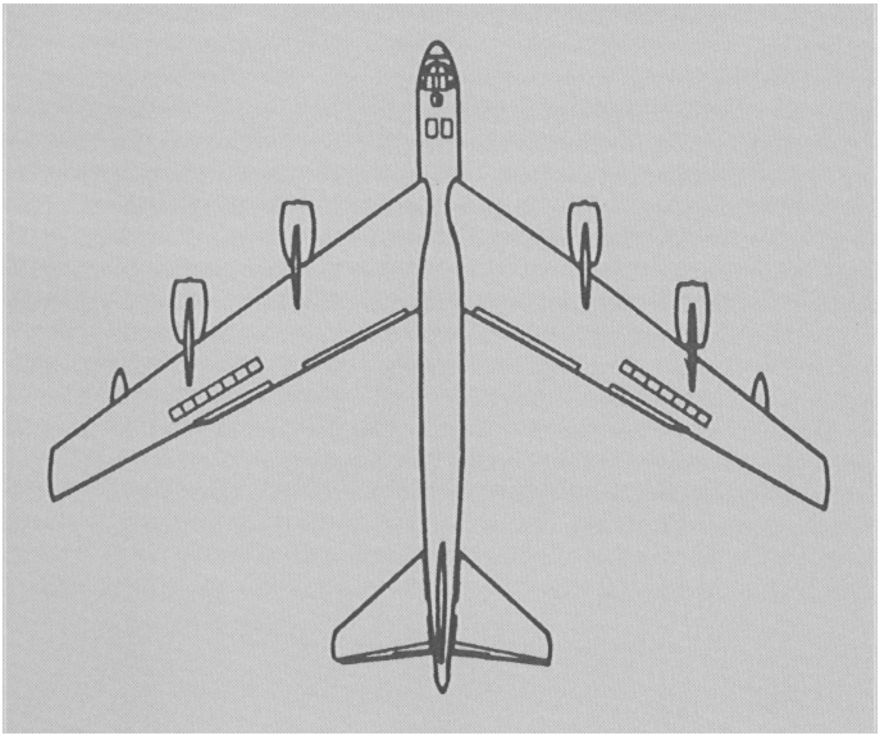
B-52 Stratofortress

Boeing Airplane Company



B–52 Stratofortress
Boeing

Manufacturer's Model 464

Weapon System 101

Overview

Most post-World War II bombers evolved from military requirements issued in the early or mid-forties, but none were produced as initially envisioned. Geopolitical factors accounted for the programs; the military threat, varying in degrees of intensity through the years, never ceased to exist. While these factors justified the development of new weapons, technology dictated their eventual configurations. Strategic concepts fell in between, influenced by circumstances as well as the state-of-the-art. Thus the B–36, earmarked in 1941 as a long-range bomber, capable of bearing heavy loads of conventional bombs, matured as the first long-range atomic carrier. The impact of technology was far more spectacular in the case of the B–52, affecting the development of one of history's most successful weapon systems, and the concepts which spelled the long-lasting bomber's many forms of employment.

As called for in 1945, the B–52 was to have an operating radius of 4,340 nautical miles, a speed of 260 knots at altitude of 43,000 feet, and a bombload capacity of 10,000 pounds. Although jet propulsion had already been adopted for the smaller B–45 and B–47 then under development, the high fuel consumption associated with jet engines ruled against their use in long-range aircraft. But what was true in 1945, no longer applied several years later. After floundering through a series of changing requirements and revised studies, the B–52 project became active in 1948. Air Force officials decided that progress in the development of turbojets should make it possible to equip the new long-range bomber with such engines. The decision, however, was not unanimous. Money was short, B-52 substitutes were proposed, and it took the deteriorating international situation caused by the Korean conflict to ensure production of the jet-powered B-52—the initial procurement contract being signed in February 1951.

While technological improvements received top priority when new weapons were designed, untried technology was a tricky business. Hovering over the B-52 weapon system was the specter of the B-47's initial deficiencies. As a result, the B-52 was designed, built, and developed as an integrated package. Components and parts were thoroughly tested before being installed in the new bomber. Changes were integrated on the production lines, giving birth to new models in the series, a fairly common occurrence. Yet, in contrast to the usual pattern, B-52 testing only suggested improvements, and at no time uncovered serious flaws in any of the aircraft. In fact, Maj. Gen. Albert Boyd, Commander of the Wright Air Development Center, and one of the Air Force's foremost test pilots, said that the B-52's first true production model was the finest airplane yet built.

Initially flown in December 1954, the B-52's performance was truly impressive. The new bomber could reach a speed of 546 knots, twice more than called for in 1945, and could carry a load of 43,000 pounds, an increase of about 30,000 pounds. Still, most of the early B-52s were phased out by 1970, due to Secretary of Defense Robert S. McNamara's mid-sixties decision to decrease the strategic bomber force. However, the later B-52G and H-models, and even some of the earlier B-52Ds, were expected to see unrestricted service into the 1980s.

By mid-1973, the B-52s had already compiled impressive records. Many of the aircraft had played important roles during the Vietnam War. Modified B-52Ds, referred to as Big Belly, dropped aerial mines in the North Vietnamese harbors and river inlets in May 1972. In December of the same year, B-52Ds and B-52Gs began to bomb military targets in the Hanoi and Haiphong areas of North Vietnam, where they encountered the most awesome defenses. Although the B-52s were often used for purposes they had not been intended to fulfill, after decades of hard work they remained one of the Strategic Air Command's best assets.

Basic Development — 1946

Officially, the B-52's development was initiated in June 1946. However, the basic configuration finally approved bore little resemblance to the original Boeing proposal. In reality, the aircraft's genealogical roots reached back to June 1945, when the Army Air Forces (AAF) directed Air Materiel Command (AMC) to formalize military characteristics for new postwar bombers, as prompted by ". . . the need for this country to be capable of carrying out the strategic mission without dependence upon advanced and intermediate bases controlled by other countries . . . ." The timing of the AAF directive of June 1945 was worthy of note. Although total victory in World War II seemed imminent, the directive obviously reflected growing pessimism over the future of international relations and increasing concern with the experimental B-35 and the problem-ridden B-36, both yet to be flown.

Military Characteristics — 23 November 1945

The first in a series of military characteristics for heavy bombardment aircraft was issued in November 1945. This initial document called for a bomber with an operating radius of 5,000 miles (4,340 nautical miles) and a speed of 300 miles per hour (260 knots)[1] at 34,000 feet, carrying a crew of 5, plus an undetermined number of 20-millimeter cannon operators, a 6-man relief crew, as well as a 10,000-pound bombload. Maximum armor protection was another prerequisite.

Request for Proposals — 13 February 1946

A design directive, allowing maximum design latitude, was distributed to the aircraft industry with invitations to bid on the military characteristics of November 1945. Three manufacturers—Boeing Airplane Company, Glenn L. Martin Company, and the Consolidated Vultee Aircraft Corporation—submitted cost quotations and preliminary design data close to requirements.

Letter Contract — 28 June 1946

The AAF concluded that Model 462, the Boeing proposal for a straight-wing aircraft grossing 360,000 pounds[2] and powered by 6 Wright T-35 gas turbine engines with 6 propellers, promised the best performance per dollar cost. The proposed aircraft, with its 3,110-mile radius, fell short

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[1] The range and speed of aircraft were shown in statute miles until the late 1940s; in some cases, until the early 1950s. Afterwards, speed was measured in knots; range, in nautical miles.

[2] Gross weight is the total weight of an airplane fully loaded; take-off weight is the actual gross weight of an airplane at take-off; the main factor limiting an airplane's maximum take-off weight is structural strength.

in range, but experience showed such a deficiency could be alleviated during the course of development. Hence, on 5 June Boeing was informed that it was the competition's winner and in mid-month Model 462, which closely resembled the much lighter B-29, became the XB-52.[3] Because money, never sufficient from the users' point of view, appeared particularly scarce at the time, the letter contract awarded to Boeing on 28 June covered only the initial development (Phase I[4]) of Model 462. Specifically, Letter Contract W-33-03A-ac-15065 asked for a full-scale mockup of the intercontinental XB-52, plus preliminary design engineering, construction of a power plant test rig, gunfire testing, structural testing, and the supplying of engineering data. Boeing could spend not more than $1.7 million on this Phase I work. And while the letter contract allowed the eventual continuation into a second phase, money was not mentioned.

Initial Reappraisal — October 1946

Despite the apparent urgency of the new bomber project, the military characteristics of November 1945 did not prevail long. In October 1946, less than 3 months after Boeing's receipt of a letter contract, discussions began that essentially reflected the AAF's unanimous concern over the "monstrous size" of the proposed XB-52 (Model 462). Maj. Gen. Earle E. Partridge, Assistant Chief of Air Staff for Operations, flatly stated that the XB-52 design failed to meet requirements. Boeing thereupon came up with a different proposal. This was Model 464, a much lighter (230,000 pounds), 4-engine version of the previous 6-engine design. Maj. Gen. Laurence C. Craigie, Chief of the AAF's Engineering Division, recommended adoption of the 4-engine XB-52, but many changes were yet to come. Indicative of the period's difficult times, new and sometimes unrealistic requirements later followed that nearly spelled the program's end.

Program Changes — 1946–1947

In November 1946, General LeMay, then Deputy Chief of Air Staff for Research and Development, while noting that the 230,000-pound XB-52

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[3] The next available bomber designation; Martin's Model 234 (a development of the contractor's winning attack design submitted in February 1946 as the XA-45) being already earmarked as the future (and later canceled) B-51 light bomber.

[4] A "phase" was a stage in the planned development of a program considered in respect both to (a) the nature of the tasks undertaken and (b) the timing.

had merits, stressed that besides extra range the future B-52 should have a higher cruising speed, something in the vicinity of 400 miles per hour. Boeing's ensuing suggestion that a 300,000-pound plane (60,000 pounds less than Model 462) might be the answer became academic, or so it seemed. In December, the AAF asked Boeing to provide design studies for a 12,000-mile range, 4-engine general purpose bomber, capable of carrying the atomic bomb. A 400-mile per hour tactical speed was required, and a gross weight of 480,000 pounds was again authorized. Fully aware of the existing limits of technology and because its first turboprop bomber had fallen far short on range, Boeing gave the AAF 2 very-heavy bomber designs—Models 464-16 and 464-17. Both appeared fairly similar and were to be powered by 4 T-35 turboprop engines of higher horsepower than those earmarked for the earlier 464 version. There was a clear difference, however. The special mission 464-16 model would carry only a 10,000-pound bombload; the general purpose 464-17 model, up to 90,000. While perhaps attractive in theory, the AAF categorically rejected the simultaneous development of 2 new bombers because this would be financially reckless. What it really wanted was an aircraft that could either carry many conventional bombs or be stripped for long-range, special missions. After careful evaluation, the AAF opted for Model 464-17.

Revised Military Characteristics — June 1947

The military characteristics of November 1945 were officially superseded in June 1947. The new characteristics called for a heavy bomber offering the improved performances that had been in the definition process for about 8 months. Except for range, the 464-17 XB-52, as proposed, met requirements. Its degree of success, however, would largely depend on the much improved T-35 engine promised by Wright. Moreover, a new problem had begun to surface. The requirements painstakingly established since October 1946 no longer seemed adequate.

New Setbacks — Mid-1947

The latest XB-52 (Model 464-17) appeared satisfactory, but only temporarily. This came as no great surprise. General LeMay long believed that, even if all went well, this XB-52 would be too large and too costly—possibly limiting procurement to 100 aircraft. General Craigie was also highly critical. In his opinion, the new XB-52 would offer little improvement over Convair's B-36G.[5] And, quite likely, the XB-52 would be obsolete before completion. Soon there was talk of scrapping the whole venture, but General LeMay favored caution. The XB-52 project should be given a 6-month "grace" period pending final decision concerning its future. This was in line with the AAF's thinking. Thus, after the shelving of Model 464-17, Boeing continued to search for means to improve the airplane. The company swiftly drew up a series of preliminary configurations (Models 464-23, 464-25, and 464-27), which finally culminated in Model 464-29. Even though the weight remained the same, high speed increased slightly to 455 miles per hour, and the operating radius jumped to 5,000 statute miles. Still, Model 464-29 was not to be the final answer.

Further Reappraisal — July-December 1947

While Boeing was told to continue development of the XB-52, AMC was reminded that no actual construction could be started without express consent of the AAF's Commanding General. The command was also directed to explore every possible means for delivering the atomic bomb. The use of subsonic pilotless aircraft was given priority, but one-way manned flights were not excluded.[6] In late September, the Aircraft and Weapons Board of the now independent United States Air Force convened a Heavy Bombardment Committee to obtain "a fresh evaluation of the long-range bomber program." In other words, committee members were directed "to study methods for aerial delivery and individual and mass atomic attacks against any potential aggressor nation from bases within the continental limits of the United States." The Heavy Bombardment Committee concluded decisively that speed and altitude were the basic qualities required of a bomber due to carry the A-bomb. This was particularly true when the bomber reached the combat zone. Up to that point, the plane could actually cruise at lower altitude. By the same token, the all-important range could well be extended by air refueling in the non-combat theater. The committee ended its work by preparing preliminary military characteristics that essentially asked for a special-purpose bomber (in lieu of a general-purpose weapon) with an 8,000-mile range and a 550-mile-per-hour cruising speed. More changes ensued, but the committee's recommendations had an

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[5] See B-36, p 42.

[6] The Air Force pursued some of those early projects. Like Brass Ring, spurred by the advent of the hydrogen bomb, none materialized as originally conceived.

immediate impact. Boeing's latest 450-mile-per-hour XB–52 (Model 464–29), obviously too slow to survive in combat, no longer had a chance.

New Military Characteristics 8 December 1947

The military characteristics of June 1947 were officially superseded on 8 December. The new set, as approved by General Vandenberg, Vice Chief of Staff, General Kenney, Commander of Strategic Air Command (SAC), and Gen. Joseph T. McNarney, who now headed the Air Materiel Command, closely resembled the proposal submitted by the Heavy Bombardment Committee. The most telling difference was that the bomber's required cruising speed was reduced—a change endorsed after studies by the AMC and Rand[7] pointed out that the desired 8,000-mile range could be attained only at a speed not in excess of 500 miles per hour.

Near-Cancellation 1947–1948

With the approval of new characteristics, the question arose within the Air Staff whether the Boeing contract should be amended or canceled in favor of a new design competition. The idea of a new competition was tempting. A better bomber might be obtained by again tapping all the engineering brains in the industry. Also, as previously noted by General LeMay, many companies which had failed to bid on the original project were of a different mind now that a large part of the Air Force production funds appeared slated for the future B–52. The Air Materiel Command did not agree with the Air Staff. AMC claimed that Boeing was the best-qualified heavy bomber contractor, that a new competition would consume much valuable time, and that some $4 million would be wasted if the Boeing development contract was nullified. For good reasons, the AMC arguments failed to convince the Air Staff. First, Boeing already had a large share of the Air Force business, and amending the company's contract might cause political repercussions or a public accusation of favoritism. Secondly, if Boeing was truly the best contractor, it would win the competition handily,

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[7] Rand (for research and development) was the code name applied to numerous studies by the Douglas Aircraft Company—a project initiated by the AAF in 1946. In 1948, a grant from the Ford Foundation brought about a reorganization of the project. It became the Rand Corporation, a non-governmental, nonprofit organization dedicated to research for the welfare and national security of the United States. Research by the corporation was conducted with its own funds or with funds supplied by government agencies. The Rand Corporation is located in Santa Monica, Calif., but maintains offices in Washington, D.C.

and little delay would occur because the company had already worked on the XB-52 preliminary design. Therefore, on 11 December 1947, following verbal approval by Under Secretary of the Air Force Arthur S. Barrows, Lt. Gen. Howard A. Craig, Deputy Chief of Staff for Materiel, directed AMC to cancel the Boeing contract. However, the case was not closed. Before the directive could be executed, Boeing's President, Mr. William M. Allen, protested vigorously to Secretary of the Air Force Stuart Symington that the decision was unsound. The Boeing letter stressed that the proposed cancellation and renewal of XB-52 competition would be "a serious injustice to the contractor . . . and provide a 'second chance' to others who would profit from Boeing's progress." The letter also underlined that the company had passed up other projects after entering the heavy bombardment competition in the spring of 1946. Since then, some of its ablest talent had been dedicated to the project. Finally, the bulk of the other Air Force production contracts held by Boeing would be completed before the B-52 production could begin. In all fairness, the Air Force had to admit that many of Boeing's arguments were valid. Thus, it might be best to avoid any rash decision.

