling around them.

U.S. foreign policy debates often focus on questions of money and political willpower, whether the American taxpayer has the patience to keep supporting overseas adventures. Less often than they should, those debates focus on the moral and ethical limits on American engagement overseas. The ongoing wars in Ukraine and the Middle East, however, have strained the *physical* limits of American power. The factories simply can't make enough ammunition to keep up with all of Washington's commitments, no matter how much money is thrown at them.

Previous Pentagon planners had not anticipated "the sort of lengthy, heavy fighting we've seen in Ukraine," and the rate of fire has "well outstripped any sort of planning assumptions that [the U.S. Department of Defense] thought it would need for its own battles," Josh Paul, a former U.S. State Department official who oversaw weapons exports, tells *Reason*.

The 155 mm artillery shell, a basic weapon of modern warfare, symbolizes this problem. The United States produced 28,000 shells in October 2023, a rate that comes out to 336,000 shells per year. In November 2023, different European officials gave different estimates of Europe's combined production capacity, between 400,000 and 700,000 shells per year. Both regions have been increasing their production.

Yet the war in Ukraine is burning through 155 mm shells faster than everyone is making them. The United States sent more than 2 million rounds in a year and a half. The stockpiles that the United States may need to fight its own future wars are running dry. It would take about five years to replenish American 155 mm stockpiles to pre-2022 levels, according to a report published by the nonprofit Center for Strategic and International Studies (CSIS) in

January 2023. Other weapons, such as Stinger anti-aircraft missiles and Javelin anti-tank rockets, would take even longer to restock.

That was before the latest war in Gaza, which has eaten up gargantuan amounts of ammunition. The Biden administration, which has released specific lists of weapons being sent to Ukraine, has remained tight-lipped about the specifics of its munitions support for Israel. A list leaked to *Bloomberg News* shows, though, that the United States sent 57,000 artillery shells and hundreds of guided missiles to Israel in the first month of the war.

These proxy wars should be a wake-up call. Americans have gotten used to fighting in indefinite conflicts, "forever wars," sustained by financial borrowing and bipartisan consensus. Now the conflicts in Ukraine and the Middle East are showing that all the money and political willpower in the world cannot overcome physical constraints. Even if the money doesn't run out, the bombs do.

"We are at a point with our munitions stockpile where everything regarding American foreign policy is an issue of 'can' and not 'should,'" says Dan Caldwell, an Iraq War veteran and public policy adviser for Defense Priorities who has been writing about munitions shortages for years. "This is not a reality that can be rapidly overcome by spending tens of billions of dollars on the defense industrial base."

### **Ukrainian Arms Shortages**

Ukraine has faced arms shortages since the Russian invasion in February 2022. Ukrainian President Volodymyr Zelenskyy warned reporters in November 2023 that "warehouses are empty" across Europe, and he mentioned the problem in his end-of-year speech the following month.

A few weeks later, Ukrainian Minister of Defense Rustem Umerov said during a video conference with foreign leaders the nation was facing a "very real and pressing" problem with ammunition. Around the same time, Ukrainian artillerymen gave a CNN news crew a tour of their dugout bunker near the front lines. The troops pointed to nearly empty shelves and claimed they were forced to fire smokescreen rounds in lieu of explosive shells.

Though the Ukrainians could have been playing up the shortages for dramatic effect, the numbers are harder to fudge. Ukraine went from firing 4,000 to 7,000 artillery shells per day in late 2023, according to European estimates cited by the Associated Press, to 2,000 rounds per day in January 2024, according to a letter from Umerov to his European counterparts.

Chet, an American volunteer fighting for the Ukrainian forces in Avdiivka, spoke about the issue on condition that his real name not be revealed. "Russia fires significantly more artillery, and this is felt on all areas of the front," he said a few weeks before Avdiivka's fall. Chet claimed that Russian forces were better able to launch attacks because of the artillery imbalance. Ukraine's shortages, Chet warns, "are continuing to get worse." After the fall of Avdiivka, he confirmed that ammunition shortages were a major reason for the Ukrainian retreat, as well as the Russian attackers' ample air support.

