

**The performance of the B-2 exceeded the expectations  
of even its most ardent fan.**



# With Stealth in the Balkans

By John A. Tirpak, Senior Editor

**I**N its first combat test, the B-2 bomber defeated not only the Serbian air defense system but also the critics who for years had insisted it would not work as advertised or would never be risked in real war.

The recent Balkan operation demonstrated that the Air Force can, indeed, wage campaign warfare with bombers from a home base in the continental US, that large-scale stealth technology works under actual combat conditions, and that now the only limitation on the number of separate targets a bomber can destroy on one mission is the number of weapons it can carry in its bomb bay.

The B-2s of the 509th Bomb Wing at Whiteman AFB, Mo., flew less than 1 percent of the total sorties flown by NATO aircraft in Operation Allied Force, but they accounted for 11 percent of the bomb load dropped in that conflict.

Flying 30-hour-long, nonstop missions from Whiteman to Yugoslavia and back, USAF B-2s attacked heavily defended targets in all weather conditions and all returned without a scratch. The stealth aircraft maintained a



**Despite years of criticism that its stealth and avionics systems were too temperamental for real combat, the B-2 proved in Operation Allied Force that it could fly halfway around the world, dish out stunning damage, and come back without a scratch.**

high readiness rate, given the small number of airplanes available. Of the total 53 air tasking orders in the conflict, B-2s were part of 34, but only one mission was scrubbed because of mechanical problems.

The B-2s of Allied Force put 90 percent of their bombs well within the prescribed 40 feet of their targets. Most of the B-2's bombs hit the bull's-eye, and the rest fell only a short distance beyond. The bomber dropped more than 650 Joint Direct Attack Munitions, chiefly of the 2,000-pound variety. It also dropped four heavyweight, 5,000-pound "bunker busters."

### Exceeding Expectations

"The performance of the plane and the Joint Direct Attack Munition, both separately and in synergy with each other, far exceeded everyone's expectations," 509th Commander Brig. Gen. Leroy Barnidge Jr. said in reporting the statistics to an Air Force Association briefing held in Washington, D.C.

Technically, the B-2 remains a new asset, having only recently achieved operational capability with the Block 30 model. Barnidge observed that, even after one week of operations over the Balkans, "we were still developing confidence" that the B-2 would perform as planned. As the campaign went on, however, it became clear that the B-2 was living up to its promise. Barnidge told *Air*

*Force* Magazine that he soon became fully confident that the B-2 could be counted on to deliver ordnance with startling accuracy even through bad weather.

Lt. Gen. Michael C. Short, the commander of NATO's air component for Allied Force, said he quickly came to expect "16 quality DMPs [Designated Mean Points of Impact]" from each B-2 mission and that it was the main success story of the operation.

The stealth bombers were used against Serbia's integrated air defense system, command and control sites, runways and airfields, communications facilities, factories, bridges, and other elements of infrastructure. The first airplanes launched in Allied Force were B-2s, lifting off from Whiteman 14 hours ahead of the aircraft in-theater.

The B-2s operated exclusively at night, sometimes in a two-ship mission, but often alone. While they did not, as Barnidge put it, fly "arm in arm" with other NATO assets as part of a strike package, the B-2s stuck to carefully scripted timing for their arrival in and departure from the target area, sometimes serving as the opening round of a multipronged assault.

For example, B-2s sometimes were used to precisely crater intersections of runways and taxiways on an airfield. Boxed in on those fields and prevented from escaping, Serb warplanes were later destroyed by

nonstealthy B-52 or B-1B bombers dropping large numbers of unguided iron bombs. A single B-2 destroyed two airfields on the same mission. For Barnidge, the operation showed that the B-2 can "be folded in, in a seamless fashion, with other assets in-theater."

Barnidge readily admitted that B-2s took advantage of jammers that were operating in the theater but said that this tactic was driven more by a desire to provide extra protection for crews than by a critical operational need. "You want to give your crews as much help as you can," he explained.

Barnidge said that he frequently receives questions about whether stealth aircraft need electronic countermeasures support. "The answer is no," he asserted. It was "beneficial and useful [to have EA-6B Prowlers and other jammers in the area, but] we operated in an autonomous fashion," said Barnidge. As the Balkan campaign wore on, mission planners became increasingly confident about sending B-2s against targets without any support.