Other Alternatives 1948

In January 1948, Mr. Symington replied to Boeing, giving a keen analysis of the problem facing the Air Force.[8] He considered the heavy bombardment project to be of the greatest importance, and believed the new bomber would play a dominant role in any future war. "For this reason," he emphasized, "the USAF must be assured of the best possible design and configuration. There could be no compromise on this provision." The Secretary said that much scientific progress had been made since the original competition. The technique of air-to-air refueling had been perfected to the point where it should be possible to develop an airplane with the top speed and cruising speed of a medium bomber and with only a slightly higher gross weight. This aircraft should certainly be lighter than previously proposed versions of the XB-52. Another possibility (insufficiently considered, according to the Air Staff) was the flying wing design. Rand studies had noted that this configuration offered definite advantages when applied to long-range, high-speed aircraft. Mr. Symington concluded that, until all avenues had been thoroughly explored, no final decision could be made on the original Boeing contract.

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[8] Concurrent difficulties with the B-36 did not help. This program once again appeared on the verge of collapse—another major decision soon confronting the Secretary.

Go-Ahead Decision — March 1948

In February 1948, after acknowledging the merits of the flying wing being tested by the Northrop Corporation, Boeing noted some of the inherent disadvantages of this type of configuration. Foremost were marginal stability and control. Boeing willingly emphasized that research and experiment with the all-wing aircraft should not be discouraged. But the proposed B–52 had more flexibility for radar and armament installation and none of the "flying wing's" problems. Consequently, the conventional aircraft should be given first developmental priority, "so that the Air Force should not be left without an effective bomber." From its own investigation, AMC's Engineering Division contended that the XB–52 development should be continued. The Air Staff also began to favor the XB–52, believing it to have a higher probability of success and to be easier to maintain than any potential version of the "flying wing." Thus, in March 1948, the Secretary of the Air Force informed Boeing that its present contract would be modified to develop a bomber meeting the military characteristics of December 1947, as already or subsequently revised. In April Boeing presented a complete Phase II proposal for the design, development, construction, and testing of 2 XB–52s (Model 464–35). Although estimated to cost about $30 million, this Phase II proposal received the Air Force's endorsement in July.

Additional Revisions — 1948

During 1948, several revisions were made to the military characteristics of December 1947. The first occurred in March, 2 months after Boeing submitted for the first time Model 464–35—a bomber having the desired range and speed but weighing only between 285,000 and 300,000 pounds. A second revision specified a 360,000-pound plane, with an average cruising speed of 445 miles per hour and a range of 11,635 miles. A final revision on 15 December defined a 280,000-pound bomber that could carry 10,000 pounds of bombs and 19,875 gallons of fuel for 6,909 miles, at a maximum speed of 513 miles per hour at a 35,000-foot altitude. None of the 3 revisions affected the December 1947 requirements for a 5-man crew and tail armament only. But more changes occurred over time and the B–52s eventually carried a crew of 6, as a rule.

Contractual Arrangements — September 1947–November 1948

Boeing's original contract, as initiated by the letter contract of June

1946, was approved on 2 September 1947. By then the contract already reached $4.6 million—$1.7 million for Phase I, the initial development commitment, plus $2.9 million for Phase II, an extension of the Phase I work directed by the existing letter contract. The Phase II funds were provided per supplemental agreement on 13 June 1947. Of necessity, these funds were shuffled around. For a while, the Phase II funds were due to finance the Phase I development of Model 464-17. However, this model's cancellation prompted a second change, the $2.9 million Phase II funds now being earmarked for the Phase II development of yet another configuration—Model 464-35. Meanwhile, as approved by Under Secretary Barrows, an additional $563,766 was allocated on 7 April 1948 for the Phase I development of the same model (464-35), bringing the Phase I investment to a total of $2.3 million. But completion of the Phase II development would prove to be considerably more expensive. In mid-1948, as a result of the revised characteristics of December 1947, the Phase II cost of developing, building, and testing 2 XB-52s (Model 464-35) was estimated at $28.3 million. This did not include $1 million for contractor-selected spare parts or $4.8 million for engineering design improvements and the installation of tactical equipment in the 2 experimental planes. Even spread over several years, the research and development budget could not possibly sustain such expense without jeopardizing other essential projects. Some expedient had to be found. On 17 November 1948, the Air Force approved another supplemental agreement to the definitive contract of September 1947. This time, the agreement shifted $6.8 million of procurement funds to support the first 2 years of the XB-52 development.

Radical Change 1948

In the spring of 1948, after floundering for about 2 years through a series of changing requirements and revised Phase I studies, the XB-52 project finally seemed on its way. Although the Air Force still made it clear that the XB-52 development program must result in the most advanced design possible, Boeing actually prepared to build 2 experimental, turboprop-equipped articles of Model 464-35, its latest bomber proposal. But the plans once again were altered—with more drastic changes yet to come—by recent progress in the development of turbojet engines. The turbojet concept was not new. As early as June 1945, during discussions over the characteristics for strategic bombers, AAF officers had pushed for the development of jet engines suitable for bombers. However, the fuel consumption of jet engines was then so high that this kind of propulsion was discarded in view of the ranges required of the strategic bombers. In 1948 the technological situation was totally different. The Air Force asked Boeing in

May 1948 if it could incorporate jet engines in the proposed XB-52. This resulted in still another XB-52 version (Model 464-40), featuring the Westinghouse J40 engine and a minimum of changes to the turboprop XB-52 under construction. The Air Force received Boeing's preliminary study of its jet-propelled Model 464-40 in late July.

New Controversy **1948**

Shortly after Boeing's Model 464-40 was submitted to the Air Force, a new debate arose. In October, General Craig expressed his dislike for the proposal, believing that improvement in heavy bombardment aircraft would come only when the bomber configuration was changed and stating that "unless supersonic propellers become a reality, future aircraft of this class will be powered by turbojet engines, however neither of these developments are sufficiently near at hand that the turboprop step can be eliminated." The Deputy Chief of Staff for Materiel's pessimism proved unwarranted, as Boeing engineers within days of his remarks devised the very solution which led to the development of the remarkable B-52. Still, Boeing did not reap success without toil. On 21 October, after arriving at Wright Field to confer on their XB-52 turboprop aircraft (Model 464-35), Boeing engineering executives were informed by AMC officials that a drastic reappraisal of the XB-52 project seemed in order. In short, AMC wanted a preliminary study of an entirely new airplane which would be powered by Pratt and Whitney Aircraft Division's new J57 turbojet engines. According to popular newspaper accounts, the Boeing representatives retired to a Dayton hotel room over the weekend. Drawing on the experience gained in the B-47 program, they worked around the clock and on Monday morning, 25 October 1948, presented the requested proposal—a 33-page report plus a hand-carved model of their new design—Model 464-49. Perhaps the feat was not as spectacular as it appeared. As exemplified by Model 464-40, Boeing had been considering for quite a while the possible use of jet power plants in bombers far heavier than the B-47. In any case, the Boeing engineers liked Model 464-49, an airplane having 35-degree swept wings, 8 engines slung in pairs on 4 pylons under the wing, and an overall configuration that departed from the B-29 and B-50 for the newer B-47 body style. They were confident that additional range could be gained with "only reasonable increase in weight," and that the new jet engines would provide improved altitude and speed performances. Besides, jet engines would eliminate the many unsolved problems of propeller aerodynamics and control, and probably extend the airplane's operational life. Finally, this jet version of the XB-52 could be available almost as quickly as the turboprop already under development.

Program Reendorsement **1949**

The Board of Senior Officers[9] was favorably impressed by most of the operational accomplishments expected of the new 330,000-pound model. When equipped with J57 turbojets (yet to be available), the swept-wing XB-52 promised to reach a top speed of 496 knots (572 miles per hour); to fly 6,947 nautical miles at an average speed of 452 knots (520 miles per hour) without refueling; and to be capable of delivering a 10,000-pound bombload at a comfortable altitude of 45,000 feet. After a final evaluation in January 1949, the board decided to continue development, "with the Boeing Aircraft Company," of the XB-52 as a turbojet in lieu of the turboprop-powered aircraft. This would be done under the same contract, and Boeing was so informed on 26 January. Meanwhile, favorable opinions did not prevail in all quarters. The stringent economy drive directed by President Truman in late 1948 endangered the costly B-52 development program. Concerted attempts were made to equate performance and cost data with present and "soon-to-be" outdated aircraft. In February, the Deputy Chief of Staff for Materiel's Directorate of Research and Development came to the program's rescue. Officials pointed out that the major difference between the B-36 and the proposed B-52 was timing. The B-36 seemed to be the solution to the strategic bombardment problem as it appeared in 1942; the future B-52, as it appeared in 1949. Under existing state-of-the-art limitations, vigorous development of the turbojet B-52 afforded the Air Force its only hope for carrying out the strategic air mission, specifically the delivery of the atomic bomb, should it become necessary over the next 5 years. Surely, the Air Force would be remiss if it failed to develop a successor to the B-36. While the arguments of the Research and Development Directorate were persuasive, a new threat surfaced. In the spring of 1949, the Fairchild Aircraft Corporation forwarded a design proposal for the development of an unconventional strategic bomber.[10] The Board of Senior Officers again reviewed the Boeing airplane's potential growth and agreed to continued development of Model 464-49. However, Fairchild's unconventional design did not disappear, and other contractors soon submitted proposals that further imperiled the new program.

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[9] Established in December 1948, the USAF Board of Senior Officers included the Vice Chief of Staff, the Deputy Chief of Staff for Operations, the Deputy of Staff for Materiel, and the Commanding General, AMC. This board replaced the USAF Aircraft and Weapons Board, which was composed of all Deputy Chiefs of Staff and major air commanders and had proved too cumbersome. The dormant board was discontinued in the fall of 1949.

[10] The Fairchild proposal aircraft, a fuel-carrying wing, indeed appeared revolutionary. It used a railroad flatcar as a launcher. The intent was to provide maximum initial speed and altitude so that the aircraft would conserve fuel and attain sufficient range.

Mockup Inspections 1948–1949

Like the many model configurations considered at one time or another, all mockup inspections scheduled prior to 1948 were canceled. Moreover, the few finally conducted in January 1948 only covered nose sections, where arrangement of the reduced crew presented difficulties. As for Boeing's latest turboprop XB-52 (Model 464-35), although its mockup was essentially complete by October 1948, all work was halted before any formal inspection could be made. Thus, the swept-wing turbojet XB-52 was the first to merit a full-fledged mockup inspection. This was accomplished at the Boeing Seattle plant and lasted from 26 to 29 April 1949. The inspection board of USAF personnel found no special faults with the mockup but noted in its report that the experimental XB-52, with its J40-6 engines, would not match the B-36's 4,000-nautical-mile radius. The board also indicated that expedited development, as well as significant improvement of the J57 turbojet might assure B-52 aircraft of a 4,000-nautical mile combat radius, but this could not be expected before 1954. In any case, the importance of meeting such a requirement had been emphasized to the contractor. The Air Staff approved the board's report on 1 October, with significant reservations. This was obvious when Gen. Muir S. Fairchild, Vice Chief of Staff since 27 May 1948, carefully underlined that the XB-52 mockup report was approved to expedite potential future production, but that such approval "does not include acceptance of any production article not meeting specified range requirements."

Last Near-Cancellation 1949–1950

General Fairchild's "tentative approval" of the XB-52 mockup inspection report was viewed by many as a practical "cancellation of the program as it now exists." Since the J57 engine, in its present developmental stage, would only give the B-52 a combat radius of about 2,700 nautical miles, the bomber would never materialize unless some "mechanical dodge" was devised to extend range. Maj. Gen. Orville R. Cook, the AMC Director of Procurement and Industrial Planning, favored a review of the program and perhaps a revision of the military characteristics and scheduling of another design competition. General LeMay,[11] in command of SAC since October 1948, believed that the solution lay in engine development, that it was unnecessary to accept inferior performance in either speed or range, and

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[11] Promoted to full general on 29 October 1951, General LeMay headed SAC until mid-1957.

that a conference on the B-52 airplane was urgently required. Meanwhile, Boeing kept busy. Accelerated engineering and development tests were conducted to solve problems of aero-elasticity, vibration, and control that resulted from the higher wing sweep, greater speeds, and thinner wing. In November 1949, convinced that inadequate range seriously jeopardized the future of its new bomber (Model 464-49), Boeing offered a heavier B-52 (Model 464-67). This 390,000-pound B-52, Boeing said, would have a radius of 3,785 nautical miles for production aircraft anticipated in 1953 and 4,185 nautical miles for a B-52 in 1957. Increased combat radius could be obtained in time and with additional expenditure of money. Boeing concluded that the heavier XB-52 was as technically advanced in aircraft design as possible. The contractor's efforts to safeguard the B-52 program did not go unnoticed. By year's end, SAC officials generally agreed that the contractor had made appreciable progress toward satisfactory development of the airplane. Soon afterwards, the conference suggested by General LeMay took place. However, the meeting's conferees at Headquarters USAF on 26 January 1950 faced a difficult task. Once more, substitutes were proposed for the B-52. Included were new proposals by the Douglas and Republic Aircraft Companies, Fairchild Aircraft Corporation's unusual design, the swept-wing B-36G (later known as the YB-60), a Rand turboprop airplane, 2 new designs of the B-47, and several missile aircraft. Even though General LeMay took a firm stand in favor of the B-52 as the aircraft which would best meet the requirements of the strategic mission, the conference ended before any decision could be reached. But SAC's Commander-in-Chief was not easily deterred. In February, the Air Staff requested from AMC all performance data and tentative production dates of the various combat vehicles recently considered. In the same month, however, General LeMay asked the Board of Senior Officers to accept Boeing Model 464-67 in lieu of Model 464-49. Approved by the board on 24 March 1950, this change eventually led to the production decision General LeMay so badly wanted.

Production Decision — January 1951

Although there were no more direct attempts to sidetrack the B-52 development once Model 464-67 was endorsed, the future of the production program remained uncertain. Some substitutes seemed to regain momentum, with the swept-wing B-36 and long-range B-47Z coming to the fore. SAC opposed both, believing the new B-36 would have lower cruising and target speeds than a future B-52 and that the 3-man crew B-47Z would retain inherent limitations for intercontinental operations. A comparative study of the B-52 and the advanced B-47, SAC officials stated, showed that the B-52 was superior in performance. The B-52's extra crewmen would materially reduce the serious fatigue problems stemming from long missions. Also, electronic countermeasures equipment could be fitted in the larger B-52, thereby ensuring protection against future surface-to-air and air-to-air guided missiles. In spite of such arguments, the Air Staff had made no definite commitment by the fall of 1950, compelling General LeMay to become directly involved once again. And whereas World War II had prompted production of the B-36, another war helped the B-52. General LeMay was quick to point out that the international situation during the Korean conflict was deteriorating rapidly; that SAC's forward operating bases were becoming more vulnerable to enemy attack; and that increasing as well as modernizing SAC's intercontinental bombardment forces should receive priority consideration. Referring again to the B-52, General LeMay said: "Perhaps even more important is the concurrent requirement for the development of a long-range, high-performance aircraft, such as the RB-52, capable of operating alone over highly defended enemy areas in the performance of the reconnaissance mission." Finally convinced, the Board of Senior Officers concurred that the B-52 would be the production successor to the B-36. Also, since the B-52 was not a radical departure from existing stages of aircraft development, procurement could start before completion of the XB-52 testing. General Vandenberg, Chief of Staff since 30 April 1948, approved the board's recommendations on 9 January 1951; Thomas K. Finletter, the new Secretary of the Air Force, on the 24th.

Initial Production Plans 1951-1952

Letter Contract AF33(038)-21096, signed on 14 February 1951 by Boeing and the Air Force, was the first document authorizing production. It covered long lead time items and the production of 13 B-52As, the first of which was tentatively scheduled for delivery in April 1953. The letter contract of 1951 was finalized on 7 November 1952 by a cost-plus-fixed-fee contract. As originally agreed, Boeing's fixed fee remained set at 6 percent of the contract costs. In the interim, there were changes and many more were to follow. An amendment to the first letter contract provided for 17 reconnaissance pods—detachable capsules to be fitted in the early bombers. In July 1951, the Air Staff directed AMC to acquire 4 more B-52s—presumably to match the number of aircraft to the total of reconnaissance pods ordered. The additional planes were to be paid for, like their predecessors, with fiscal year (FY) 1952 funds, but would come from a second Boeing plant—yet to be selected. The directive, however, was soon rescinded, and in October the Air Staff informed AMC that all B-52 production aircraft would be in a reconnaissance configuration. In September 1952, the Air Force gave Boeing a second letter contract—AF33(600)-22119—that called for 43 RB-52s. But none of these early plans materialized due to technical improvements and budgetary restrictions. Ironically, the Korean War, which first worked in favor of the production program, slowed down progress because the industrial situation was confused following the unexpected outbreak of hostilities. Meanwhile, development of the 2 experimental B-52s gradually moved on.

