



The B-2A Spirit of Kansas of the 393d Bomb Squadron slips through the skies over Whiteman AFB and Knob Noster, Mo.

An aerial photograph showing the wing of a B-2 Spirit bomber in the upper half of the frame. The wing is dark and has white markings, including a large '7' on the underside. Below the wing, the landscape is a patchwork of green fields, roads, and some buildings. In the bottom left corner, an airport runway and taxiway are visible.

Operational progress for the new bat-winged bomber is running ahead of schedule at Whiteman AFB, Mo.

With the First B-2 Squadron

By John A. Tirpak, Senior Editor



Despite its experimental look, the B-2 is well on its way to operational status, accumulating up to thirty sorties per week. The bomber's flyers and maintainers are impressed by its reliability and maneuverability.

THREE or four times a day, the sleek, sinister-looking B-2s roar out of their hangars, glide along a taxiway to the airstrip, push forward, and then seemingly levitate into the Missouri sky. They hook up with tankers, practice aerial refueling, cross a few states, carry out a practice bomb run, do some low-level hill dodging, and return.

It's almost routine, but no one expected it to be that way—not at this point.

The hundreds of Air Force people who fly, maintain, and support the B-2s at Whiteman AFB, Mo., are "writing the book" on the new bomber, and it is now clear that they have raced a few chapters ahead of schedule. They are quickly filling in the gaps of knowledge about the true capabilities of this aircraft, a huge wing with windows and wheels, crammed with dozens of new technologies.

"We're taking some pretty big steps right now," reported Brig. Gen. (Maj. Gen. selectee) Ronald C. Marcotte, commander of the 509th Bomb Wing and the man who has shepherded the B-2 program at Whiteman since before the first stealth bomber arrived in December 1993. The "steps" mark the location of the B-2 on a continuum of crawl, walk, run—a strategy the people of the 509th scrupulously follow.

When General Marcotte was organizing the unit for the B-2's arrival,

he asked those experienced with bringing new airplanes on-line what he could expect.

The experts, noting that the B-2 is still considered to be in development, cautioned him not to try to do too much too fast, the General said. Though the B-2 had been wrung out in flight test, its novel technologies might still provide some unpleasant surprises in initial service. Extreme caution was called for.

National Treasure

"You don't have to think very hard to realize this is a lot of national treasure we're talking about," General Marcotte said. The unit flyaway cost of each bomber is a breath-catching \$600 million, and in addition "there are all the people and the facilities put into it."

Air Force officials knew that critics of the B-2 would be watching keenly for any error that would suggest the new bomber was unreliable, a technological failure, or unsafe. The months before the B-2 arrived were spent trying to figure out how to bring it to operational status "in a fashion that you don't make mistakes that could, basically, end it all," General Marcotte said.

The General was told that the B-2s would likely fly "maybe once or twice a quarter" in the initial phase of deployment, given USAF's experience with other large, complex flying machines and considering the many

unproven technologies rolled up in the new bomber. He likened the first operational sortie, carried out less than a week after the first B-2 arrived at Whiteman, to "a shuttle launch . . . with cameras rolling and hundreds of personnel" attending to every detail.

Now, the launch of an airplane takes place "with one supervisor out there," and the sorties amass at up to thirty a week. Two years ago, such a rate would have been wishful thinking, but the B-2 is "exceeding any expectations," said General Marcotte. He added, "I expected more 'unknown unknowns,' " and he was prepared for "one step forward, one step back, . . . but we haven't had that."

The B-2 went to its first Red Flag exercise last summer, "a year ahead of schedule," General Marcotte noted. It made an appearance at the Paris Air Show last June and at the Singapore Air Show in February by way of Guam. A second, more challenging Red Flag role was planned for early this year. In early summer, the 509th will receive a new, improved model of the B-2—the first Block 20 airplane.

General Marcotte said that the Air Force is "on track" in its plans for the B-2 squadron to become an operational unit of US Strategic Command in March 1997. In that month, it will take its place alongside the B-52 in the bomber leg of the strategic nuclear triad, the General said.

"We're doing very well," he asserted. "We're pushing forward in a safe and productive fashion."