Officials have often framed the problem as a lack of political willpower for Ukraine's backers to spend money on the war. American funding for Ukraine ran dry at the end of 2023, and Congress spent months debating whether to send more. U.S. Assistant Secretary of Defense for International Security Affairs Celeste Wallander told reporters in January 2024 that Ukrainian "units do not have the stocks and stores of ammunition that they require" and the Pentagon wants Congress "to move forward on a decision to pass the supplemental" aid package. When Avdiivka fell, the White House again blamed "congressional inaction" for the ammunition shortages.

Most of the money in the supplemental aid package, however, "is going to go into munitions and arms contracts that will take years to fulfill," according to Caldwell.

Huge military budget numbers often feel divorced from reality. Especially with a Federal Reserve willing to constantly print more money, Americans have little frame of reference for understanding the difference between \$10 billion and \$20 billion, between \$500 billion and \$750 billion. But every dollar represents a demand on physical resources, some of which are more limited than others.

The military-industrial complex is not as competitive as it could be. While the government used to buy from smaller, more specialized firms, arms manufacturing in the United States is today dominated by larger conglomerates: Lockheed Martin, Northrop Grumman, RTX (formerly known as Raytheon), Boeing, and General Dynamics.

"These massive defense companies...make their money in great part from research and development, and from new systems. If you look at Lockheed that produces everything from artillery ammunition to F-35 [fighter jets], where are they making their money? It's on the F-35s," explains Paul, the former State Department official. "You used to have much smaller companies, and all they would make was artillery ammunition. It would have been much easier to ramp up production, because there would have been a much more direct incentive for companies to expand their production."

The most basic type of 155 mm round starts its life as a steel billet in Scranton, Pennsylvania. The billet is placed into a 2,000-degree furnace and shaped by robotic arms into a tube shape. The tube is cooled, heated again, and shaped into a bullet-shaped shell. It is then shipped to Ohio to be stuffed with explosives. Finally, on the front lines, artillerymen screw a fuse onto the nose of the shell and load it into the gun along with firing charges.

That process seems simple enough to scale up. To some extent, it has been. The U.S. Army doubled its production of 155 mm shells over the course of the war in Ukraine, from a rate of 14,000 shells per month in February 2022. Army officials are now aiming to produce 100,000 shells per month by October 2025. Ukraine itself has announced plans to build new ammunition factories on its soil with the help of American companies, although its minister of strategic industries, Oleksandr Kamyshin, said in December 2023 that the production lines would take years to start running.

## **Competition for Munitions**

Precision-guided munitions, anti-aircraft systems, and standoff munitions are a much trickier problem. ("Standoff munitions" are weapons that can be fired at a distance, including cruise missiles and glide bombs.) These weapons often require advanced electronic parts and highly skilled labor, including workers with security clearances.

"The greatest challenge facing the U.S. when it comes to the defense industrial production of more advanced munitions is that the skilled labor pool to produce these munitions is shrinking, and the contracting procedures to produce them are complicated," says Nicholas Heras, senior director for strategy at the New Lines Institute for Strategy and Policy, a Washington-based nonprofit.

Chet, the American volunteer in Ukraine, points to one consequence of running out of advanced munitions. Russia has been able to terrorize Ukrainian cities with cheap Iranian-made Shahed drones, forcing Ukraine to use up its modern, high-quality anti-aircraft ammunition. Older anti-aircraft missiles have sometimes malfunctioned and crashed. In November 2022, a Ukrainian missile accidentally killed two Polish farmers and caused a war scare in Poland. A year later, another errant air defense missile blew up a market in the Ukrainian city of Kupyansk, killing 17 civilians.