Development Difficulties 1950-1952

As far as General LeMay was concerned, it was difficult enough to persuade the Air Staff to approve Model 464-67, but even more challenging to avoid the frustrating series of events that had marked the B-47 development. The reconnaissance requirements finally stipulated in early 1951 especially complicated matters. Boeing had known for a long while of the Air Force's reconnaissance ambitions.[12] There was nevertheless considerable disagreement between the Air Staff and SAC. Headquarters USAF thought photography should be the RB-52's main mission and that any equipment compromising this function should be excluded. On the other hand, SAC believed the airplane should have a full complement of electronic reconnaissance (or ferret) equipment for operation at night or in bad weather. Furthermore, only a minimum of cameras should be carried to give "local" photographic coverage when light conditions permitted. At any rate, preliminary designs for an experimental RB-52 were completed by mid-1950, but in August Boeing embarked on another approach. The contractor suggested forsaking the RB-52 because it would be simpler and much cheaper to install in the B-52's bomb bays a multi-purpose pod housing reconnaissance equipment. This multi-purpose pod could be replaced by a photo pod or a ferret pod, as needed. At this point, AMC agreed

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[12] Development of a special, long-range reconnaissance airplane, the so-called X or RX-16, became a topic of primary interest soon after the end of World War II. Yet, by 1949 ideas about the equipment required to accomplish the strategic reconnaissance mission remained in constant flux. There was also increasing concern that the cost of building a specific airplane for reconnaissance would be "staggering to the national economy." The Air Force therefore dropped the RX-16 project. It began instead to consider modifying bomber aircraft for the reconnaissance role. A first step toward this goal, the Air Materiel Command stressed, was to determine the type of data needed, then decide on the equipment best fitted to gather such data. The Air Force nevertheless believed that manned aircraft such as the B-36 and B-52 would be required for reconnaissance duty well into the 1960's. There were concurrent talks about parasite aircraft and guided missiles which most likely would some day perform reconnaissance functions.

that the proposal was sound, but cautioned Boeing that the B–52's bombing capabilities could not be jeopardized to satisfy reconnaissance objectives. In response, SAC proposed in June 1951 a reconnaissance B–52, capable of conversion to the bomber configuration. This could be done, according to SAC, by removing the reconnaissance pod and adding bomb racks in its place. An August conference, attended by representatives from the Air Staff, Air Research and Development Command, SAC, AMC, and the Air Weather Service seemed to settle a controversy that centered essentially on priorities. In short, should the aircraft be primarily a bomber with a secondary reconnaissance role, or vice versa? The conferees voted for a B–52 bomber that could be converted to the reconnaissance configuration and returned to its original configuration, as necessary. This "convertibility," the conferees decided, should allow personnel "at the wing level in the field" to do the transformation in a reasonable time. But the lull in the controversy did not last. As already noted, the Air Staff directed in October 1951 that all aircraft "will be of the RB–52 configuration as there is no requirement for a B–52." The directive was misleading since the aircraft would retain conversion features for bombardment operations. In actuality, the Air Staff's decision was a belated approval of SAC's most recent planning. Just the same, the discussions, delays, and production orders of 1952, along with subsequent deletions, did not as a whole expedite the experimental program.

Other Development Problems — 1951–1952

Besides the reconnaissance requirements of 1951, various circumstances affected the B–52's development. Early in the year, General LeMay told Boeing that the tandem-seating arrangement featured by the XB–52 mockup was poor. Since it allowed little room for flight instruments, small panel instruments would have to be used, and this had proven unsatisfactory in all types of aircraft. In addition, the tandem arrangment reduced the copilot's role to a flight engineer operating emergency flight controls— obviously limiting his assistance to the pilot. In a plane as important and costly as the B–52, safety was a top priority. General LeMay believed that side-by-side seating of the pilot and copilot would ensure closer coordination between the two, which in some cases might prove vital. The issue of tandem versus side-by-side seating was settled in August. The Air Staff agreed that significant operational advantages would be gained by adopting the side-by-side arrangement. Some slight confusion nevertheless ensued. First, a few of the early B–52 productions would retain the tandem seating configuration; then, only the experimental planes would not be changed. This was decided after Boeing pointed out that the lack of additional facilities made some production delay inevitable. The production time lost could be put to good use, the contractor felt, by incorporating a side-by-side cockpit from the start. This would save SAC the trouble of operating and maintaining 2 B-52 configurations and cut production costs by almost $17 million. There were other protracted discussions. SAC continued to strive for near-perfection, insisting that even greater range was desired to secure better operational flexibility in the dispersal of the B-52 force. Based on earlier experience, SAC also thought that space should be provided in the aircraft to carry the greater bombloads and large missiles anticipated in the future. Finally, there were several arguments about which engines should be used. For instance, SAC asked that an advanced engine, the General Electric X-24A, be made available without delay to permit the B-52 to realize its full potential. But this engine's production was not scheduled until 1957, and no plans were made to phase such an engine into the B-52 program.

First Flight (YB-52) 15 April 1952

Contrary to usual practices, the prototype B-52 took to the air several months ahead of the experimental B-52.[13] Lagging deliveries of engines[14] and pneumatic systems retarded the XB-52's first flight, but the main delay came from an engineering decision to change the aircraft's rear wing spar—a structural modification directly incorporated in the YB-52. In any case, the prototype's flight also slipped 1 month because General Electric did not deliver the pneumatic systems until 1952. Yet, the YB-52's 15 April flight proved well worth the wait. Taking off from Boeing's Renton Field, Seattle, Washington, the plane flew for 2 hours and 51 minutes before landing at nearby Larson AFB. Enthusiastic reports flowed in from engineers, observers, the pilots and, naturally, from the contractor. Pilots of the escort planes which accompanied the YB-52 on its flight reported that its performance was excellent and commented that its slow approach and landing speed were particularly remarkable. At touchdown, the drag parachute was deployed for testing only, as very little braking was required. Of course, there were a

[13] Boeing's original contract called for 2 XB-52s, bare of certain expensive tactical equipment. In mid-1949, Boeing suggested that such equipment be installed in the second XB-52. The contractor justified the costly installation by pointing out that the resultant airplane could serve as production prototype. The Air Force agreed and the second XB-52 became the YB-52.

[14] The Air Force Power Plant Laboratory insisted from the start that Pratt and Whitney had to supply Boeing with prototypes of the J57-P-3 engines for both the X and YB-52s. It believed that since those engines would equip the B-52s, they should also go into the experimental versions of the plane. This would allow Pratt and Whitney to "debug" the engines during the flight test program, while Boeing was "debugging" the airframe.

few minor problems. One of the quadricycle landing gears retracted improperly, the liquid oxygen system failed (due in part to the crew's unfamiliarity with it), and 1 of the engine oil valves leaked, causing a trail of puffy white smoke rings throughout the flight. A second flight on 20 April was even more successful. Remaining below 15,000-foot altitude because of restrictions on engine operation, the YB-52 attained a speed of 350 miles per hour. The restrictions were anticipated. Pratt and Whitney had encountered difficulty in pushing the experimental J57 through the 50-hour qualification run—succeeding only in August 1951, on the third qualification attempt. Whatever the cause, these early problems were swiftly corrected. By October 1952, the YB-52 had flown some 50 hours and had reached speeds of Mach 0.84 without full power at altitudes above 50,000 feet. The Air Force officially accepted the prototype on 31 March 1953 but let Boeing keep it for further testing. The contractor flight-tested the plane for a total of 738 hours, accumulated in 345 flights.[15] The YB-52 remained on loan to Boeing until January 1958, but the contractor kept it in storage during most of 1957. On 27 January 1958, the aircraft was donated to the Air Force Museum, Wright-Patterson AFB, Ohio.

First Flight (XB-52) — 2 October 1952

Although the experimental B-52 rolled out of the factory on 29 November 1951,[16] it did not fly until almost 1 year later—after significant modifications. The Air Force took possession of the XB-52 on 15 October 1952 (13 days after the aircraft's 2-hour first flight), but did not formally accept it until 1953. Because of its late start, the XB-52 barely participated in the contractor's Phase I testing, flying only 6 flights for a total of 11:15 hours. For the same reason, the Phase II flight test program, which was the Air Force's responsibility, began behind schedule. It was entirely conducted on the XB-52 between 3 November 1952 and 15 March 1953—reflecting an additional slippage of almost 2 months because of inclement weather in the Seattle area. Phase II tests revealed a number of deficiencies. The XB-52's engines surged and might shut down if normal throttle accelerations were

[15] Actually, USAF pilots flew the YB-52 8 times for 27 hours from Edwards AFB, Calif., between 5 June and 18 July 1953. Because the plane was on loan to Boeing, flights and flying hours were included in the contractor's totals.

[16] The XB-52 was moved to the flight test hangar under concealing tarpaulins during the night. According to the press, the great secrecy surrounding the whole event was dictated by the Air Force as a means of testing the effectiveness of its latest security policies. Yet, in view of Boeing's competitors and the many proposals still floating around, one could reasonably assume that the contractor was also eager to keep its new plane out of sight.

attempted at high altitude and low engine inlet temperatures. The brake system could not stop the aircraft within the distances guaranteed by Boeing. The XB-52 tended to pitch up and roll to the right just before stalling. Also, during landing roll, the experimental plane required twice the normal distance to stop. There were also problems with the tires, which tended to blow out when cross winds shoved the aircraft to one side. Completion of the Phase II tests prompted the XB-52's return to Boeing—the aircraft remaining on loan to the contractor for several years. In late March 1953 the plane began to undergo Phase III flight tests, but was soon grounded for major rework and did not resume flying until mid-1954. It nevertheless took part in the overall flight test program, finally accounting for 24 flights and a total of 46 flying hours. Boeing returned the XB-52 to the Air Force in early 1957, and in March the plane was assigned to the Wright Air Development Center at Wright-Patterson, to serve as a test-bed. After 893 hours of flight, 2 J75 engines were installed on the outboard struts, the XB-52 becoming a 6-engine airplane since the 4 inboard J57 engines remained. Modifications to the nacelles and installation of the new engines took time, immobilizing the airplane for almost a year.

Testing Program 1952-1962

Perhaps no aircraft would ever be as thoroughly tested as the B-52, nor did such a long-lasting program often start with so many controversies. The Air Force at first wanted to evaluate the aircraft at Edwards AFB's Flight Test Center. Boeing immediately disagreed, insisting that flying time at Seattle was rarely affected by bad weather and that excessive delays and expenses would occur in correcting defects discovered during testing, if the airplanes were not flown from the Boeing field. The Air Materiel Command somewhat reluctantly sided with Boeing in the belief that B-52 testing at Edwards AFB, under the auspices of the Flight Test Center, might lead to costly post-production modifications—a B-47 episode the Air Force did not care to repeat. The Air Research and Development Command, however, advocated testing the B-52 at the Flight Test Center, since that facility was responsible for the task. Although impressed by the research and development command's logic, AMC pointed out that conducted tests at Edwards would require perhaps an extra $20 million. Air Research and Development Command conceded, "partially as a result of the AMC's uncompromising refusal to provide the necessary additional funds." In 1953, contrary to Boeing's claims, the Seattle weather began to hold back testing. In February, after considering the extended Phase II[17] flying period and the hazards of operating in and to Seattle's metropolitan area, the Air Force directed a change in the test site. Initially, Larson AFB was chosen; subsequently, Fairchild AFB (also in the state of Washington) became the test base, with some of the later tests to be flown from Edwards. Meanwhile, other changes were underway, with more anticipated for the future. To begin with, the testing program acquired several extra B-52s. While the Phase I and II tests were conducted with only the X and YB-52s, the contractor's Phase III testing required 6 B-52s besides the YB-52. In the interim, the Air Force accepted 3 B-52As (the only ones built of 13 ordered) and returned the 3 planes to Boeing for Phase IV testing. Phase IV tests began with the third B-52A production (Serial No. 52-003) on 25 January 1955 and ran through the end of November. These tests had two main purposes. The contractor wanted to spot-check the stability data obtained during the Phase II tests of the reworked XB-52, and to compare the performance of the more powerful J57-P-29 engine against that of the J57-P-1W (first installed in the B-52A). The third B-52A, by itself, accounted for more than 288 hours of Phase IV testing accomplished in 60 flights. As expected, the J57-P-29-equipped B-52A demonstrated superior takeoff and climb performances.

Phase VI functional development testing also took place in 1955, ahead of the Phase V tests, which were delayed because of equipment shortages. The Phase VI tests, conducted at Edwards AFB, started on 3 March and made use of 2 B-52Bs (Serial No 52-005 and 52-006). They ended on 6 September, 2 months earlier than forecast, after 157 flights totaling 984 hours. Phase VI was designed to subject the entire strategic bomber weapon

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[17] The Air Force used the word "phase" to identify definite facets of the testing program. Phase I testing determined contractor compliance and consisted of some 20 hours of flight testing, during which the aircraft was held at about 80 percent of its design limits. Phase II testing was essentially similar to Phase I, but was done by Air Force rather than by contractor pilots. Phase III testing, called contractor development testing, ironed out most of the "bugs" thus far discovered and incorporated most of the modifications suggested by test pilots. In Phase IV, performance and stability testing, the entire performance range was investigated during some 200 hours of flight. Phase V, all-weather testing, as a rule took place at Wright Air Development Center and Eglin AFB. Phase VI tested functional development, using production models. Pilots of the scheduled using agency tested every part of the weapon system. Usually, this phase made use of 3 to 6 aircraft, each of which flew approximately 150 hours. Phase VII, called "operational suitability," was also performed by pilots of the using agencies. Phase VIII, termed unit operational employment testing, was also accomplished by pilots of the using commands, under the supervision of the Air Proving Ground Command. In the late fifties, there were some superficial changes, affecting the testing program's terminology more than its scope. Three categories supplanted the many pre-1960 phases. Categories I and II were essentially similar to Phases I and II; Category III, and its numerous special tests, covered all other former phases. Obviously, testing had to be flexible to serve its purpose. Often, some tests were extended, while others were scheduled out of order. But the testing program's thoroughness remained constant.

system to the demands of an accelerated program (a speed-up of production being actually recommended on 20 June 1955). One of the primary objectives was to determine the system's durability, maintenance manpower requirements, parts consumption, and compatibility of all support equipment. Completion of the Phase VI tests proved that the B-52 (Weapon System 101) was capable of performing its mission. Each B-52 subsystem had been carefully evaluated, with many improvements being requested. This in no way detracted from the B-52's intrinsic excellence, but attested to the importance of such testing during a period of great technological innovation.

Completion of the Phase VI tests, although a basic milestone, did not spell the end of testing. At least 1 of every B-52 model series was extensively tested, with no less than 1,500 Phase II and III test hours programmed for the last one—the B-52H, still being tested in 1962. Final tabulations showed that 13 B-52 productions were used in the overall testing program. Several of these planes were involved in accidents, and 2 were destroyed. But time would vindicate testing costs and efforts.

Research and Development Costs 1952

The research and development work done over some 5 years, plus the price and early testing of the X and YB-52s totalled about $100 million—1.5 percent of the entire program cost. In the early fifties, this was a shocking sum. Yet, the investment soon paid dividends. No major changes appeared until the last 2 models in the series (B-52G and B-52H), and even though the configuration of the early B-52s remained relatively unaltered, they too were to prove invaluable to the strategic force. In retrospect, the Air Force had to admit that money was seldom so well spent.

B–52A

Manufacturer's Model 464–201–0

New Features

The B–52A differed in several major respects from the prototype B–52. It looked more like an older type of bomber because of its enlarged nose that provided side-by-side pilot seating. To accommodate additional equipment, the forward compartment was extended 21 inches. Other improvements consisted of a 4-gun, .50-caliber tail turret, electronic countermeasures equipment, a chaff dispensing system, and J57–P–1W engines. The engines were fitted for water injection, 360 gallons of water being carried in a rear fuselage tank. Although the A-model was capable of "flying boom" flight refueling, its unrefueled range was increased by providing two 1,000-gallon auxiliary fuel tanks supplementing the normal 35,600-gallon fuel load.