General Marcotte said he has hammered on the message of caution to his people because most of them have "succeeded their entire career by . . . being aggressive." Now, the same individuals must blend this attribute with caution.

To be part of the initial cadre assigned to the B-2, pilots went through a rigorous selection process. An individual's record had to be spotless, without the slightest safety infraction. Each candidate needed the recommendation of his wing commander, other endorsements, and thousands of hours of flight time. Many of the first pilots have combat experience, and all have demonstrated an ability to learn and progress quickly. Maturity was an important factor, and they had to pass muster in personal interviews not only with

General Marcotte but also with Gen. John Michael Loh, former commander of Air Combat Command.

Mature Pilot Force

"We have a very mature pilot force," said Col. Gregory H. Power, 509th Operations Group commander. "My youngest pilot is a midlevel captain," he noted. The pilots' experience comes mostly from flying in bomber units, but there are veterans of various fighter aircraft as well. B-2 pilot training, once administered by flight-test and contractor pilots, now is carried out by USAF instructor pilots at Whiteman.

"The training program is about six months [long], which is typical of bombers," reported Col. James F. Whitney, Jr., chief of the 509th Formal Training Unit.

Besides flying the airplane and



Photos by John A. Tirpak

Each bomber has its own "dock," a purpose-built hangar with floor umbilicals that mate perfectly with the airplane. The glossy floors are spotless because the B-2's tight tolerances make fuel leaks and hydraulic leaks a thing of the past.



The B-2's smooth contours play a large role in its stealthiness, and its wide expanses of exotic surfacing must be carefully protected. Note the special footwear on SSgt. David Maxwell as he inspects two of the F118 engines.

establishing the rules by which it flies—covering everything from take-off weather minimums to weapons release procedures—pilots are also heavily involved in developing tactics for the airplane, exploring what it can do operationally in order to derive the maximum effect from its unprecedented range, payload, and stealth.

"It's a free-for-all," said Capt. John S. Paganoni, a B-2 pilot. "With all this combined expertise from all over, there's no predisposed thought and

no inertia" requiring that things be done in a traditional way. "We have a lot of guys here who were in the war" in the Persian Gulf in 1991, and their combat experience is proving highly valuable in developing "the best way to employ the airplane," he said.

Captain Paganoni added that the B-2 pilots are considered the experts on their still-new airplane and are invited to think tanks and conferences where tactics and strategy for the entire Air Force are developed. "We have a direct impact," he said.

There is a mix of ranks in the B-2 pilot cadre, and it is intentional, the result of a lesson learned in the B-1 program. The pilots bringing that system into service all had about the same experience level and about the same number of years of service. It was a situation that led to staffing bottlenecks and difficulty turning officers loose for professional military education.

Every B-2 pilot can count on flying about one sortie per week. Each flight is preceded by a day of mission planning and a full dress rehearsal in the Weapon System Trainer. This full-motion simulator is "ninety-five to ninety-eight percent like the real aircraft," said Col. Jonathan George, commander of the 393d Bomb Squadron. "It really is outstanding fidelity."

Colonel George asserted that the simulator gives a "very accurate" feel for the way the B-2 handles. Another instructor, Maj. Steven M. Tippetts, said its state-of-the-art graphics system accurately depicts the countryside surrounding Whiteman for "almost 200 miles in every direction, just about down to every tree."

Because the 509th has a small number of operational aircraft, the wing "relies more heavily on simulators than other flying units," said Colonel Whitney. However, he does not believe that the 509th will use more and more simulator time as a substitute for real flying time.



up for the B-2 generally goes like this: The Air Force would send the B-2 as a single ship against a "high-value target set" well within an enemy's air defense net. The bomber would be equipped and flown in a way that would permit it to hit multiple aimpoints in a single pass with great accuracy.

Soon the B-2 will have capability for employing a near-precision weapon guided by signals from the Global Positioning System satellite constellation, the GPS-Aided Targeting System/GPS-Aided Munition (GATS/GAM). Later, it will have the Joint Direct Attack Munition. Both weapons will be able to hit a target through bad weather, relying on cues from GPS satellites and aimpoints desig-

Lots of Stress

"To make a good pilot," said Colonel Whitney, "you have to handle inordinate amounts of stress. A pilot knows he's not going to get hurt in a simulator."