Chet claims that both types of incidents—Russian drone penetrations and Ukrainian air defense misfires—have happened more than the Ukrainian government is willing to admit. "Russia is still responsible for the core issue," he emphasizes. "Those defective [surface-to-air] missiles wouldn't have been launched if Russia didn't send stuff we need to shoot down."

Just as each type of weapon has different production needs, different conflicts have different needs, though many overlap. "The weapons Taiwan needs are not the exact same weapons Ukraine needs," says Paul. Taiwan is an island, so it needs more anti-ship weapons. Ukraine is trying to retake lands conquered by Russia, fighting limited naval skirmishes along the coast. Both countries do require Patriot missiles, used to shoot down enemy aircraft.

The competition between Ukraine and Israel for the limited supply of arms is much more direct, since both are fighting artillery-heavy ground wars. The United States stores large amounts of ammunition in the War Reserves Stockpiles-Israel, which, as the name suggests, is meant for use by the United States, Israel, or other allies. By early 2023, a large chunk of Ukraine's artillery ammunition came from the stockpile. But "for political reasons as much as defense-analytical ones, the U.S. has sent those [munitions] back to Israel," says Paul.

The October 2023 attacks on Israel by Hamas killed hundreds of Israelis, often in gruesome ways. Americans felt a sense of urgency to help a friendly country that they no longer felt for the Ukrainian war effort. U.S. President Joe Biden and the Republican opposition, who sharply disagreed on Ukraine, both threw their weight behind Israel.

The growing pro-Israel war fervor led Paul, who strongly supported U.S. aid to Ukraine, to publicly resign from his post. He told *The New Yorker* that limiting Israel's access to weapons might force Israeli leaders to be more "selective" in their attacks, but the attitude inside the U.S. government was, "Let's give them weapons, it doesn't matter."

Paul's worst fears seem to have been realized. In his words, Israel has unleashed an "insane" quantity of weapons onto Gaza.

Ukrainian forces fire about 240,000 artillery shells per month, across hundreds of miles of front line that includes cities and the countryside. In October and November 2023, the first two months of the war in Gaza, the Israeli army fired 100,000 shells, which comes out to 50,000 per month, into a city that is 25 miles long. Israel, unlike Ukraine, has total air superiority, so it has also been dropping huge numbers of U.S.-made bombs from fighter jets.

By the end of 2023, around 70 percent of the homes in Gaza had been destroyed, a rate comparable to the most battle-torn cities of World War II. Tens of thousands of Palestinians, 1 percent of Gaza's prewar population, have been killed. Israeli spokespeople argue that this level of destruction is Hamas's fault for embedding itself in Palestinian society.

"Israel has its own deep stockpiles that it's free to use as it pleases, but we've also been accelerating deliveries to them to allow them to continue firing at that pace," Paul says.

### **Unprepared for Future Wars**

Meanwhile, the war has expanded across the Middle East, as Iran and its Arab allies demand an end to the siege on Gaza. The Houthi movement, one of two rival governments in Yemen, began threatening Israeli shipping in the Red Sea and attacking ships of multiple nations. The United States and several of its allies sent a naval fleet to Yemen to protect ships passing through the region. The Houthis continued to defy American demands and attack foreign shipping, including non-Israeli ships. On January 12, the U.S. Navy and its partners attacked weapons caches and airports across Yemen. The bulk of the firepower came from American ships, which launched at least 80 Tomahawk missiles.

The U.S. Navy had blown through a year's supply of its missiles in just one night. American factories produce a few dozen Tomahawk missiles per year; the Navy had ordered 70 of them in FY 2022, and only 50 in FY 2023. (The U.S. military is believed to already have several thousand Tomahawk missiles in storage.) Biden signaled his willingness to drag out the conflict for a long time with no concrete endpoint. "Are [the airstrikes] stopping the Houthis? No," he told reporters on January 18. "Are they going to continue? Yes." The airstrikes have indeed continued since then, with the Navy launching another tranche of Tomahawk missiles at Yemen on February 4.