Production Slippage — April 1953–June 1954

Restricted to testing, the B–52As were nevertheless considered as the first B–52 productions. While they were also 14 months behind schedule, extenuating circumstances abounded. As early as 1950, Boeing urged AMC to prepare for production, claiming that 1 year in lead time could be gained by securing tooling, materials, and other items without delay. "I can say in all honesty," Boeing's Vice President wrote, "that I believe the $13 million investment would be the cheapest insurance premium our Government ever paid." That the Air Force did not leap into action made sense at the time, since alternative aircraft remained under consideration. Later, when the XB–52 materialized, the aircraft appeared so complicated that even the contractor doubted that a B–29-type of mass production could be applied to the B–52. Comparing the 2 bombers, Boeing's President was quoted as saying, would be like comparing a kiddie-car and a Cadillac. In fact, designing the B–29 had required 153,000 engineering hours; the B–52, 3,000,000. In any case, it would take until August 1952, long after the

YB-52 flew, to get the rival YB-60 out of potential production;[18] several more months for SAC to dispose of the B-47Z competitor,[19] and until mid-1953 for the B-52 program to get truly under way.

Other Delaying Factors 1951-1954

Had the Air Force endorsed Boeing's early request for tooling, it is questionable whether this would have made much difference. Because of the Korean conflict, the tooling industry was unable to meet the demands of the aircraft manufacturers. Another related problem prevailed, however. After World War II, many trained aircraft personnel of necessity migrated to other jobs. These people had to be regrouped and retrained. And, with industry booming nationwide as a result of the Korean War, military procurement began to compete with commercial production. Although Boeing selected subcontractors in the spring of 1951,[20] (immediately following the production letter contract for 13 B-52As), the low priority assigned to the B-52 by the Air Staff was a formidable handicap.[21] Even more serious, according to

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[18] The YB-52 made its first flight on 15 April 1952; the YB-60, on the 18th—Convair flying its modified B-36 only 14 days after receipt of the prototype's eighth engine. The initial scarcity of J57 engines (also used by North American F-100 Super Sabres) presented problems. The worried Boeing contractor was being troublesome and kept on reminding the Air Force that the company had been led to believe that it would receive priority allocations of the new engines—particularly over Convair. The issue, however, did not reach serious proportions. The Air Force lost interest in the YB-60 in August 1952, after the aircraft's performance flaws tarnished its first bright prospects. The B-60 project was officially canceled in January 1953, the 2 experimental planes being scrapped in July 1954.

[19] Boeing B-47Z, also earmarked to receive J57 engines, was the last stumbling block to large-scale B-52 production. SAC won the debate in late 1952, after preparing a convincing new study of the problems at hand. To begin with, the B-47Z had a limited growth potential, but the B-52 was in its comparative infancy. The B-52 could carry more atomic weapons than the B-47Z. The latter, because of its weight limitations, would be less suitable to deliver hydrogen bombs. With almost uncanny vision, the SAC study concluded that it would be a serious mistake not to procure an adequate B-52 force.

[20] Boeing used 2 main criteria for its selection—availability of labor and wartime experience. The major subcontractors eventually picked were the A. O. Smith Co., of Toledo, Ohio, for landing gears; the Kaiser Manufacturing Co., of Richmond, Calif., for profile milling items; the Rohr Aircraft Corporation of Chula Vista, Calif., for drop tanks, power pods, and tail compartments; the Briggs Manufacturing Co., of Detroit, Mich., for rudders, elevators, vertical fin flaps, ailerons, spoilers, and outboard wings; and the A. O. Smith Co., of Rochester, N.Y., for weldments.

[21] At its inception, the program was assigned "S" priority position #63 which was exceedingly low and augured poorly for the successful accomplishment of stated production schedules (1 aircraft per month, at first; 4, later). It was not until September 1952 that the

an Air Force team that analyzed the situation, was "a general inability to adequately plan for the magnitude and complexity of the program." In summary, the protracted B-52 development was caused on one hand by revolutionary changes in aircraft design and propulsion; on the other, by uncertainty within the Air Force as to how far and in what direction it could go in utilizing these changes. As to the early production delays, the program's low priority was an obvious factor. Another cause, the Air Force believed, were defects in the overall organization originally set up by Boeing. Finally, production slipped to allow incorporation of mandatory changes that were identified during the early testing phases of the X and YB-52s.

Program Increase — August 1953

The procurement plans of 1951-1952 underwent many changes. In keeping with almost traditional patterns, the B-52's early production was shaped by deletions, additions, and reconfigurations. The letter contract of February 1951 was amended on 9 June 1952—several months before the definitive contract was signed. Consequently, although 13 B-52As had been initially ordered, only 3 were built. As was usually the case, the second model in the aircraft series bore the brunt of the changes. Against this routine background, important events unfolded. The Air Force, during the first half of 1953, finally endorsed a sizeable B-52 program. Made official in August 1953, the decision called for 282 aircraft—enough to equip 7 SAC wings. Since the Air Force wanted Boeing to deliver the aircraft between October 1956 and December 1958, another plant would be needed. Actually, an additional plant had been approved in mid-1951 and canceled within a few weeks. But this time, the decision stood firm. Harold Talbott, who had succeeded Mr. Finletter as Secretary of the Air Force on 4 February 1953, announced the action on 28 September. Boeing's second facility, established at Wichita, Kansas, eventually surpassed the Seattle plant in B-52 production.

B-52A Roll-Out — 18 March 1954

The Air Force chose to honor its new bomber months before it flew, with a factory roll-out ceremony attended by Gen. Nathan F. Twining, Air Force Chief of Staff since 30 June 1953. Addressing the several thousand

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priority level was raised to #27, but by this time slippages had occurred that were not recoverable.

people assembled at Boeing's Seattle plant, General Twining said: "The long rifle was the great weapon of its day. . . . Today this B-52 is the long rifle of the air age." The very existence of these global jet giants, General Twining stressed, would be a powerful deterrent against attack, for the Stratofortresses were designed to deliver devastating blows deep behind any aggressive frontier.

First Flight (Production Aircraft) 5 August 1954

The Air Force accepted the initial B-52A (Serial No. 52-001) in June 1954—2 months before the aircraft's first flight—and returned it immediately to Boeing for use in the test program. For the same purpose, the other 2 B-52As were also loaned to Boeing as soon as accepted.

Total B-52As Accepted

The Air Force accepted 3 B-52As—the total built by Boeing. The 10 other B-52As, ordered in early 1951, were completed as B-52Bs.

Acceptance Rates

All 3 B-52As were accepted in 1954, 1 each in June, August, and September.

End of Production 1954

B-52A production ended in September, with delivery of the third plane.

Flyaway Cost Per Production Aircraft $28.38 million[22]

Airframe, $26,433,518; engines (installed), $2,848,120; electronics, $50,761; ordnance, $9,193; armament, $47,874.

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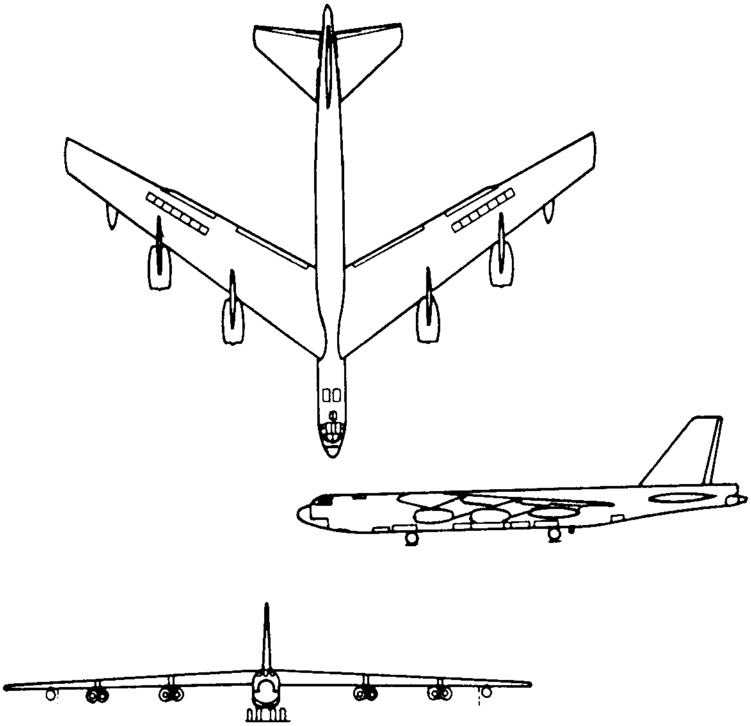
[22] Somewhat cheaper than the X and YB-52s, but not much. Air Force records carried the production B-52As at such seemingly fantastic prices because the aircraft were essentially experimental, with much of the initial tooling and new development costs charged against them.

The first B-52A was "rolled out" of the Boeing Seattle plant in March 1954.



Subsequent Model Series — B-52B

Other Configurations — NB-52A[23]

The last B-52A (Serial No 52-003) was redesignated NB-52A in 1959, after being modified to carry the North American rocket-powered X-15. The origin of the X-15 project dated back to the mid-1950s, when the United States became deeply interested in the space age and manned space flight. The program was a joint venture by the National Advisory Committee for Aeronautics,[24] the Air Force, and the Navy, with the X-15 conceived as a means to obtain technical data on hypersonic aeronautics. As it turned out, the immediate beneficiary of the X-15 flights was the manned space program, and the X-15 established itself as a most successful research aircraft. But the NB-52A's mother ship role, although less spectacular, was important and later a second B-52 became involved. For its part, the B-52A had to undergo extensive as well as permanent modifications by North American and USAF technicians. Specifically, a 6- by 8-foot section was cut out of the B-52's right wing flap to make room for the X-15's wedge tail. A pylon to mate the X-15 to the NB-52 was installed between the bomber's inboard engines and the fuselage. Lines and wires that held the X-15 below the NB-52 passed through this pylon. Large liquid oxygen tanks were placed in the B-52's bomb bays for topping off the X-15's liquid oxygen system prior to separation. A closed circuit television system was added so that the B-52 crew could carefully watch the X-15 and its pilot prior to launch. Finally, there was an elaborate launch control system to make sure that the X-15 was released at precisely the right instant. Captive flights to check out the X-15 and X-15/B-52 combination began at Edwards AFB on 10 March 1959. On 8 June, the first true flight occurred, but the rocket was not lit and the X-15 was flown as a glider. The first rocket-powered flight came in

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[23] The letter N was a prefix used by the Air Force to denote that an airplane (bomber, fighter, and other aircraft alike) was assigned to a special test program and that the aircraft had been so drastically changed that it would be beyond practical or economical limits to bring it back to its original or to standard operational configuration. Besides the familiar X and Y, 3 other so-called classification letters were used as status prefix symbols: namely, the letter G, which denoted an aircraft permanently grounded, utilized for ground instruction and training; J, temporarily reconfigured for special tests; and Z, in planning or predevelopment stage. As of late 1973, all 3 services of the Department of Defense still applied this medium to identify the status of their aircraft.

[24] The National Advisory Committee for Aeronautics, a federal agency established by Congress in 1915, did research for the benefit of commercial and military aviation. The advisory committee was absorbed by the National Aeronautics and Space Administration in the fall of 1958, becoming in the process the organizational core of the newly created agency.

September, with the NB–52A eventually participating in 59 of the 199 X–15 flights conducted before the program's end in 1968.

Phaseout 1960

The B–52A phaseout began in 1960, when the first of the 3 aircraft was retired after being test flown from Edwards AFB at take-off weights up to 415,000 pounds.

B-52B

Manufacturer's Model 464-201-3

New Features

Increased gross weight (420,000 instead of 405,000 pounds), the MA-6A bombing navigation system, and more powerful engines were the main differences between the B-52B and the preceding B-52A. Also, in contrast to the B-52As, some of the B-52Bs could be fitted with "capsule" equipment for reconnaissance duties.[25] In the latter case, the 6-man crew B-52B became an 8-man RB-52B crew.

Configuration Planning — February 1951

Boeing started working on the B-52B design in February 1951, concurrent with signature of the first production document.

Design Improvements — 1951-1954

Because the aircraft design was derived from the B-47, the B-52B (as well as the fairly similar B-52A) benefited from the start from hard-earned experience. Always hovering over the program was the specter of the B-47's initial deficiencies and delays. Both the contractor and the Air Force seemed determined that the B-52 would not endure such problems. Characteristics of the intensive B-52 development were 670 days of testing in the Boeing wind tunnel, supplemented by 130 days of aerodynamic and aeroelastic testing in other facilities. In essence, Boeing personnel designed, built, and developed the B-52 as a well-knit, integrated packaged system. Parts were thoroughly tested before being installed in the new bomber. Improvements suggested by the YB-52's early flight tests appeared on B-52B production lines. That these changes were few remained worthy of note. Test reports were generally pessimistic, concerning themselves with every aerodynamic

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[25] The result of another policy reversal. See pp 235-236.

fault, however serious or minor, suspected or real. In 1953, more often than not, the published account of a B–52 test flight included the unusual statement that "no airplane malfunctions were reported." But the B–52B development was lengthy. Moreover, several B–52Bs, although earmarked for SAC, were diverted to the test program before joining the operational forces. The B–52B's early participation in complex flight tests soon pinpointed desirable production improvements—giving way in turn to new models in the series. Nevertheless, the airplane was considered to be outstanding, and the praise of Maj. Gen. Albert Boyd, the Wright Air Development Center's Commander, would long be remembered. General Boyd, who was also one of the Air Force's foremost test pilots, in May 1954 said that the B–52 was the finest airplane yet built. In a lighter mood, the general told his staff that someone should try to discover how "we accidentally developed an airplane that flies so beautifully."

Procurement Changes 1952–1955

Letter Contract AF33(600)–22119 of September 1952, which called for 43 RB–52Bs, gave way to a definitive contract that was signed on 15 April 1953. In May 1954, an amendment to this contract reduced the number of RB–52Bs by 10 (leaving 33 RB–52Bs on order) and directed construction of the canceled planes in the configuration of the next model series (RB–52C). The May 1954 amendment also added 25 other RB–52Cs on the 15 April 1953 contract. Hence, even though a sizeable B–52 program had been approved in mid-1953, Boeing in May 1954 had only 88 airplanes under contract—3 B–52As, 17 RB–52Bs (per definitive contract AF33(038)–21096 of November 1952), 33 RB–52Bs, and 35 RB–52Cs. Moreover, forthcoming procurement would not affect the current program—the first new order in August actually calling for still another B–52 model. Just the same, the modest program so far endorsed was not immune to further changes. Of significance, from the early procurement standpoint, was an Air Force decision, made official on 7 January 1955, that flatly reversed the Air Staff directive of October 1951. It gave the B–52 first priority as a bomber and once again relegated the aircraft's reconnaissance potential to a secondary role.[26] As a result of the new decision, the 50 RB–52Bs and 35 RB–52Cs

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[26] The January 1955 decision coincided with a procurement order for several specialized reconnaissance versions of the Martin B–57 Canberra. These planes would all go to the Strategic Air Command, sometime in early 1956. In the ensuing years, SAC also got a contingent of high-altitude, reconnaissance U–2s, developed by Lockheed and first flown in 1955.

were redesignated B-52Bs and B-52Cs, respectively. Besides, as finally built, 23 of the 50 B-52Bs could not be used for reconnaissance.

Production Slippages 1953-1954

As planned in early 1951, B-52 deliveries were due to start in April 1953. A 15-month slippage soon occurred, because of the Korean War and its many implications. Revised production schedules set up in June 1952 called for the B-52Bs to be delivered between April and December 1954, but additional procurement (finalized in April 1953) extended deliveries to April 1956. Meanwhile, the Air Force accepted 2 B-52Bs in 1954—1 in August and 1 in September. However, scheduled deliveries were suspended for 90 days, while Boeing engineers sought to correct cracking in the landing gear trunnion forgings. This second loss of time was never recouped, the last B-52B reaching the Air Force in August 1956—3 months behind schedule. Yet, once the Air Force decided to go ahead with large-scale procurement, the bulk of the production program went forward with few delays.

First Flight (Production Aircraft) December 1954

Boeing first flew the B-52B in December 1954. Like the B-52A (and subsequent models in the series), the B-52B Stratofortress was impressive. The new aircraft had twice the wingspan and nearly 3 times the wing area of the B-17, and its 8 engines delivered 10 times the power of the B-29. The B-52B's tail fin stood as tall as a 4-story building, while the bomber's length of almost 157 feet spanned over half the length of a football field. The B-52B's wingspan of 185 feet represented a greater distance than that travelled by Orville Wright in his historic first flight at Kitty Hawk, North Carolina.