### First to the Fight?

Barnidge maintained that Allied Force proved the B-2 is a ready asset that could easily become the first weapon called on in a crisis. At some point, he said, the US might have to prepare for battle in a foreign area without the benefit of on-hand, forward-based forces. This situation could result from a number of factors—strategic surprise, space constraints, and political constraints, to name but three. In such a situation, Barnidge pointed out, the United States would still have a powerful military option.

"We have validated that we can reach out from the continental US and begin to prosecute the air campaign while other assets are flowing into the theater," Barnidge said. "That's a pretty big deal. I think people have fundamentally changed—broadened—their perspective of the capability of American airpower. And certainly the B-2 is an American asset, instead of just an Air Force asset."

The B-2 has taken considerable heat because of the labor intensity of maintaining its stealth surfaces, but Barnidge said the low-observables required "minor extra effort [during the campaign], compared to what we expected."

He said the B-2's fastest turn time—the interval between landing and being ready to launch on another mission—was about four hours. The longest was four days. The longer intervals were chiefly caused by the need for curing time, meaning that low-observable paint and tape required time to set and harden. The overall average, he reported, was about one day per mission flown.

The Balkan conflict also yielded positive news on another important front—pilot endurance. At the start of the action, even B-2 pilots had concerns about being able to continue the long Missouri–Yugoslavia round-trips beyond a couple of weeks. The end of the 78-day conflict, however, found them convinced that they could have kept up the bombing campaign as long as necessary.

"We're pretty confident now," Barnidge said.

Exactly 51 pilots flew the B-2 in combat. Most of them flew one mission; a handful flew two, and one pilot flew three times. Barnidge said he insisted that pilots get at least three days of rest between missions, but he was impressed that, as they landed, they seemed alert and ready to get back in the rotation for another mission. He said he would only begin to worry about pilot fatigue on missions lasting more than 40 hours.

The B-2 mission capable rate

during Allied Force, not counting low-observable maintenance, averaged about 75 percent. When such maintenance is included, the figure was about 60 percent. However, not a single B-2 mission started late, and only one airplane had to abort its mission for an in-flight mechanical problem. Once it landed, a repair was made, and it was ready to go again in 15 minutes, Barnidge reported. Two other missions were canceled after takeoff because NATO partners withdrew permission to attack the intended targets.

During Allied Force, the 509th had nine operational B-2 bombers on the ramp at Whiteman. USAF assigned eight B-2s to combat missions—six were available at any given time. The bombers not in action were used to continue training of new B-2 pilots, conduct aircraft tests, or carry out mandatory inspections.

#### "Piece of Cake"

The pace was easily manageable, Col. Donald P. Higgins, Barnidge's deputy, observed. "It ended up being a piece of cake," Higgins said. "And the evidence for that is we launched all of our sorties on time. [In] this particular conflict," Higgins continued, "we had the assets to be perfectly prepared for every mission." Sufficiency of airplanes, pilots, and maintainers enabled the 509th to generate all the missions required.

"Had the requirement for sorties

been in excess of what it was, perhaps we wouldn't" have achieved the performance attained, he said.

The B-2 did not deploy to a forward base, partly because planners did not require the force to generate large numbers of sorties. "Six airplanes ... was plenty to fill the tasking [given by the Supreme Allied Commander Europe, Army Gen. Wesley K. Clark]," Higgins reported. Had the SACEUR requested substantially more sorties from the 509th, Higgins said, forward basing would have become a higher profile issue. The decision not to deploy the B-2s forward—along with their spare parts, equipment, personnel, and other gear—spared the US airlift fleet another big mission and permitted the US to assign its lift to other needs.

However, Higgins said, the Air Force was prepared to use forward basing—and in a novel way. The option given most serious consideration was called "employ on the deploy." A stealth bomber could take off from Whiteman, fly directly to a combat area, bomb its targets, and then recover at a forward base. At that base, the B-2 could rearm, take off for a new combat zone, attack more targets, and then return to Whiteman. This type of employment would have permitted more sorties but still kept the B-2 support train mostly back at Whiteman.

Barnidge said the B-2's wartime operating pace was not routine, but neither was it crisis management. The B-2 proved to be far more hardy than even its most ardent fans expected, he said. "You put gas in it, and it kept on running."

The commander remarked, "[As Operation Allied Force went on] we were willing to sign up to increased sortie numbers, should the requirement exist, ... because we had learned how robust the airplane was and indeed how good we could be." At no time was the bomber unit asked to do anything it could not do, he said.