"The more advanced standoff munitions are necessary in theaters where naval warfare is decisive, which is why a protracted and potentially metastasizing conflict in the Red Sea threatens U.S. preparedness to respond in the Indo-Pacific," says Heras of the New Lines Institute.

Mike Black, a former U.S. Air Force maintenance officer known for his acerbic commentary, was more blunt about the profligacy of the anti-Houthi assaults on social media: "It'll take them until 2026 to replenish what was shot here. Hope blowing up some cobbled together radio shack drones and commercial radar sets was worth it." He added later in the thread that "the amount of stuff we would burn through in a dust up with Iran would take years to replace."

The military is not a retailer; it does not benefit from getting rid of its inventory quickly. A war with China would require far more firepower than a limited campaign against "radio shack drones and commercial radar sets" does, which raises questions about whether the current ammunition stockpile can meaningfully deter that nation from adventurism against Taiwan. When CSIS conducted a series of war games simulating a war over Taiwan, it concluded that the United States would have to launch "about 5,000 long-range precision missiles" within three or four weeks of combat.

The U.S. would use different types of missiles for striking different types of targets, including enemy ships and airfields, but bottlenecks can affect all of them at once. "A critical part of this is not just the finished weapon that's relevant. It's also the sub-components, for instance, turbofans for missiles," said Elbridge Colby, author of the Trump administration's National Defense Strategy, in a December 2023 interview with C-SPAN. A shortage of one type of turbofan engine could hold up the production of several different missile types.

The U.S. Navy is not the only relevant actor. Japan and South Korea would be key U.S. allies in any Pacific confrontation. Both countries have indirectly sent some of their own munitions to support the war in Ukraine. Although South Korean law bans supplying weapons to conflict zones, South Korea agreed in 2023 to "loan" the United States half a million 155 mm shells. Japan has similarly agreed to send Patriot missiles to the United States, in order to replenish U.S. stocks sent to Ukraine.

The Taiwanese military itself, of course, would be Taiwan's first line of defense. But there is a \$19.17 billion backlog in American weapons that Taiwan has ordered and not yet received, according to a 2023 study by the Cato Institute. Perhaps because the possibility of a conflict seems so remote, Taiwan has had to wait longer than other U.S. customers for weapons deliveries, the authors found.

Competition for arms is piling up among U.S. allies. The wars in Ukraine and the Middle East have created what Paul calls a "bow wave" of demand, as nations near the conflict zones (like Poland) begin building up their own militaries. There is competition not only among the nations at war for American weapons, but also among the nations preparing for war.

### **Problems Money Can't Fix**

Just as Paul would rather the U.S. aid Ukraine than Israel, Colby has been calling for the United States to ditch some of its commitments to focus on countering China. He also differs from Paul in believing that Israel is a more worthy recipient of American weapons than Ukraine is.

But even if they would set their priorities differently, the two former officials are making the same underlying point: The United States has made heavier military commitments than its factories can bear.

There is a "fundamental discordance between where we are and where we would like to be," Colby said during a debate hosted by the conservative Hoover Institution last year. "And the thing is, you can't solve that with defense spending."

That is not the impression that American leaders have given. Biden, in an October 2023 interview with *60 Minutes*, brushed off a question about whether the U.S. can support Ukraine and Israel at the same time. "We're the United States of America for God's sake, the most powerful nation not in the world, in the history of the world," the president said.

Caldwell, the public policy adviser, says politicians are "lying to us about these constraints" and pretending that "the only thing holding back American foreign policy is a lack of willpower." He calls it "mathematically impossible" for the U.S. to continue supplying different war efforts at the rate it has been, even without new wars on the horizon.

"We have no choice but to deprioritize certain conflicts and avoid getting into new conflicts unless we want a serious military disaster," Caldwell concludes. "Stop pretending we don't have constraints, because you are doing a disservice to the American people, and you are risking our safety and our prosperity."