Enters Operational Service 29 June 1955

SAC assigned its first B-52, a B-52B (Serial No 52-8711) that could be converted for reconnaissance, to the 93d Heavy Bomb Wing, at Castle AFB, California. The 93d, a former medium bomb wing flying late model B-47s, used its new aircraft for crew transition training. SAC had planned from the start that the B-52s would be integrated into B-36 units on a 1-for-1 replacement basis—with retired B-36s being salvaged. Also, units would be converted 1 squadron at a time to facilitate B-52 operations and to prevent problems likely to arise in the assignment of maintenance equipment.

Combat ready on 12 March 1956, the 93d Wing regressed to a nonready status 2 months later, when it was authorized 15 additional B-52s. The wing was again fully operational on 26 June 1957, after crew training had become its primary mission.[27] Most of the B-52Bs produced were assigned to the 93d. A few early B-52Bs were first earmarked for testing, but they too ended with the heavy bomb wing.

Initial Problems 1955

Uncertain B-52 delivery schedules precluded proper budget planning, affecting in turn crew training, maintenance scheduling, and stocking of spare parts. There were shortages of ground support equipment, dual bomb racks, crew kits, electronic countermeasure components and training items. Delayed construction of maintenance facilities, the lack of warehouse space to store flyaway kits, as well as shortages of operational facilties for squadron briefings and other functions were serious handicaps. In addition, the failure of B-52 ramps and taxiways together with runway deterioration interfered with operations. These initial problems, practically resolved at Castle AFB by the end of 1955,[28] were to prove far more severe at many of SAC's future B-52 bases.

Early Deficiencies 1955-1956

Fuel leaks, icing of the fuel system, imperfect water injection pumps, faulty alternators and, above all, deficient bombing and fire-control systems were the main troubles of the early B-52Bs. However, these deficiencies as a whole were not as severe as those usually encountered by a new bomber,

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[27] The Air Training Command had no B-52 school, and SAC's new bombers had to become operational as soon as possible. The best way to solve the problem was for SAC to handle the training of B-52 crews with a combat crew training squadron. This did not create a precedent, the same procedure having been used in SAC's B-36 training program at Carswell AFB, Tex. The 4017th Combat Crew Training Squadron was established at Castle AFB on 8 January 1955, as an integral part of the 93d Wing. When the B-52 training task became too great for 1 squadron, the wing's 3 other squadrons took over flight training, with the 4017th assuming ground instruction and the administrative phase of the program. As a rule, the training program consisted of 5 weeks of intensive ground school and 4 weeks of flight training, totaling between 35 and 50 hours in the air.

[28] Castle AFB's parking ramp and runways were strengthened to handle 450,000-pound loads (the forthcoming B-52C's expected take-off weight). The width of the taxi strips was increased 175 feet. In October 1955, postflight B-52 docks, as well as operations and engineering buildings were under construction. A large hangar had been completed.

and far less distressing than those experienced by the B-47 at the same stage of its career. In any case, most of the B-52B's initial problems were not entirely unexpected. Air Research and Development Command and Air Materiel Command had been insisting for months that the aircraft should be perfected before delivery. Strategic Air Command, in contrast, steadfastly objected to further postponement,[29] believing the aircraft should be accepted and modified at a later date—which they were. SAC's objections to more delay were not inconsistent. General LeMay continued to press for the best weapon system for his force. But after approval of a configuration as nearly perfect as possible, the SAC Commander thought too many immediate improvements, refinements, or additional requirements could well be self-defeating. As late as February 1955, SAC protested against "unneccessary changes;" pointed out that operational units would benefit from "more standardization" in the B-52s; and asked to participate in the coordination of all engineering change proposals. While AMC, which was assigned executive responsibility for the new bomber, did not wish to concede any of its engineering prerogatives, SAC did get its way. Some 170 engineering change proposals suggested for the first 20 B-52s were reduced to 60 by the end of March.

Other Temporary Flaws 1955–1956

In October 1955, Boeing engineers had yet to solve the problem of cabin temperatures. The pilots, sitting high in the nose, were comfortable at a given heating setting. However, observer and navigator, sitting with their feet against the bottom of the fuselage, with the metal sometimes reaching 20 degrees below zero, suffered from the cold—the wearing of winter underwear, heavy clothing, and thick flying boots hardly helping.[30] Conversely, if enough heat was turned on to keep the observer and navigator warm, the pilots became overheated. Pilots also criticized the new bomber's high-frequency communications system. First installed in the B-47, the AN/ARC-21 long-range radio was proving even less reliable in the B-52.

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[29] Most in the Air Force seemed to agree that production should wait until research and development had worked most of the kinks out of any new aircraft. Yet different opinions cluttered the key issue of determining at what point an article was ready for full-scale production. One might conclude that SAC, ill-equipped at the time for its awesome responsibilities, wondered how much caution and time it could reasonably afford.

[30] The problem was compounded by another factor for which the B-52 could not be blamed. The development of personal equipment lagged years behind airframe and engine. Crew MC-1 spacesuits, parachutes, and other paraphernalia were uncomfortable. Crew fatigue from flying the new bomber was often insignificant, compared to that caused by wearing all this survival equipment.

Engine Problems 1955-1956

The J57 engines of the B-52 at first presented a serious problem. The principal difficulty persisting in mid-1955, when the aircraft started reaching SAC, was that none of the various J57s performed adequately with water injection, a process due to augment the engine's thrust at takeoff. The YB-52's J57-P-3 engine had been discarded after many modifications failed to keep it from shutting down at high altitude, regardless of speed. In addition, the power-poor and therefore temporary P-3 could not use water.[31] Equally frustrating were concurrent difficulties with other models of the J57, which left the P-1W as the only fully-qualified engine, even though its performance was substandard. Although fitted for water injection, this model had to be used as a dry engine. For lack of anything better, about one-half of the B-52B fleet was fitted with P-1Ws. The J57-P-9W, slated to succeed the P-1, ran into trouble. It was a lighter engine, incorporating titanium components. Unfortunately, the titanium compressor blades cracked as a result of both forging defects and of substandard metal containing too much hydrogen. A return to steel parts, at a weight penalty of 250 pounds, produced the J57-P-29W[32] and J57-P-29WA engines, which equipped most other B-52Bs. However, by mid-1956 the titanium problems had been solved and the P-19W, a higher-thrust version of the titanium-component P-9W, appeared on the last 5 B-52Bs.

Grounding 1956

The Air Force surmised that the first fatal B-52 accident in February 1956 was caused by a faulty alternator. Twenty B-52Bs, carrying the suspect equipment, were immediately grounded. In addition, the Air Force stopped further B-52 deliveries. In mid-May, after Boeing seemed reasonably convinced that the alternator problem was solved, more aircraft were accepted. However, the alternator problem later resurfaced. The B-52Bs were again temporarily grounded in July, this time because of fuel system

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[31] Even before the B-52 was built engineers recognized that a serious thrust problem would show up during a fully loaded takeoff, particularly on days when runway temperatures approached 100 degrees Fahrenheit. For a while, it seemed jet assisted takeoff units would be needed to provide reserve auxiliary thrust. The Air Force canceled such a project in April 1954, following Pratt and Whitney's successful development of a water injection system that promised to rectify the thrust deficiency. The unexpected difficulties that followed were serious, but not insurmountable.

[32] The rate of water that could be injected in the P-29W engine was only half that of the P-29WA. Subsequent modifications brought the P-29W to the P-29WA's standard.

and hydraulic pack deficiencies. Although this latest grounding did not last long, the 93d Wing's training program suffered. In mid-year, no combat-ready crews were available for the 42d Heavy Bomb Wing's new B-52s.

Support Achievements 1955–1956

The lessons learned during the B-47 conversion program were put to good use in preventing many B-52 maintenance and supply problems. Specialists associated with jet engines, the repair of fuel tanks, and the maintenance of all kinds of systems (bombing, navigation, hydraulics, electrical, and the like), were dispatched to Air Training Command for schooling on B-52 components, their education proving easier than their original transition from propeller-type aircraft to the jet-powered B-47. Other steps were taken to avoid, or at least to minimize, potential difficulties. After 2 years of bickering with SAC, AMC finally consented to establish special holding accounts at various supply depots for ground support equipment. The "Z" accounts, as they were known by 1955, had two distinct advantages. First, they segregated the various equipment needed by the B-52. Secondly they ensured that the 800 or so B-52 line items, which they eventually comprised, would be used exclusively in support of such aircraft. Once the "Z" accounts were established, SAC made certain that all available support items were in place, whether at Castle or elsewhere, prior to the arrival of any B-52. Yet, the Air Staff agreed with SAC that much more would be necessary to thwart other possible support problems of the B-47 type. As a result, in the summer of 1955 the Air Staff asked AMC to study how to speed up the repair of future malfunctions reported by operational units. The Air Staff's request and ensuing discussions between AMC and SAC representatives gave way to Sky Speed, a program organized by AMC's Oklahoma Air Materiel Area. And, before long, Sky Speed set up 1 contractor maintenance team of 50 people at every B-52 base. The Sky Speed teams did not participate, even indirectly, in the important modification projects subsequently done at the Boeing-Wichita plant. Nor did they take over the depot workload of the San Antonio Air Materiel Area, which was responsible for the B-52 inspect and repair as necessary (IRAN) program. However, the teams did reduce the time B-52s spent at the depot by doing much of the work that would ordinarily await the IRAN cycle. The maintenance teams practically kept the aircraft flying, because they immediately corrected noted safety deficiencies, installed fixes, and performed a great many other technical chores. As a rule, it took an average of 1 week for a B-52 to go through a Sky Speed routine checkup, and each B-52 received at least 1 checkup per year.[33]

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[33] By 1958, Sky Speed had reaped such success that a similar program was being devised for SAC's KC-135s.

Post-Production Modifications 1956-1958

Sunflower, a modernization project handled by Boeing, brought 7 early B-52Bs to the configuration of the next model in the series (B-52C). Started in the summer of 1956 at the Wichita plant, the project involved the installation of approximately 150 kits. Sunflower took time to accomplish; the last modified B-52B was not returned to SAC until December 1957. B-52Bs underwent many other modifications. They participated in such projects as Harvest Moon, Blue Band, and Quickclip, all of which were first initiated for the benefit of subsequent B-52 models.

End of Production 1956

The Air Force took delivery of the last B-52B in August.

Total B-52Bs Accepted 50

The Air Force accepted 50 B-52Bs, 27 of which qualified as RB-52Bs.

Acceptance Rates

The Air Force accepted 13 B-52Bs in fiscal year 1955 (the first one in August 1954); 35 in FY 56, and the last 2 in FY 57 (1 each in July and August 1956).

Flyaway Cost Per Production Aircraft $14.43 million

Airframe, $11,328,398; engines (installed), $2,547,472; electronics, $61,198; ordnance, $11,520; armament, $482,284.[34]

Subsequent Model Series B-52C

[34] Cost breakouts were sometimes undeterminable and occasionally misleading. For instance, contractor-furnished equipment such as electronics might be included in the airframe's cost, instead of being broken out to its proper category. Similarly, the costs of some components and subsystems were often lumped under armament, a category carried on Air Force records as "other, including armament."

Other Configurations

RB-52B and NB-52B

RB-52B—Development of the RB-52B, once briefly referred to as the RX-16,[35] dated back to the early part of 1951. The reconnaissance model featured multi-purpose pods[36] carried in the aircraft's bomb bay. Initially, 17 pods were ordered, solely as flight test articles. The pods were pressurized and equipped with downward ejection seats for the 2-man crew. For search operations, the multi-purpose pod contained 1 radar receiver (AN/APR-14) at the low frequency reconnaissance electronic station, and 2 radar receivers (AN/APR-9) at the high frequency station. Each station had 2 pulse analyzers (AN/APA-11A), with which to process the collected data. The pod also housed 3 panoramic receivers (AN/ARR-88), and all electronic signals were recorded on an AN/ANQ-1A wire recorder. Photographic equipment consisted of 4 K-38 cameras at the multi-camera station, and 1 camera (either a T-11 or K-36) at the vertical camera station. For mapping purposes, the pod had 3 T-11 cartographic cameras. A December 1951 mockup inspection of the multi-purpose pod went well, no major changes being requested. SAC wanted a special electronic reconnaissance (or ferret) pod but this project did not encounter the same success. Work at Boeing progressed smoothly. Air Research and Development Command ascertained that 1 ferret pod-equipped aircraft could gather in a single flight all the electronic reconnaissance data formerly obtained by 3 conventional RB-52s. Nevertheless, the Air Staff canceled the project in December 1952, and a second SAC request in 1954 for a separate ferret pod did not fare any better. By 1955, however, the original multi-purpose pods had become "general purpose capsules," carrying the latest search, analysis, and direction-finding devices. While the more modern capsules might not satisfy all of SAC's requirements, they constituted clever, if temporary, cost-saving expedients. The capsule, which could be winched in and out of the bomb-bay, added only 300 pounds to the weight of the basic aircraft. Finally, the capsule's installation was so simple that it took just 4 hours to convert a B-52 to the reconnaissance configuration. First flown at Seattle on 25 January 1955 (actually, several months ahead of latest schedules), capsule-equipped B-52Bs began reaching SAC's 93d Heavy Bombardment Wing on 29 June. Phaseout of the 27 RB-52Bs followed the B-52B's pattern.

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[35] The X-16 or RX-16 designation, first applied to a post-World War II reconnaissance project, was reserved for the test version of high-altitude aircraft and was never permanently used.

[36] A pod is a compartment or container, often streamlined, attached or incorporated into the outer configuration of an airplane or rocket vehicle. The term is usually qualified. For example, a wing pod is a streamlined nacelle slung beneath an airplane's wing, especially for the installation of a jet engine or engines, while a pod gun was a housing for a machine gun.

NB–52B—After undergoing permanent modifications similar to those made on the last B–52A, the eighth B–52 production was redesignated NB–52B. In this configuration, the new bomber was credited with 140 of the 199 X–15 flights resulting from the NB–52/X–15 combination.[37] The NB–52B also participated in many other important projects, including the lifting body research aircraft program sponsored by the Air Force and the National Aeronautics and Space Administration (NASA). Started in 1966, the program's test flights were still going on in late 1973, with Martin-Marietta's needle-nosed X–24 soon to be tested with the NB–52B. The permanently modified B–52B was also used to test solid rocket boosters for the space shuttle. Moreover, as a mother ship, it was expected to play an active role in the remotely piloted research vehicle program, another joint project of the Air Force and NASA. The NB–52B, like the A-model, carried the price tag of the bomber from which it derived. In each case, however, an additional $2 million was spent to fit the basic aircraft for its many experimental tasks.

Phaseout 1965–1966

In March 1965, SAC began retiring B–52Bs that had reached the end of their structural service life, some of the planes going to the Air Training Command for ground crew training. The first B–52B (Serial No 52–8711), received by SAC 10 years earlier, deserved special treatment. On 29 September, it was donated to the Aerospace Museum at Offutt AFB, Nebraska, for permanent display. The remainder of SAC's 2 B–52B squadrons were earmarked for accelerated phaseout in early 1966, and by the end of June all B–52Bs had been sent to storage at Davis-Monthan AFB, Arizona.

Milestones May 1956

On 21 May, an Air Research and Development Command B–52B, flying at 50,000-foot altitude above the Pacific Ocean, dropped a hydrogen bomb over the Bikini Atoll. It was the first time a B–52 was used as a carrier and drop plane for the powerful thermonuclear weapon.

[37] After being dropped from the wing of the NB–52B mothership, the X–15 flew to altitudes of more than 250,000 feet and reached speeds exceeding Mach 6, with air friction heating its skin to 1,100 degrees Fahrenheit.

Items of Special Interest **November 1956**

On 24 and 25 November, in a spectacular operation called Quick Kick, 4 B-52Bs of the 93d Wing joined 4 B-52Cs of the 42d Bomb Wing for a nonstop flight around the perimeter of North America. The most publicized individual flight was that of a 93d Wing B-52, which originated at Castle AFB and terminated at Baltimore, Maryland, covering some 13,500 nautical miles in 31 hours and 30 minutes. SAC promptly pointed out that the flight would have been impossible without 4 flight refuelings by KC-97 tankers. Also, flying time could have been reduced by 5 or 6 hours with the refueling help of a higher, faster flying all-jet tanker, such as the KC-135 then being developed by Boeing.[38]

January 1957

From 16 to 18 January, in another spectacular operation called Power Flite, 3 B-52Bs of the 93d Bomb Wing made a nonstop, round-the-world flight. With the help of several KC-97 inflight refuelings, the lead plane, Lucky Lady III, and its 2 companions completed the 24,325-mile flight in 45 hours and 19 minutes, less than one-half the time required on the Lucky Lady II flight—the first-ever nonstop round-the-world flight, accomplished in February 1949 by a B-50A that was refueled by KB-29M tankers. The National Aeronautic Association subsequently recognized Operation Power Flite as the outstanding flight of 1957 and named the 93d Wing as recipient of the Mackay Trophy.