Mission planning entails plotting radar threats the B-2 would face on a given run and determining how best to avoid or defeat them with the B-2's stealth capabilities. It's a process that can take "one day, plus" to complete, said B-2 pilot Capt. Scott Hughes.

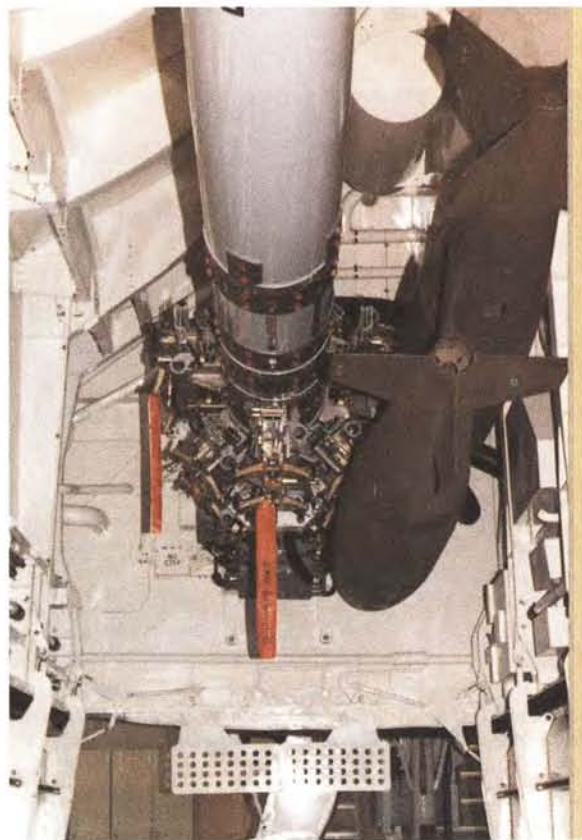
B-2 crews fly to bomb ranges in Utah, Wisconsin, and Kansas in order to perform practice runs within the US; they go to other sites when required to do so by the particular exercise or the specific mission to be rehearsed. About one in every five sorties entails the release of a live bomb, inert bomb, or smoke bomb. During the flight, a weapon release can be fully simulated, with nothing actually being dropped.

All flights involve practice in aerial refueling. The B-2 has a considerable bow wave that can make tanker rendezvous "kind of tricky," Major Tippetts said.

Low-level flying is usually part of a four-hour training sortie. Though the B-2 is designed to be stealthy at medium and high altitudes, and may not need to make ground-hugging flights, the pilots practice the skill because under some circumstances it might be required.

"There are some advantages to going low," Captain Hughes said, "and, if you don't train to do it, you lose the ability to do it."

Above, Whiteman weapons loaders practice their trade on a specially built replica of the B-2's undersurface, bomb bays, and cockpit. This trainer makes it unnecessary to occupy an actual aircraft for loading practice. At right is the huge bomb bay containing two of the up to sixteen Mk. 84 2,000-pound bombs that the B-2 can carry.



Photos by John A. Tirpak

General Marcotte noted that the B-2's flight profiles will be "totally target-dependent" and crews "have to be able to do it all."

To get the most out of what is an exhaustive preflight inspection, two training sorties are flown back-to-back to save time. When one crew lands, the engines are kept turning while a second crew climbs aboard.

The operational concept forming

nated by the mission commander on the photographic-quality synthetic aperture radar. Unlike precision weapons of the Gulf War, it will not be necessary for the mission commander to manually hold an aimpoint for the bomb.

Triple Threat

One B-2 pilot, Maj. Gregory A. Biscone, asserted that the B-2 en-

joys "all the advantages of an F-15E in terms of precision, with all the advantages of the B-52 in load, coupled with the advantages of the F-117 in stealth."

The B-2 can land at "twice as many fields" as the B-1 can, General Marcotte said, meaning the aircraft can be deployed just about anywhere, worldwide. Deployment kits are being developed now, and within a year the Air Force should have enough to permit three to eight aircraft to fly a mission to an expeditionary airfield.

In a major regional conflict, the B-2s may well fly and fight directly from Whiteman, requiring missions lasting more than twenty-four hours. The airplane's part in last year's Red Flag exercise was "planned and run all from Whiteman," said Colonel Power.