#### Salesmanship

The process of getting the B-2 into Allied Force began months ahead of the start of the war. A B-2 pilot was assigned to Short's staff to familiarize on-scene planners with the bomber's capabilities and to perform what the pilot called "some salesmanship" on behalf of

USAF photo by SRA Jessica Kochman



The other part of the B-2 success story was the Joint Direct Attack Munition, a 2,000-pound version of which is shown here being loaded in the B-2's bomb bay. Global Positioning System coordinates guide the JDAM to the target in any weather.

the system. (For security purposes and at the request of the Air Force, names of all B-2 pilots and their call signs have been withheld.) This pilot then served throughout the war as a liaison between the Combined Air Operations Center at Vicenza, Italy, and operators at Whiteman.

When it became apparent that NATO might have to use force against Serbia, the 509th began practicing for what would probably be its first combat missions. Fixed targets in the region had already been cataloged; these were programmed into the B-2's weapon system trainers, or simulators. The initial strikes were rehearsed many times on the simulator before they were flown. In fact, the B-2 sorties resembled space missions in their duration, requirement for physiological preparation, constant simulations, and incessant verification of checklists.

Mission planning was done over several days. Barnidge explained that, about four days in advance of the launch, pilots received Global Positioning System coordinates of a target, along with imagery of the target area, particularly any radar-significant structures. All these would be checked against synthetic aperture radar imagery just before weapons release.

"Then," said Barnidge, "it was up to us to build the flight plan," which included refuelings, how to fly through all the defenses to the target area, and the set up to drop the bombs and put the target out of commission.

During these few days before the start of a mission, the pilots familiarized themselves with prevailing conditions in the Balkans—tanking procedures, jamming operations, weather conditions, and the combat situation. "We would get 'up' on what's happening," one pilot said. Then the pilots started shifting to a night cycle of waking and sleeping, because takeoffs would be at night and bombs would be released at night. Getting into phase for the mission might include extra sleep or getting away from possible distractions by staying in visiting officer quarters.

Every B-2 pilot has had extensive training for long-endurance missions and has developed a unique physiology profile of diet, sleep, and other factors. Each does whatever works

best for him as an individual, said one pilot, such that he can remain fully alert at the most important times of a mission.

Every aspect of a mission's combat phase was practiced several times. The B-2s actually spent only an hour or two in hostile airspace, so it was possible to simulate the attack a number of times. Even when the specific mission could not be exactly simulated, pilots flew one that had already been flown, using the data actually collected on that run. "It helped us get the sense of timing and a feel for threat location," said one pilot.

On the night prior to their mission, aircrew members would serve as a "spare" for that night's primary strikers. Usually, the spare was not needed.

Finally, on the day of the mission, the 509th carried out the preflight inspection and final mission planning for the B-2s going into action. These tasks were conducted by others on behalf of the pilots, who were in crew rest and not to be disturbed until just before the flight. Then, the assigned crews got into their airplanes, taxied, and took off.

Even if they were headed for targets in entirely different parts of Yugoslavia, the B-2s taking off on the same night usually flew together from Whiteman across the Atlantic, their goal being to provide mutual support on the long overwater trip. They refueled twice en route—once

over the Atlantic and again just before entering the battlespace.

### Practice Makes Perfect

During the flight, crew members reviewed their checklists, studied imagery of the target, got weather updates, and monitored the health of the aircraft, endeavoring to make sure everything was perfect on the first pass. They also slept in shifts.

"There is some amount of sleep an individual needs in the form of a 'power nap,'" Higgins said. "If he gets less than that or more than that, he ends up groggy, but if he gets just the right amount, he's good to go."

The power naps were actually factored into the mission planning. A crew member took his snooze on a beach lounge purchased at the local variety store. The lounge just happened to fit perfectly in the space behind the mission commander's station.

Other techniques for freshening up included changing clothes, eating warm meals, or wet-toweling.

Upon entering the battlespace, crew members went through a ritual of getting ready for combat—putting on long johns, winter-weight flight jackets, a survival vest, and other gear not necessary during other portions of the mission. They "power[ed] up the weapons [and made sure] the computer was talking to the bombs," said one.



USAF photo by TSgt. Lance Cheung

**All B-2 strikes feature elaborate planning—including a dress rehearsal in the simulator—to help crews avoid enemy guns and missiles. Planning is done in a secure facility housing a comprehensive database on world air defenses.**



On approach to the designated target area, the B-2 generated a synthetic aperture radar picture almost photographic in its detail and quality, one pilot said. This was checked against intelligence photos, and the target was identified. Next, the GPS coordinates were verified via the B-2's unique GPS-Aided Targeting System, or GATS. The GATS permits the B-2 mission commander to choose aim points on the target, even if it is obscured by clouds. Barnidge referred to this procedure as "taking out the location error in the coordinates."