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[38] SAC's 93d Air Refueling Squadron at Castle AFB received the command's first all-jet tanker on 28 June 1957. The acquisition of KC-135s meant a great deal to SAC. Mating the new tanker and the B-52 would pay high dividends. It would reduce refueling time and increase safety, the latter remaining a constant goal of the command. Specifically, with a KC-135, the refueling rendezvous could be conducted at the bomber's normal speed and altitude. In contrast, using a KC-97, the B-52 had to slow down and descend to lower altitudes than normal to accomplish the hookup—an exacting exercise.

B-52C

Manufacturer's Model 464-201-6

Previous Model Series B-52B

New Features

Increased gross weight (450,000 instead of 420,000 pounds), larger underwing drop tanks, improved water injection system, and white thermal reflecting paint on the under surfaces were the B-52C's main new features.

Configuration Planning December 1953

As a product of the evolutionary process, the B-52C design did not take shape until December 1953.

First Flight (Production Aircraft) March 1956

Less than 30 months elapsed between design and first flight.

Enters Operational Service 1956

All B-52Cs went to the 42d Bomb Wing at Loring AFB, Maine. The 42d received its first B-52C on 16 June 1956, but did not become combat ready until the end of the year.

Avionics Problems 1956-1957

The B-52 (like the B-47) carried only a tail turret for defensive armament. Providing a suitable fire-control system for the aircraft was particularly important, but proved to be a problem from the start. The A-3 system that equipped the B-52A and a few B-52Bs, was capable of both optical and automatic tracking and search, but because of deficiencies, it was replaced by the MD-5. Installed in most B-52Bs, the MD-5 fire-control system did not live up to expectations. Hence, a theoretically perfected A-3, after reappearing on the last 7 B-52Bs, was fitted in every B-52C. Still unsatisfactory, the A-3 was supplanted by the MD-9 in subsequent B-52 models. The bombing-navigation system was another difficulty of the B-52 program. Moreover, the problem promised to be fairly constant, since any progress was likely to be counteracted by enemy technical developments. The problem of bombing navigation was not new. It had plagued Convair's B-36 and still hampered Boeing's B-47. Actually, the Air Force and various contractors had been wrestling for years with the difficulties associated with accuracy, a primary requirement of any bombing system, multiplied many times in importance by the high cost of nuclear weapons. Simply stated, the bombing-navigation system of the atomic age called for greater instrumental accuracy, increased automatic operation to reduce human error, and immunity from more sophisticated defenses. Two main systems remained under consideration as late as 1953:[39] the K-series bombing-navigation system, which relied essentially on radar and optics, and the MA-2 or Bomb Director for High Speed Aircraft system. The MA-2 combined an optical bombsight, a radar presentation of target, and an automatic computer, together with radar modifications designed for use in high-speed aircraft. The MA-2 appeared ideally suited for both the B-47 and the B-52, but SAC did not believe that the system would be tested sufficiently even by the end of 1955. And while the Strategic Air Command was willing to overlook certain minor deficiencies, it stood firm on the issue that no bombing system that had not been tested or fully approved would be installed in any of its bombers. When the B-52s started reaching the Air Force, neither the K-2 or K-4 bombing-navigation systems of most B-47s, nor the B-36's K-3A had proven satisfactory. For lack of any better system, the K-3A was fitted in some early B-52Bs. However, at altitudes above 35,000 feet, the K-3A became almost useless—loss of definition and poor resolution preventing target identification. The Philco Corporation came to the rescue with a "black box" that increased the K-3A's power output by 50 percent. Yet, this development was merely an expedient, rather than the beginning of a new and improved system. It gave way to the MA-6A bombing-navigation system, a modernized K-3A which was installed in all remaining B-52Bs. Meanwhile, after being rushed through intensified flight tests, the MA-2 kept acting up. In mid-1955, the system still did not perform as well as

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[39] The XB-52, YB-52, and B-52As actually came off production without any bombing-navigation system.

expected and its autopilot was particularly deficient. Nevertheless, progress was being made. A vastly improved system, the AN/ASB-15, initially equipped the B-52Cs. However, technical refinements did not cease, and most B-52Cs were retrofitted with the AN/ASQ-48 bombing-navigation system.

Other Problems 1956-1957

In mid-1956, the Air Force and the Thompson Products Company were still working on a permanent fix for the faulty alternators that had been responsible for the fatal crash of a B-52B. A new Thompson model, in use by 1957, was much better but still troublesome. Problems occurred because of defects in the alternator drive's lubricating system, which used grease instead of oil. This was expected to be corrected before the end of the year. Another B-52 malfunction, detected in March 1957, had to do with the trunnion fittings of the main gear. Defective fittings were found in nearly all B-52Cs.

Post-Production Modifications 1958-1962

A special project, Harvest Moon, increased the B-52C's combat potential to that of the next model in the series. Otherwise, as in the B-52B's case, B-52C post-production modifications were parts of large programs that concerned themselves with the overall improvement of the entire B-52 fleet. None of those programs was initiated for the sake of the small contingent of B-52Cs.

End of Production 1956

All B-52Cs were built in 1956, the last 5 reaching the Air Force in December.

Total B-52Cs Accepted 35

The Air Force received 35 B-52Cs, the total finally ordered. All B-52Cs could readily be converted to RB-52Cs.

Acceptance Rates

The Air Force accepted 5 B-52Cs in FY 56; 30 in FY 57. Actually, 1 B-52C was accepted in February 1956; the rest, between June and December.

Flyaway Cost Per Production Aircraft — $7.24 million

Airframe, $5,359,017; engines (installed), $1,513,220; electronics, $71,397; ordnance, $10,983; armament (and others) $293,346.[40]

Subsequent Model Series — B-52D

Other Configurations — RB-52C

The 35 B-52Cs, like some of the B-52Bs, could easily be fitted for reconnaissance. The RB-52Cs were superior to the RB-52Bs, since they were powered from the start by higher-thrust engines—8 J57-P-29Ws. The RB-52Cs also benefited from the other improvements first introduced by the B-52C. Of special importance to the reconnaissance role was the extra fuel carried by the C-model, which significantly extended the aircraft's unrefueled range.

Phaseout — 1971

All B-52Cs were phased out of the active forces in 1971. A B-52C (Serial No 53-402) of the 22d Bomb Wing at March AFB, California, was the last one to be retired. The aircraft reached the storage facility at Davis-Monthan AFB on 29 September, only 3 months later than planned some 5 years before.[41]

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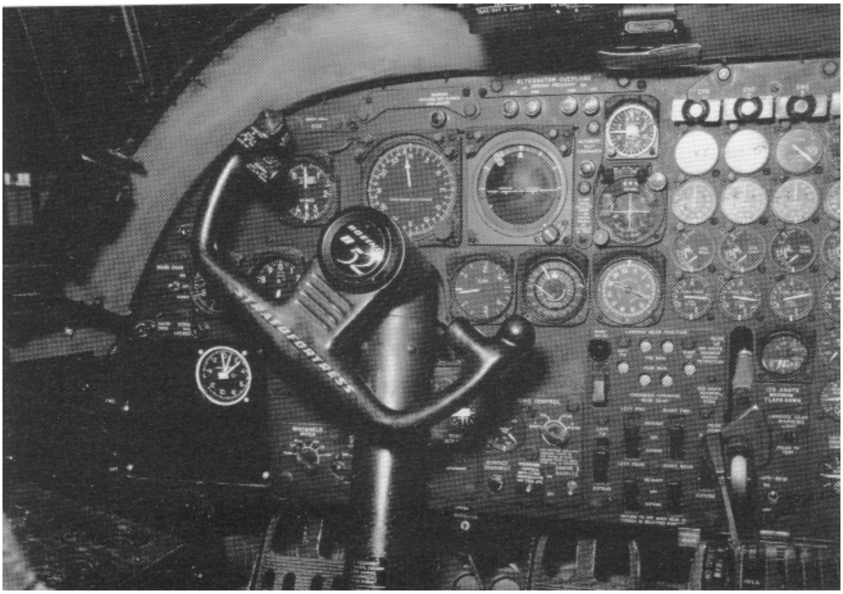
[40] Increased production meant lower unit costs. First beneficiary was the B-52C, acquired at half of the B-52B's price.

[41] In December 1965, a few months after the first B-52Bs started leaving the operational inventory, Robert S. McNamara, Secretary of Defense from 21 January 1961 to 29 February 1968, announced another phaseout program that would further reduce SAC's bomber force. Basically, this program called for the mid-1971 retirement of all Convair B-58s, of the B-52Cs, and of several subsequent B-52 models. Secretary McNamara in December 1965 also stated that 210 General Dynamics FB-111s would be purchased to replace SAC's phased-out bombers. The forthcoming strategic FB-111, closely related to the once highly controversial TFX, was a modified version of the F-111. As such, information on the FB-111 was included in Volume I, *Post-World War II Fighters, 1945-1973*, published by the Office of Air Force History. However, some of the controversies generated by the FB-111 procurement are covered in this volume, in connection with the B-70, AMSA (Advanced Manned Strategic Aircraft), and B-1A projects. See Appendix II, pp 559-593.



View of a B-52 instrument panel.

A Boeing B-52C in flight, its under surfaces coated with white thermal reflective paint.

B-52D

Manufacturer's Model 464-201-7

Previous Model Series — B-52C

New Features

In contrast to the B-52C, easily convertible to the reconnaissance configuration, the B-52D was equipped exclusively for long-range bombing operations. This was initially the most telling difference between the two. Like some of the B-52Bs, the preceding B-52Cs, and subsequent B-52 models, the B-52Ds could carry the newly developed thermonuclear weapons, all necessary modifications being incorporated on the production lines.

Configuration Planning — December 1953

As in the case of the B-52C that it so closely resembled, the B-52D's design was initiated in December 1953.

Additional Procurement — 1954-1956

The B-52D marked the beginning of the B-52 large-scale production. It reflected the mid-1953 decision to raise procurement and Secretary Talbott's final endorsement of a second production plant. The B-52D program also benefited from ensuing program increases, and the "D" became the second most-produced B-52 model. The aircraft were ordered under 4 separate contracts. The first, AF33(600)-28223, finalized on 31 August 1954, covered 50 aircraft; the second, AF33(600)-31267, signed on 26 October 1955, involved 51 B-52Ds and 26 B-52Es—the next model in the series. Like preceding B-52s, the new planes were to be built at the Boeing Seattle plant. The other 2 contracts, AF33(600)-26235 and AF33(600)-31155, finalized on 29 November 1954 and 31 January 1956 respectively, totaled 69 B-52Ds and 14 B-52Es—all to come from Boeing's new production facilities in Wichita, Kansas. The 4 contracts, as well as those that covered other B-52Es and subsequent B-52Fs, were of the fixed price type, with redeterminable incentives.[42]

First Flight (Production Aircraft) 4 June 1956

The Air Force accepted the initial B-52D, a Wichita production, in June 1956, on the heels of the aircraft's first flight. The new Seattle-built B-52D, first flown on 28 September, joined the testing program immediately.

Enters Operational Service December 1956

The new B-52Ds did not reach SAC before the fall of 1956. The first few went to the 42d Bomb Wing, at Loring AFB, replacing the wing's initial B-52Cs. Before the end of December, several B-52Ds had also begun to reach another SAC wing, the 93d. However, while the B-52 inventory at the time already counted almost 100 B-52s (40 B-52Bs, 32 B-52Cs, and 25 B-52Ds), combat-ready crews lagged behind, with only 16 in the 42d Wing and 26 in the 93d. But the command did quickly resolve this problem. Less than 2 years later, SAC had 402 combat-ready crews for 380 B-52s.

Operational Problems 1957-1962

B-52Ds encountered the same initial problems as preceding and subsequent models. They were hampered by fuel leaks, icing of the fuel system, and malfunctions of the water injection pumps. After much frustration, the cause of the pump's failure was uncovered. It was simply due to the fact that the water pumps kept operating when the water tanks were empty. The installation of water sensors was the answer. This was done by Sky Speed teams as part of the water injection system's overall improvement program, which was completed by the spring of 1959. Other problems, however, took longer to solve.[43]

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[42] In 1962, when production ended, 16 definitive contracts had been concluded. In addition, the B-52 program was tagged with at least 25 miscellaneous contracts for special studies, special flight tests, the procurement of mobile training units, of flight simulators, and of other related items.

[43] See B-52F, pp 266-267.

Other Problems 1957–1959

As B–52Ds were becoming more plentiful, B–52Es and B–52Fs were also reaching SAC. Concurrently, the command's base facilities kept deteriorating. The eagerly awaited B–52s put stresses on runways that had been designed for the lighter B–47s or the slower B–36s. SAC's problems were further compounded by the large size of the first B–52 wings, generally composed of 45 bombers and 15 or 20 tankers, all situated on 1 overcrowded base.[44] In mid-1958, paving projects started at 9 of 13 bases which, the command pointed out, needed immediate attention. Paving costs alone were estimated at $25 million. Congress also approved $232 million under the fiscal year 1959 military construction program to cover projects programmed by SAC, but an additional $210 million was denied. While few of the requested alert facilities were affected, drastic cuts were made in other SAC construction projects. Strangely enough, the facilities shortage was alleviated somewhat by another problem. In the late fifties, as the Russian missile threat became more pronounced and warning time shrank, SAC bases presented increasingly attractive targets. The only immediate solution was to break up these large concentrations of aircraft and scatter them over more bases.[45] Existing B–52 wings therefore were broken up into 3 equal-size units of 15 aircraft each. Two units would normally be relocated at bases of other commands, which was not an ideal arrangement since runway deficiencies, as well as other difficulties, would be sure to materialize. In essence, after 1958 each dispersed B–52 squadron became a strategic wing, usually accompanied by an air refueling squadron of 10 to 15 aircraft. The same principle would be followed in organizing and equipping the still growing B–52 force.

"Big Four" Modification Package 1959–1963

Concurrent with the increasing Russian missile threat and the beginning of the B–52 dispersal program, a new difficulty came to light. Namely, there was no longer any doubt that the Soviet Union had developed formidable defenses against high altitude bombers. Of some consolation, enemy defenses were known to be far less reliable and potentially successful against low flying aircraft. Undeterred by the fact that its new B–52s had been

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[44] The early and mid-fifties expansion of the bomber force compelled some of the SAC bases to support as many as 90 B–47s and 40 KC–97 tankers.

[45] In the B–47's case, dispersal was a long-range program. It would be accomplished primarily through the phaseout of wings in the late fifties and early sixties.

designed for high-altitude bombing, SAC wasted no time in planning the best way to face its new challenge. To begin with, all B-52s, except for the early B-52Bs, would have to be capable of penetrating enemy defenses at an altitude of 500 feet or lower, in any kind of weather, and without impairing the bomber's inherent high speed at high altitude. Two other necessary steps were to equip all B-52s, modified for low level, with Hound Dog missiles and Quail decoys, so far due to be carried only by the latest B-52s. SAC's fourth requirement was to add an AN/ALQ-27 electronic countermeasure (ECM) system in every modified B-52. This system, the command believed, would allow the B-52 to automatically counter ground-to-air and air-to-air missiles, airborne and ground fire-control systems, as well as the early warning and ground control interception radars of the enemy. Although the requirements outlined by SAC would involve significant modifications and the addition of complex and costly components, they were approved by Headquarters USAF in November 1959. There was an immediate exception, however. The AN/ALQ-27 production was canceled. The command had wanted 572 B-52s fitted with the new AN/ALQ-27, which promised to integrate all ECM functions into one major subsystem, but this modification alone would cost over $1 billion. The Air Staff chose instead a quick reaction capability (QRC)/ECM combination of black boxes that would cost much less. The B-52H (last of the B-52 model series) would feature this equipment from the start, and it would be retrofitted in other B-52s. However, deletion of the AN/ALQ-27 was not to be the program's only setback. Although eventually successful, the "Big Four" low-level modification—also identified as modification 1000—had to overcome numerous difficulties. First was the lack of money. In early 1960, the Air Staff constantly reiterated that a maximum effort was necessary to eliminate complexities and expensive components that promised only incremental improvements. Meanwhile, low-level modification costs had increased from $192 million in November 1959 to $241 million in March 1960. By July, the cost had risen to $265 million. In August, funds were withheld by the Air Staff pending assurance from the Oklahoma City Air Materiel Area that the work would be completed within the $265 million fund ceiling. At the same time, SAC again emphasized that basic requirements should not be compromised just to keep rising costs down. In any case, technical problems also multiplied. At first sight, the low-level modifications appeared straightforward. They called for improvement of the aircraft's bombing-navigation system, modification of the Doppler radar, and the addition of a terrain clearance radar. Low-altitude altimeters also had to be acquired, and each aircraft had to be equipped to carry its newly allocated missiles. The project was actually far more complicated than it seemed, because it covered different B-52 models. In other words, modifications had to be tailored to fit specific configurations. Airframes had to be strengthened, and they also slightly differed from model to model. As a result, low-level modification costs for each B-52C and B-52D aircraft[46] were almost twice as much as for any other B-52. Finally, development of special terrain clearance radars proved more difficult than anticipated. Nevertheless, most low-level modifications were completed by the end of September 1963. Some ECM improvements, due to be accomplished during the aircraft's regular inspect and repair as necessary program, took longer.[47]

Structural Fatigue 1960-On

The phenomenon of fatigue was yet to be fully understood by 1960, but a great deal had been learned from the B-47's structural problems. For instance, it was well established that takeoffs and landings formed one of the primary sources of fatigue damage. In this case, the B-52, with its wing fuel loads, promised to be especially vulnerable. Moreover, there were other known causes of fatigue: atmospheric gusts, maneuver loads, downwash turbulence from tankers during refueling, taxi, buffet, sonic noise, and stress corrosion. Although flying the B-52 at low level was absolutely necessary, SAC knew there would be a price to pay.