The pilots are unconcerned about sustaining such a seemingly exhausting flying schedule. Unlike the B-52, which can carry additional crew, the B-2 can carry only two pilots. The B-2 bomber is highly automated, and the pilots believe it is safe for one of the crew members to take a nap while the other flies the airplane.

"For the initial round [of combat], adrenaline alone will keep you going," Major Biscione said, and for continuing missions, "we may do go/no-go pills" relied on by some combat crews during the Gulf War.

However, he added, "crew ratio is the only thing that will sustain long sortie durations." So far, USAF has no plan to put a third crew member on the B-2, although there is room and an escape hatch exists for a third ejection seat. General Marcotte said that "for training purposes only, it would be nice to have a third seat in the B-2," but he would not put this near the top of a wish list for improvements to the airplane.

The General said he is pleased that, with videoconferencing, he has the ability to get the System Program Office, the test center, the contractor, and the operations room all talking to each other at a moment's notice, such as for an in-flight emergency.

Captain Paganoni noted that the B-2 does offer two amenities helpful in reducing crew fatigue on a long mission—the means to prepare a hot meal and a flush toilet.

Staying Sharp

To supplement their B-2 time, the



Photo by Randy Jolly

B-2 pilots routinely take a break from the highly automated bomber to get refreshers in the fast-moving T-38 Talon. The twin-jet trainer requires quick thinking and vigorous cross-check, helping stealth pilots maintain their edge.

pilots also fly the T-38 Talon, which helps build their flight experience and keep their airmanship edge, said Maj. William R. "Buzz" Barrett. "The B-2 and the T-38 fly very differently," he said, with the B-2 being "much easier to fly."

While the B-2 is highly automated and will cruise with minimal effort, the T-38 "does 300 knots in the pattern. There's a lot of cross-check, . . . a lot of airmanship decisions. The B-2 requires more systems knowledge, but the T-38 keeps your pilot skills sharp," he said.

In a time of budget stringency, only B-2, U-2, and F-117 units have access to T-38s as companion trainers.

After a B-2 mission, an extensive debrief takes place. In the room are the flight crew, contractor representatives, maintenance specialists, and people from the B-2 Combined Test Force at Edwards AFB, Calif. Gripes are detailed, and lessons learned are submitted on Air Force Form 847. These, in turn, build the B-2 Dash One manual, which describes better-flying tips as well as a host of "do nots" that could lead to damage or destruction of the aircraft.

The initial cadre of maintenance personnel on the B-2 was handpicked, but shortly after the B-2 came to Whiteman it became a specialty available for any enlisted person with good enough marks. There are one- and two-stripe airmen working on

the airplane. They get four to eight weeks of specialized training for it, and the aircraft has proven docile in their hands.

"You can do ninety percent of the maintenance on the B-2 without removing any panels," according to 2d Lt. Jeffrey M. Burnside, of the 393d Bomb Squadron. "There was a great deal of thought put into maintenance when they were designing this aircraft."

As to its reliability, Lieutenant Burnside said the B-2 is a champ. "You don't have people sitting around with nothing to do," he said, "but they aren't here all night fixing things, either."

Propulsion Specialist SrA. Michael P. Sullivan observed that the B-2's F118 turbofans are similar to others he has worked on, though "a little harder to get to" because they are buried in the fuselage to hide their fan blades from radar. He has "no big gripes" with the engines.

Flight controls are critical to the highly unstable B-2, which operates by a quad-redundant, fly-by-wire system, but they "work great," said SrA. Robert G. Rayburn, who specializes in them. "I haven't seen any problem areas."

Each B-2 has its own "dock," a term the crews prefer over "hangar" because the airplane is positioned carefully to hook up with umbilicals in the floor. Each dock is immaculate, with none of the hydraulic fluid



Engines keep turning as a Spirit changes pilots for another training sortie—a practice that eliminates the need for a lengthy preflight. The B-2's reliability has allowed crews to gain experience far faster than originally predicted.

or fuel puddles or stains one would find under any other large airplane.

"Used to be, if an airplane didn't leak, it meant there wasn't any fuel in it," Lieutenant Burnside said, but the B-2 is a departure from most large aircraft.