The coordinates were updated, if necessary, then fed into the JDAM weapon via an electronic umbilical cord. At the appropriate moment, once for each bomb, the bomb bay doors opened, a JDAM dropped clear of the aircraft, and then steered to the target.

### Never Detected

Each B-2 could—and, in some cases, did—attack 16 targets in 16 different locations per mission. Pilots reported they were apparently never detected. One said he was amused, moments after touching down at Whiteman, to see a Serb leader on television, standing in a crater and complaining about NATO's use of cruise missiles. "It wasn't a cruise missile," he said. "It was us. That showed they never knew we were there."

"[The JDAMs proved] outstandingly reliable and accurate," remarked one lead pilot. Barnidge offered a statistic of well above 95 percent



*At top, a B-2 takes on fuel from a KC-135 during an Operation Allied Force mission. Above, a Block 20 B-2 uses the GPS-Aided Targeting System to guide a munition during testing. In Allied Force, the combination of the Block 30 B-2's GATS with the JDAM produced outstanding accuracy.*

reliability of the JDAM, adding that "there were no stupid munitions [dropped by the B-2]."

Rep. Duncan Hunter (R-Calif.), a member of the House Armed Services Committee who had been briefed on the B-2's first combat sorties, confirmed the outstanding war record of the JDAM. "This simple weapon," said Hunter, "cost only \$15,000 a copy to buy, but, combined with the radar and accuracy of the B-2, it performed flawlessly and demolished almost every target it was assigned to destroy."

"Like all the aircraft in the operation, we coordinated with the other aircraft in the vicinity," one pilot

observed, meaning that the B-2 and other NATO airplanes were deconflicted through the mission planning process and the air tasking order. However, Barnidge insisted that no jammers were specifically sent to protect the B-2s. Rather, the bombers took advantage of assets in the theater. "I never sent an airplane in that I wasn't confident could handle all the threats it would encounter," Barnidge asserted.

A B-2 pilot said that he was glad to have the extra protection but that he was also confident he would have been successful without it. "It's a basic principle of war," he said. "Apply mass if you have it."

As to whether any B-2s had close calls, Barnidge said, "We didn't have

any that scared our pilots to death." He acknowledged that a few things of interest took place, but "the airplane took care of its pilots." He did not elaborate.

Once out of the theater, the B-2s took two more refuelings en route to home. On the ground, they got back in the rotation to fly another mission.

The most experienced B-2 pilots flew the first B-2 sorties. As missions continued, pilots were selected in order, until nearly all pilots qualified to fly the airplane in combat actually did so.

The 509th worked up many plans for stepping up the pace of operations, or for even more rigorous missions,

but these “never materialized only because [the SACEUR] chose not to exercise them,” Barnidge reported.

“We had a lot of capability available here at Whiteman, should it have been needed, especially toward the latter part of the war,” he added.

### Great Airplane, But ...

Despite the B-2's success in the Balkans, the Air Force has no plans to alter its mix of aircraft to include more bombers or to accelerate moves toward a new stealthy bomber. “[The operation] validated our vision for long-range bombers,” USAF said in response to an *Air Force Magazine* query, and the service will continue with its plan to modernize and sustain the force as laid out in its Bomber Roadmap, released early this year. [See “The Bomber Roadmap,” June, p. 30.]