The extent of the damage could not be fully predicted, but gusts at 800 feet were 200 times more frequent than at 30,000 feet. At best, it was believed that low-level maneuvers and gust loads would speed the B-52's structural deterioration by a minimum quotient of 8. Justifying the Air Staff's as well as SAC's opinion, Boeing cyclic testing of a B-52F soon showed that numerous manhours would have to be spent on every B-52F in order to alleviate stress in critical areas of the aircraft. Even though the B-52F contingent was not large, strictly mandatory modifications would total at least $15 million. Meanwhile, following the cyclic tests of a B-52G in early 1960, numerous structural fixes were ordered for the entire B-52 fleet, the B-52Bs included. These modifications, soon carried out as the

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[46] Extra structural modifications accounted for some of the additional expenditure. Another factor was upgrading of the aircraft's initial MA-6A bombing and navigation system, finally replaced in 1964 by the ASQ-48. In any case, the whole project was complex, and modifying the ASQ-38 bombing navigational system of subsequent B-52 models also proved costly.

[47] The ECM improvements were programmed to take place in several phases. Phase I was an emergency modification that provided the necessary minimum ECM equipment to cope with the enemy's radar and surface-to-air missile threat. Phase II was essentially an ECM retrofit that was included in the "Big Four" package. The components installed during Phase II were either equal to or nearly as sophisticated as those introduced by Phase III. The best available ECM equipment, comparing favorably to the deleted AN/ALQ-27, was fitted in Phase III and also featured in the B-52H. Except for the first 18, all B-52Hs were equipped in production for all-weather and low-level flying.

Hi-Stress Program, initially consisted of 2 phases. The Phase I High Stress fixes were scheduled when the aircraft approached 2,000 flying hours;[48] Phase II, when it was nearing 2,500.[49] The Hi-Stress Program was not to interfere with the "Big Four" modification package; it was not allowed to fall behind schedule and was practically completed by the end of 1962. Concurrently, because of the results of the B-52F cyclic tests, an unanticipated third phase was started. The High Stress Phase III consisted of inspecting and repairing, as necessary, wing cracks in all early B-52s. Sky Speed teams and personnel of the Oklahoma and the San Antonio Air Materiel Areas again took care of most of the work. But these modifications, as thorough as they were, only marked a beginning. In the mid-sixties, the B-52 remained SAC's primary bomber and modifications were necessary to offset structural weaknesses caused by aging.[50] In the early seventies,

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[48] Phase I counted 9 fixes. The main ones consisted of strengthening the fuselage bulkhead and aileron bay area. Other important fixes were the reinforcement of boost pump access panels and wing foot splice plate.

[49] Phase II called for modification of the upper wing panel splice inboard of inboard engine pods, reinforcement of lower wing panel supporting inboard and outboard pods, reinforcement of upper wing surface fuel probe access doors, and strengthening of a bottom portion of the fuselage bulkhead. Some work was to be done also on the upper wing panel splice, 8 feet inboard of the outboard engine pods.

[50] An engineering change proposal (ECP 1128), approved in 1964, was scheduled for completion in June 1966. It called for various structural improvements, including replacement

The D-model was equipped solely for bombing missions.

similar projects would be undertaken either to beef up or to modernize selected models of the elderly B-52s.

Big Belly Modifications December 1965

Less than 6 months after the B-52s became involved in the Vietnam War (B-52Fs were the first to go), the Air Force initiated a special modification program to allow the B-52Ds to carry more bombs. Referred to as Big Belly, the modification program left the outside of the aircraft intact. Modified B-52Ds could still carry twenty-four 500-pound or 750-pound bombs externally, but the internal changes were significant. Reconfiguration of the B-52D bomb bay allowed the aircraft to carry 84, instead of twenty-seven 500-pound bombs, or 42, instead of twenty-seven 750-pounders, for a maximum bomb load of about 60,000 pounds—22,000 pounds more than the B-52F.

Overseas Deployment April 1966

B-52Ds of the 28th and 484th Bomb Wings, deployed to Guam in April 1966, immediately began to replace SAC's B-52Fs in the Vietnam conflict. All B-52Ds committed to Southeast Asia had been modified to carry more bombs than the planes they relieved. In the spring of 1967 modified B-52Ds began also to operate out of U Tapao Airfield in Thailand. From there, the aircraft would complete their mission without inflight refueling, which was necessary when operating from Guam. This saved both time and money.

Additional Training 1968

Because of the war, SAC established on 15 April 1968 a Replacement Training Unit within the 93d Bomb Wing's 4017th Combat Crew Training Squadron at Castle AFB. The unit's purpose was to cross-train every B-52 crew, from the B-52E through the B-52H model, in the operation of B-52D aircraft. After 2 weeks of training, the crews were used to augment the cadre units in Southeast Asia. This spread out combat duties more equitably among the entire B-52 force and provided the crews needed to meet the increased bombing effort.

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of the vertical fin spar and skin. It would enable most of the B-52s to resume unrestricted operations, but was expected to cost $230 million.

Other Structural Modifications 1966–1968

When a single B-52, set aside for static testing, was subjected to final destruction back in February 1955, its wings accepted 97 percent of the ultimate up-bending load before failing—an entirely satisfactory outcome for the configuration tested. However, since that time, the B-52 had flown many hours and far more years than expected. Furthermore, many of the hours accumulated by the 10-year-old bomber had been flown at low-level, which put a great deal of extra stress on an aircraft structure, originally intended for high-altitude bombing. Therefore, the structural modifications, approved in the mid-sixties as a result of engineering change proposal 1243, came as no surprise. Started in December 1966, this modification program ensured selected B-52s of an additional 2,000 hours of service life. All Big Belly B-52Ds, reconfigured with high-density bomb bays, were automatically earmarked for the work. The others were chosen according to a very straightforward formula. Namely, B-52C, D, or F models qualified if they were nearing their flying maximum of unrestricted "E" hours and had not been tabbed for upcoming phaseout.[51] The modification program was completed during the second half of 1968, at a cost of approximately $16 million, after replacing fatigued structural parts in the most critical wing areas of the involved planes.

Special Modifications 1969–1971

Because they had already been fitted to carry heavier bombloads, a number of B-52Ds were earmarked for another round of modifications. The changes this time would allow the aircraft to carry extra aerial mines. As requested by Deputy Secretary of Defense David Packard in December 1968, the project had been thoroughly reviewed, the Air Force concluding that the suggested modification of later B-52 models would be less efficient and more costly—$6.9 million instead of $6.3 million. Although the Air Force's selection was approved by the Office of the Secretary of Defense in mid-1969, the B-52D special modifications were only completed in the fall of 1971.[52] Not too soon, it seemed, for President Richard M. Nixon ordered the mining of North Vietnam's harbors and river inlets on 8 May 1972.

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[51] The "E" hour was an equivalent used to indicate the fatigue damage accrued in the wing structure of all B-52C, B-52D, and B-52F bombers.

[52] It also took time to finalize logistics agreements with the Navy for procurement, modification, storage, and delivery of mines.

Southeast Asian Losses 1966–1973

The Vietnam conflict cost SAC 22 B–52Ds. Surface-to-air missiles and other ground defenses accounted for 12 of the losses. Ten B–52Ds were lost in operational accidents of one kind or another.

End of Production 1957

The B–52D production ended in late 1957, the last 6 productions being accepted by the Air Force in November.

Total B–52Ds Accepted 170

The Air Force accepted 101 B–52Ds from Seattle; 69 from Wichita.

Acceptance Rates

Only 1 B–52D was accepted in FY 56 (June 1956); 92 in FY 57 (between July 1956 and June 1957); and 77 in FY 58 (all in calendar year 1957).

Flyaway Cost Per Production Aircraft $6.58 million

Airframe, $4,654,494; engines (installed), $1,291,415; electronics, $68,613; ordnance, $17,928; armament (and others), $548,353.[53]

Subsequent Model Series B–52E

Other Configurations None

Initial Phaseout 1973–1974

In accordance with Secretary McNamara's mid-sixties decision to cut

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[53] Another price decrease, almost $700,000 below the B–52C's cost.

down the strategic bomber force by mid-1971, SAC inactivated 3 squadrons of B–52D and B–52E aircraft during the early part of 1967. This action, however, did not spell the immediate retirement of the aircraft that had been attached to the inactivated units. Badly needed elsewhere, the Big Belly B–52Ds were immediately used to bolster the resources of the B–52D wings committed to Southeast Asia. The B–52Ds actually outlived 2 subsequent B–52 models. In 1973, a partial retirement of the B–52D fleet was planned. Based on the age and condition of their airframe, 45 B–52Ds were earmarked for phaseout by September 1974.

Operational Status — Mid-1973

In mid-1973, SAC forces still counted about 130 B–52Ds. Some of these aircraft were on their way out—45 by the fall of 1974 and a few others soon afterward. But 80 B–52Ds were expected to see unrestricted service into the 1980s. The Air Force was negotiating a contract with Boeing for the Wichita fabrication of kits and the reworking of wings that would be installed on the 80 B–52Ds, during the aircraft's regular depot maintenance. The cost of extending the B–52D's operational life seemed high, over $200 million for 80 planes, but the Air Force believed it had no alternative.[54] As approved by the Office of the Secretary of Defense on 30 November 1972, the modification, identified as engineering change proposal (ECP) 1581, promised to be extensive. It included redesign and replacement of the lower wing skin, to make it similar to the B–52G wing, and in the process Boeing was to use a more fatigue resistant alloy. The wing center panel was also to be redesigned and replaced. Finally, ECP 1581 called for new upper longerons and some new fuselage side skins. Also, the pressure bulkhead in the B–52D nose would be changed. Already delayed for lack of money, ECP 1581 had been programmed to take at least 2 years.

Record Flights — 26 September 1958

Two B–52Ds of the 28th Bomb Wing, Ellsworth AFB, South Dakota, established world speed records over 2 different routes. One B–52D flew at 560.705 miles per hour for 10,000 kilometers in a closed circuit without payloads; the other, at 597.675 miles per hour for 5,000 kilometers, also in a closed circuit without payloads.

[54] As explained by Secretary of Defense Elliot L. Richardson to the Senate Armed Services Committee, without the hi-density B–52Ds, the Strategic Air Command's conventional bombing capability would be at the expense of its other missions.

B-52E

Manufacturer's Model 464-259

Previous Model Series — B-52D

New Features

As rolled out of either the Seattle or Wichita plant, the B-52E hardly differed from the B-52D. It was equipped with more reliable electronics, and the more accurate AN/ASQ-38 bombing navigational system replaced the B-52D's final AN/ASQ-48. The relocation of some equipment and a slight redesign of the navigator-bombardier station increased crew comfort and provided better access to instruments and greater maintenance ease. Other dissimilarities between the 2 models grew from post-production modifications.

Configuration Planning — December 1953

As an improved B-52D, the B-52E development dated back to the end of 1953.

Program Increases — 1954-1956

The beginning of large-scale production, the opening of the Wichita plant, and the 7-wing program endorsed in late 1953 did not satisfy General LeMay. The program's long-range increase to 408 aircraft, as approved in March 1954, remained short of his command's requirements. On 20 June 1955, the Air Force Council recommended that the B-52 program be raised to 576 and that production be accelerated. Secretary Talbott approved the council's recommendation, but pointed out that money remained the limiting factor and only 399 aircraft would be produced on an accelerated basis, beginning in mid-1955. The further increase to 576, the Secretary indicated, would depend entirely on the amount of funds obligated in the coming 2 years.[55] In September 1955, on the

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[55] On 15 August 1955, Donald A. Quarles replaced Harold Talbott as Secretary of the Air Force.

assumption that money would indeed be forthcoming, SAC began to plan the equipping of 11 bombardment wings, each with 45 B–52s. Five command support B–52s would be added to each wing once every unit had been converted as programmed. In the spring of 1956, the Subcommittee on the Air Force of the Senate Armed Services Committee undertook a review of American airpower. Asked for his opinion, General LeMay again urged that the B–52 production be increased. In December, the President's budget set the B–52 program at 11 wings, and reprogrammed procurement to acquire 53 additional B–52Es, starting in mid-1957, when fiscal year 1958 funds would become available.

Additional Procurement 1955–1956

The B–52E procurement was covered by 4 definitive contracts, funded in fiscal years 1956 and 1957. The first one, AF33(600)–31267, concluded on 26 October 1955, was essentially a B–52D contract to which 26 B–52Es were attached. The second, AF33(600)–32863, signed on 2 July 1956, counted 16 B–52Es and 44 further improved productions (B–52Fs). All such aircraft were to be built in Seattle. The other 2 contracts, AF33(600)–31155 of 10 August 1955 and AF33(600)–32864 of 2 July 1956, also involved other B–52s (either D or F models), but covered 14 and 44 B–52Es, respectively. All would come from the new Wichita plant.

First Flight (Production Aircraft) October 1957

The Seattle-built B–52E was first flown on 3 October 1957, 3 weeks ahead of its Wichita counterpart.

Enters Operational Service December 1957

A few B–52Es began reaching the Strategic Air Command in December 1957.

Initial Operational Problems 1958–1964

Besides sharing the initial deficiencies of other B–52s, the B–52E introduced a new problem. The aircraft's new ASQ–38 bombing-navigation system at first was not as accurate as had been anticipated. It was difficult to maintain, and replacement parts were in short supply. The ASQ–38 problems at first appeared relatively minor, but grew in importance as soon as the B-52E entered the Big Four modification program. Moreover, since the same bombing-navigation system would be installed in all subsequent B-52s, extensive engineering changes were initiated to improve low-level terrain avoidance for the long term. The modifications promised to be time-consuming and costly, and they gave way to a special project, Jolly Well, which exchanged major parts of the ASQ-38 and replaced the terrain computer—another critical component of the overall system. Jolly Well was completed in 1964, after successful modification of the ASQ-38 of 480 B-52s—B-52E, F, G, and H models.

End of Production 1958

The B-52E production ended before mid-1958, the last 3 aircraft being accepted by the Air Force in June.

Total B-52Es Accepted 100

Of the 100 B-52Es accepted by the Air Force, 58 came from Wichita which thus began to assume production leadership over Seattle.

Acceptance Rates

All B-52Es were accepted in FY 58, between October 1957 and June 1958.

Flyaway Cost Per Production Aircraft $5.94 million

Airframe, $3,700,750; engines (installed), $1,256,516; electronics, $54,933; ordnance, $4,626; armament (and others), $931,665.[56]

Average Maintenance Cost Per Flying Hour $925.00

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[56] The B-52E cost less than any other B-52. Although production kept on increasing, the price of ensuing models did not go down. On the contrary, in-production structural improvements, better engines, more sophisticated components, and other technological pluses boosted costs.