"The tolerances are very tight" between panels on the aircraft, Airman Sullivan said. "They have to be; leaks can damage the LO," or low-observable—stealth—characteristics of the surface.

Tolerances are so tight that the B-2, even with a wingspan comparable to that of the B-52 (the wings of which can flex up to eighteen feet in flight), remains highly rigid. Its wings flex less than three feet, and as a result nothing drips.

"We don't have hydraulic problems or electrical problems, only one fuel [incident], and no leaks," Colonel Power noted. He also said that, to date, no B-2 crew has had to shut down an engine in flight.

"You just don't lose sorties on this airplane," said Major Biscone, a veteran of many aborts with his previous ship, the B-52. "If you're scheduled to go, you go."

The Blackout

Only one really serious in-flight emergency has occurred; on that occasion, all the displays in one B-2's glass cockpit went blank. The airplane landed without further incident.

The specialized work pertaining to the B-2's stealth characteristics is conducted in a windowless, keypad-entry hangar across from the flight line. There, experts maintain the advanced materials and gear that reduce the B-2's radar cross section—special tape that shields panel joints, heat-absorbent tiles in the exhaust area, and structures made of epoxy resins and other exotic materials.

"Tape is tape," observed Capt. Casey W. Hughson, who supervises LO maintenance in the 509th Maintenance Squadron. "Fly it around long enough at high speed and it will start to peel back." The tape must be carefully reapplied using special adhesives, and it must rest on the airplane just so, lest it disturb the surface contours. A barely noticeable disruption of the surface contour can increase the airplane's radar cross section considerably.

"What these guys do isn't a science; it's an art," Captain Hughson said. "For example, getting the paint on exactly one mil thick—that's an art."

The LO shop is also the first line of repair for the B-2. There have been no catastrophic problems, but there have been some challenges. A birdstrike several months ago hit a bull's-eye on a B-2 control surface. Though the Whiteman team initially thought the part would have to go back to the factory, it was diagnosed and repaired at the base.

The B-2 is not problem-free, however. The LO shop spends most of its time maintaining the aft deck, part of the exhaust covered with heat-absorbent tiles similar to those on the space shuttle. The aft deck also experiences lots of dynamic stress in flight. Cracks occur regularly.

"The aft deck is a known challenge," General Marcotte said, "but we are repairing it mostly ourselves."

Northrop Grumman has developed new procedures that "speed up the process" to repair cracks, General Marcotte noted. "What used to be months now is down to a week or two weeks."

Weapons loaders have a rare advantage in the B-2 program. They are able to practice on a weapons loading trainer that is a close replica of the B-2's bomb bay and cockpit. They practice the extremely precise process—down to millimeter accuracy—of loading Mk. 84 bombs and nuclear "shapes" but can also simulate malfunctions and emergencies that might be hazardous if practiced with a real aircraft.

"It was purpose-built" for weapons loading and "allows us to train loaders without sacrificing an airplane from the flying lineup," Colonel Power said. With only eight aircraft available, "that's a tremendous help."

Different Kind of Stealth

The B-2's stealthiness is what sets it apart from the other bombers in Air Combat Command, and it is one of the big unknowns still being explored in the program. Though the Air Force has operated a stealthy airplane under combat conditions—the F-117 in Operation Desert Storm—General Marcotte said that the B-2 "is stealthy in a different way from the F-117" because of the techniques and materials used.

Early this year, the first of a planned series of tests was run to see how well the B-2's stealthiness holds up in the field. The test is called the Periodic RCS (Radar Cross Section) Surveillance Mission (PRSM), and it determines whether field maintenance can keep the B-2 at the specified, factory-installed levels of radar observability.

The test findings are classified, but "we were pleasantly surprised . . . and very happy with the results," said Colonel Power. Technical or-

ders have been upgraded—"we need to do some fine-tuning." However, said the Colonel, "we are applying the lessons learned, and next time we'll see even better results."

The B-2 is being phased into service gradually. The 509th has been operating with the initial batch of airplanes—Block 10 models—but has already returned one to the factory, where it will be reconfigured into a Block 30 version. As Whiteman gets Block 20s from the assembly line, its Block 10s will be traded back for refitting. When fully equipped with Block 20s, the 509th will start trading them back for Block 30s, which will have the full complement of capability planned for the B-2, in both weaponry and stealth.