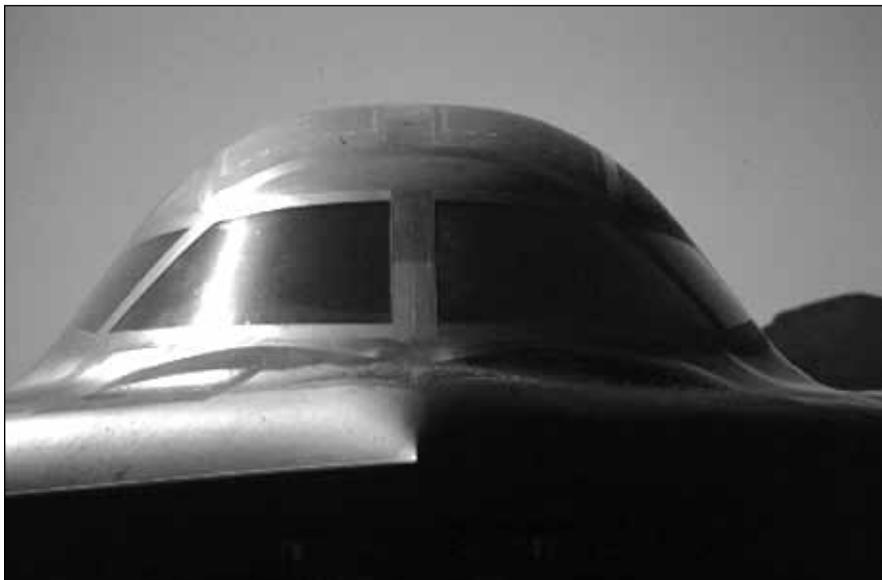
However, it will make adjustments to its schedule for buying new munitions—necessary to replenish depleted stockpiles—and will shift its design emphasis for new ones now on the drawing board.

“The top priority in the near term is accelerating the production rate of JDAM,” the Air Force said. “USAF is seeking funding to increase production ... from 500 per month to 700 per month.” That will bring 10,500 JDAM kits into the inventory by Fiscal 2002 and move up the full planned buy to 2005. The service is also looking at speeding up purchases of the Joint Standoff Weapon and the Joint Air-to-Surface Standoff Missile—a stealthy glide bomb and long-range missile, respectively.

The Air Force reports that the next generation of precision guided munitions will emphasize “longer range to minimize crew risk; miniaturization to enable more kills per sortie; and increased accuracy to ensure destruction with a smaller weapon and to minimize the chances for collateral damage.”

The B-2 force maintained its role as a nuclear bomber throughout the Balkan conflict and now is preparing for a nuclear surety inspection in November, Higgins reported. “[The Single Integrated Operation Plan is] something we take very seriously,” he said, and despite the B-2's conventional success, the nuclear role carries at least equal weight.

Asked to sum up lessons learned



Staff photo by Guy Aceto

***The precision achieved by the B-2 and the JDAM in Operation Allied Force is a taste of things to come. Increased accuracy will allow future bombs to be smaller, increasing the load a B-2 can carry and expanding the list of targets it can destroy on a single mission.***

from the B-2's first combat experience, Higgins said, “We don't think it's particularly a challenge to fly from Whiteman anywhere in the world anymore. [In Allied Force,] it just so happened we could do it all from here.”

However, getting money for pre-positioned spares and JDAM kits and deployable aircraft shelters is still a priority, should a more aggressive sortie rate be required in a future conflict, he said.

Higgins also said the Balkan air operation had “opened our eyes” to new possibilities for the B-2. A stealth bomber standing conventional alert might be a valuable capability to have, he said, if a crisis erupts somewhere in the world and “you don't have a carrier within a couple of weeks' steaming time.” In the absence of overflight rights or forward-basing privileges in the region, “you have to rely on something like the B-2 [to provide the wherewithal for a quick attack],” he added.

For that, the Air Force would like to give the B-2 crews a more sophisticated capability to do mission planning in real time, en route to the target. Such capabilities are being developed and will add a powerful punch to the system, he said.

“Stealth [equipment] is not invisible,” Higgins pointed out. “Stealth is low observable. ... We have tremendous dependence on mission planning. We have to know where the

threats are; we have to compare those threats with our stealth capabilities and what our vulnerabilities are. [The Link 16, a secure digital data-sharing system planned for the B-2 and many other combat airplanes,] will help us do that.” Though “flex” targeting—changing targets en route—was done in Allied Force, none of the 509th personnel were willing to discuss the particulars.

Higgins said an obvious lesson learned from Allied Force is to pursue smaller weapons with more precision. Greater precision in a smaller bomb will allow each bomber on a single mission to hit more targets—possibly as many as 84—with no sacrifice in per-target effectiveness. Most of the explosive effect of a 2,000-pound JDAM is needed to ensure a kill in the event that the bomb falls some distance from the bull's-eye.

“Accuracy means you can use a much smaller warhead and still assure destruction of the target,” he said.

The 509th will receive its 20th B-2 a year from now, and the 21st airplane—dedicated to test and assigned to Edwards AFB, Calif.—will be available in September 2002.

“A lot of people were really pleased that we finally got a chance to show what this weapon system can really do,” Higgins said of the B-2's combat debut. “I think the American people have some measure of satisfaction that they got their money's worth.” ■