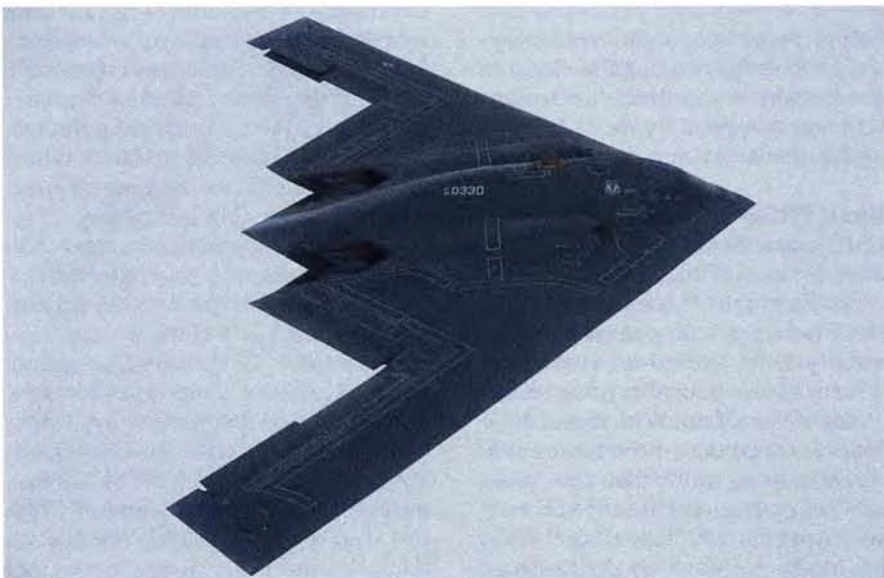
During this rolling conversion period—expected to last another four years or so—the 509th will have a stable complement of eight to nine B-2s at any given time, so today's operating pace is likely to remain "fairly stable" until the last eleven Block 30 airplanes start arriving, Colonel Power said.

The 509th is now undergoing nuclear surety inspections, involving tests of security, procedures, and facilities. Colonel Power said the unit expects to receive certification for nuclear weapons by January 1, 1997. Initial operational capability will focus on the nuclear mission, but it is clear that the Air Force would prefer to measure the B-2

The B-2 seems to levitate into the sky, and pilots must avoid flaring a landing or risk a long "float" because of massive ground effect. Also, the Spirit's considerable bow wave makes aerial refueling "kind of tricky," according to B-2 pilots.

against full requirement and full capability, which will come only with the arrival of the Block 30 airplane.

"Initial LO signature tests have confirmed the stealthiness of the B-2 and provided confidence that the final configuration will meet the user's needs," an Air Staff spokeswoman said. "Initial tests on the radar, navigation, and weapon-delivery systems are complete, and we are working to deliver full functionality and capability in our Block 30 configuration."



The B-2 is one of the "cleanest" aerodynamic designs ever to go into production, and the payoff is reduced radar cross section and increased range. Split ailerons, visible here, function as rudders on the tailless flying wing.



Photos by Randy Jolly

Flight testing of the B-2 airframe and of the weapons in the Block 10 and Block 20 is complete, the Air Staff reported. Block 30 testing is already under way and should be finished next summer.

The Whiteman facilities built to support the B-2 were designed and constructed bearing in mind that the B-2 has a very long life expectancy. "These buildings will last a hundred years," Colonel Power said. Each of the twenty currently planned B-2s will have its own dock at Whiteman, but "the acreage is here" to accommodate more if they are built, he added.

General Marcotte was wrapping up his stewardship of the B-2 early this year and counted it as the plum job of his career. Looking ahead to emerging technologies that may compete with the B-2, he said he cannot foresee "the bomber losing its place in the near future."

The B-2 brings "a tremendous advantage" to war planners because it "ensures the capability to slow down an enemy," buying time for follow-on forces, he continued. So far, incremental improvements in engine and weapons technology for smaller aircraft haven't come close to matching the B-2's ability to "get a warning order and twenty hours later be dropping bombs" precisely on target.

"We have to make our own people understand what it brings to the fight."