Subsequent Model Series B-52F

Other Configurations NB-52E

The second B-52E built (Serial No. 56-632) was assigned from the start to major test programs. It was used for prototyping landing gears, engines, and other major B-52 sub-systems, test results contributing significantly to the improvements featured by subsequent B-52 models. Also, the B-52E test plane underwent permanent modifications in order to participate in highly specialized development projects. Small swept winglets were attached alongside the nose of the reconfigured bomber—NB-52E. A long probe extended from the nose of the modified plane and the NB-52E wings displayed nearly twice the normal amount of controlling surfaces. In addition, traditional mechanical and hydraulic linkages to move the control surfaces were replaced by electronic and electrical systems. Internally, the NB-52E was loaded with a multitude of special electronic measuring systems. The aircraft was first used to develop an electronic flutter and buffeting suppression system. This would decrease the fatigue and stress of aircrews flying at low level. The N configuration participated in another project, known by the acronym LAMS—Load Alleviation and Mode Stabilization. During the LAMS flights, sensors noted gusts and activated the control surfaces to cut down on fatigue damage to the aircraft. In mid-1973, the NB-52E flew 10 knots (11.5 mph) faster than the speed at which flutter normally would disintegrate the aircraft. This was made possible by the aircraft's winglets (canards), which reduced 30 percent of the vertical and 50 percent of the horizontal vibrations caused by air gusts. The NB-52E's contributions were significant, but its cost was relatively low—$6.02 million. Over the years, barely more than $500,000 had been spent to bring the aircraft to its permanent testing configuration. In 1973 its career was nearing its end; the Air Force planned to retire the NB-52E in mid-1974.

Beginning of Phaseout 1967-1973

The Secretary of Defense's decision to reduce SAC's bomber fleet by mid-1971 affected the B-52Es more than it did the B-52Ds. While the B-52Ds of units inactivated in 1967 went to other operational wings, excess B-52Es were designated non-operational active aircraft. This meant that the aircraft were stored with operational units, maintained in a serviceable condition, and periodically flown. However, no additional crews or maintenance personnel were authorized for these planes. A few B-52Es were permanently retired in 1967, but only because they had reached the end of their operational life by accumulating a specified number of flying hours under conditions of structural stress. This phaseout pattern was retained in the following years. In mid-1973, the Air Force still carried 48 B-52Es in its inventory, but they were not part of the active operational forces.

B–52F

Manufacturer's Model 464–260

Previous Model Series B–52E

New Features

New J57–43 engines took the place of the B–52E's J57–P–19s or P–29s. Alternators, attached to the left-hand unit of each pair of the J57–P–43W engines replaced the air-driven turbines and alternators in the B–52E's fuselage. The B–52F's only other new feature was a more efficient water injection system.

Configuration Planning November 1954

Continued improvements of the J57 engine series prompted the November 1954 initiation of the B–52F design. Incorporation of the J57–P–43W engines had to entail some changes. A slight modification of the wing structure also had to be planned in order to install 2 additional wing tanks, which would give the B–52F's injection system an increased water capacity—the system's main overall advancement.

Contractual Arrangements 1956

B–52F procurement was accomplished by 2 B–52E contracts—AF33(600)-32863 and AF33(600)-32834. One contract called for 44 Seattle B–52Fs; the other, for 45 B–52Fs from Wichita.

First Flight (Production Aircraft) May 1958

The Seattle-built B–52F first flew on 6 May; the Wichita-built model, on 14 May.

Production Slippages 1958

Whether from Seattle or Wichita, B-52F deliveries lagged a few months behind schedule because authorized overtime for Boeing personnel was curtailed. Fiscal limitations, imposed by the Office of the Secretary of Defense in late 1957,[57] were the cause.

Enters Operational Service 1958

B-52Fs did not start reaching the Strategic Air Command until June 1958. By the end of the month, SAC's 93d Bomb Wing counted 6 B-52Fs.

Initial Problems 1954-1959

Fuel leaks, occurring in the B-52Fs and preceding B-52s, proved difficult to stop. The problem manifested itself from the start. Marman clamps, the flexible fuel couplets interconnecting fuel lines between tanks, broke down on several occasions during the first few weeks of B-52 operation. This caused fuel gushers that obviously created serious flying hazards. Blue Band, a September 1957 project, put new clamps (CF-14s) in all B-52s. Depot assistance field teams did the retrofit well, but Blue Band did not work. The CF-14 aluminum clamps soon showed signs of stress corrosion and were likely to fail after 100 days of service. Highly concerned, the Air Force and Boeing began replacing the aluminum clamps with a Boeing-developed stainless steel strap clamp, the CF-17. Hard Shell, a high-priority retrofit program, put CF-17 clamps in all in-service B-52s. Completed in January 1958, the Hard Shell retrofit was not a fool-proof solution. B-52 operations were again restricted, as several CF-17 clamps ruptured, this time because of deficient latch pins. CF-17A couplings, CF-17 clamps that had been modified to strengthen their latch pins, were used to correct the problem. But neither Boeing nor the Air Force put too much credence on the new modification. This gave way to Quickclip, a new retrofit project started in mid-1958. All B-52s went through Quickclip, which installed a safety strap around the modified clamps. Several cases of broken latch pins were reported before the end of 1958. However, the safety straps prevented the fuel from leaking out, which was Quickclip's whole

[57] Charles E. Wilson was sworn in as Secretary of Defense on 28 January 1953, and served until 8 October 1957. He was succeeded by Neil H. McElroy, who resigned on 1 December 1959.

purpose. Additional B-52Fs, entering the inventory after the fall of 1958, therefore were also fitted with Quickclip safety straps.

Other Fuel System Problems 1954-1962

Fuel system icing posed another initial and long-lasting B-52 problem which had been shared for several years by other jet aircraft. However, little was known about its cause and effect. A B-52 accident in 1958 brought the problem to a climax, while providing a few definite findings. In many previous crashes, icing of the fuel system had been recognized as a probable cause of accident, but the ice had melted in ensuing fires, leaving no concrete evidence. This time, the Air Force could ascertain that icing of the fuel system strut filters and fuel pump screens had caused the engine to flame out and lose thrust. As a remedial step, B-52s were immediately fitted with filters and screens which promised to be less susceptible to icing. The Air Force in addition initiated new fuel draining procedures and directed use of the driest fuel available. A new fuel booster transfer valve came under development during the same period. The B-52 accident of 1958 also speeded research on fuel additives that would prevent the formation of ice in fuel system components. The Air Force, Boeing, and fuel vendors participated in the intensified research program. Nevertheless, progress was likely to be slow. In the meantime, the only meaningful solution was to put fuel heaters in every B-52 and to do so as quickly as possible. Despite troubles encountered during the thermal shock and vibration tests of the heaters, this retrofit project proceeded according to schedule in late 1959. Concurrently, however, a new problem arose. The fuel additive program, after going on unabated, came to a sudden stop because the additives were damaging the fuel cell's inner coating. But this latest problem was resolved in due time. In October 1962, jet fuel additives had proven so successful in eliminating icing problems that SAC was disconnecting the fuel heaters on its latest B-52s (B-52Hs).

Overall Improvement 1962-1964

The B-52F, after participating in the High Stress and Big Four modification programs, was further improved. Again the improvement covered all B-52s, even the early B-52Bs. It consisted of installing the equipment necessary to detect and locate actual and incipient malfunctions in the bombing-navigation and autopilot systems. This equipment was known as MADREC, an acronym for Malfunction Detection and

Recording.[58] The requirement for MADREC had been established in 1961, and its installation was part of a long-range program. The first stage involved the B–52B, B–52C, and B–52D bombers and was completed by mid-1963. The second stage was directed at the more complicated ASQ–38 bombing-navigation system of the B–52E, B–52F, and subsequent B–52s. In essence, the program was closely associated with the Big Four package. MADREC equipment would play an important role in monitoring the Hound Dog missiles that were carried by almost every B–52, as a result of Big Four. The program neared completion by 1965.

Special Modifications 1964–1965

The revised strategy of the early sixties, calling for a greater non-nuclear retaliatory force, did not leave the B–52 untouched. In June 1964, the Air Staff approved the modification of 28 B–52Fs under a project known as South Bay. Completed in October of the same year, the modification program allowed selected B–52Fs to carry twenty-four 750-pound bombs externally—almost doubling the aircraft's original conventional bombload. In June 1965, as the tempo of activities in Southeast Asia began to escalate, Secretary of Defense McNamara requested that 46 other B–52Fs receive similar modifications. Referred to as Sun Bath, the project this time carried a 1-month deadline. Some problems arose. Multiple ejection racks, beams, kits, and supporting aerospace ground equipment were in short supply. To fulfill its many commitments, Air Force Logistics Command's Oklahoma Air Materiel Area, the project's prime coordinator, had to borrow assets from war reserve materiel and from units of the Tactical Air Command. Just the same, Sun Bath was completed 1 week ahead of schedule.

Southeast Asian Deployments 1965

The first B–52 bombers that entered the war in Southeast Asia were B–52Fs. On 18 June 1965, the initial Arc Light bombing mission was carried out from Guam by 27 B–52Fs of the 7th and 320th Bomb Wings. B–52Fs were the only SAC bombers committed to the Vietnam conflict throughout 1965. Even though all deployed B–52Fs had received ahead of time the

[58] B–47Es were also due to be fitted with MADREC equipment.

South Bay or Sun Bath modifications to increase their bombload to 38,250 pounds, they were replaced before mid-1966 by modified B–52Ds.

Southeast Asian Losses 1965

B–52F participation in Southeast Asian operations accounted for the loss of 2 of the planes. The 2 collided in mid-air on 18 June 1965, on their way to the first Arc Light mission.

End of Production 1958

Production of the B–52F, the last model of the B–52 series built in Seattle, ended in November 1958. The Seattle plant, after manufacturing nearly one-half of the B–52F productions, transferred all B–52 engineering responsibility to Wichita.

Total B–52Fs Accepted 89

The Air Force accepted 44 B–52Fs from Seattle; 45 from Wichita.

Acceptance Rates

The Air Force accepted 10 B–52Fs in FY 58 (all in June 1958), and 79 in FY 59 (between July 1958 and February 1959).

Flyaway Cost Per Production Aircraft $6.48 million

Airframe, $3,772,247; engines (installed), $1,787,191; electronics, $60,111; ordnance, $3,016; armament (and others), $862,839.

Average Maintenance Cost Per Flying Hour $1,025.00

Subsequent Model Series B–52G

Other Configurations None

Beginning of Phaseout 1971–1973

Although the 93d Bomb Wing retained every one of its B–52Fs, 1971 marked the beginning of the aircraft's phaseout.[59] Retired planes went to Davis-Monthan for storage. In mid-1973, the Air Force still possessed 62 B–52Fs. Thirty-six of these aircraft were in the inactive inventory. Other B–52Fs were used for training.

[59] The Air Force retired a few B–52Fs in 1967. As in the B–52E's case, these planes were retired only because they had exceeded their service life criteria.

B-52G

Manufacturer's Model 464-253

Previous Model Series B-52F

New Features

Besides an increase in gross weight (488,000 instead of 450,000 pounds), major configuration changes characterized the B-52G. A principal distinction was the "wet wing," as it was often called, which contained integral fuel tanks that significantly increased the aircraft's unrefueled range. The B-52G retained the B-52F's new J57-P-43W, but the engine's water injection system was improved in duration by the installation of a single 12,000-gallon tank in the forward fuselage. There were many other changes, some of them quite noticeable. The nose radome was enlarged, the size of the vertical fin reduced, the tail cone modified, and the ailerons eliminated. The B-52G's redesigned wings supported 700-gallon fixed external fuel tanks that replaced the 3,000-gallon auxiliary wing tanks, carried by several preceding B-52 models. While retaining the AN/ASQ-38 bombing navigational system, the B-52G featured the new AN/ASG-15 fire-control system, improved electronic countermeasures technology, a powered stability augmentation system, and emergency ejection seats for the entire crew, including the gunner who was moved to a rearward-facing seat, next to the electronic countermeasures operator.[60] Finally, in addition to its standard bombload, most B-52Gs were in production equipped to carry 2 Hound Dog missiles,[61] 1 on a pylon under each wing between the inboard

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[60] The location of the bombardier and radar navigator was unchanged. They sat forward facing behind and below pilot and co-pilot. Prior to the B-52G, B-52s and their normal crew of 6 only had 5 ejection seats, none for the gunner.

[61] The North American AGM-28 (formerly GAM-77) Hound Dog was an air-to-surface missile powered by a single Pratt & Whitney J52 turbojet. The AGM-28 was equipped with an inertial guidance system and a nuclear warhead. Launched at high altitude and supersonic speed, the AGM-28 could reach a target 500 nautical miles away; at low altitude and subsonic speed, the distance was reduced to 200 nautical miles.

nacelles and the fuselage. Four Quail decoy missiles could also be fitted in the bomb bay.[62]

Basic Development 1955–1956

The B–52G design was officially initiated in June 1956. Yet the roots of the new aircraft can be traced back to January 1955, when Convair's delta-wing B–58 appeared to be heading for trouble. The Air Force's indecision about the future of the costly, high-risk B–58 program meant that the next decade might not bring new bombers to replace or supplement SAC's B–52s. Development of a much more potent version of the original B–52, Air Research and Development Command stated, would prevent a possible technical obsolescence of the strategic force in the 1960s. As envisioned in May 1955, the new aircraft would be a B–52 fuselage with a redesigned wing, J75 engines, and a number of detailed changes. General LeMay at first was unenthusiastic about the proposal, which brought to mind the Lockheed F–84F and its many early production problems.

While conceding that the Boeing bomber should be improved "as much as possible" during production, General LeMay argued that the B–52 production schedule should not be disrupted. Although he came to favor the "super B–52" somewhat later, General LeMay noted that if "true meaningful improvement" was to result, the B–52 production schedule would inevitably be slowed down. As urgent as it seemed, the B–52G design did not start until June 1956. Delays in providing $1.2 million for Boeing to complete the necessary study was a factor; another was the Air Staff's continued concern about the B–58 and resulting procrastination in formally approving the Boeing project.

Development Engineering Inspection 16–18 June 1956

Once the Air Force finally decided to endorse the B–52 model improvement, events moved quickly. In July, the Air Staff shifted $8.8 million to the project, funds which, in any case, had been allocated to support engineering changes. In the same month, Boeing held an initial development engineering

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[62] The McDonnell ADM–20 (formerly GAM–72) Quail was a small delta-wing drone, equipped with 1 General Electric J85 turbojet engine. It had a range of several hundred nautical miles, could match the B–52's performance, and accomplish at least 2 turns and 1 speed change. It contained electronic devices that made it look like a B–52 on enemy radar scopes. The Quail was unique among air-launched missiles in that it was the only decoy missile in the United States Air Force.

inspection at its Seattle plant. The purpose of the inspection was to determine the new configuration of the crew compartment. While the Air Force found no specific faults with the arrangements set up by Boeing, it pointed out that many questions remained unanswered. On 15 August, the contractor submitted for review a model improvement program that was more comprehensive. The Air Staff approved the revised program on 29 August, but specified that its implementation would be only on a "minimum sustaining basis" until more was known about the B-58 program. Possible forthcoming fiscal limitations were another reason for curtailing program's implementation.

Mockup Inspection — October 1956

The Air Force inspected and approved the crew compartment's mockup for the improved B-52 toward the end of October. The new configuration, based on the so-called "battle-station" concept, placed the defensive crew (the ECM operator and gunner) facing aft on the upper deck, the offensive team (bombing-navigation system operators) facing forward on the lower deck, and the pilot and co-pilot (still sitting side-by-side) facing forward on the flight deck.

Production Slowdown — 1957

The impact of unforeseen events, international as well as domestic, often played havoc with the best plans. In 1955, B-58 problems worked in favor of producing an improved B-52 (B-52G). In April 1956, the Air Force wanted the B-52 production increased to a monthly rate of 20. In December, the President set the B-52 program at 11 wings and procurement was revamped to provide a greater quantity of improved B-52s (B-52Es). Money from the next fiscal year (FY 58) would cover the procurement changes, and faster production would take place as soon as practicable. But the progress was short-lived. In early 1957, Secretary of Defense Wilson made it known that B-52 monthly production rates would be held at 15. There were several compelling reasons for the Secretary's decision. As explained by Secretary of the Air Force Quarles, progress was being made on the B-58 development, and Mr. Wilson had already indicated that the B-58 would not only merit some production effort, but would definitely get it in due time. Moreover, a slower B-52 output might give the Air Force a larger number of further improved models, this time perhaps fewer B-52Es and more B-52Fs. Other factors bearing on the decision were revised intelligence estimates, particularly the latest information on Soviet Bison and Bear bomber production

Roll-out of the first G-model Stratofortress at Boeing's Wichita plant, July 1958.

rates, which seemed to have slowed down. Those, as Mr. Quarles pointed out in Secretary Wilson's words, were "a little different, and it looked like we had more time to do an orderly job." Finally, it was Secretary Wilson's belief that "in many cases we get cheaper production by phasing it out over a longer period of time and getting more expert people to work on it." The Air Force had few grounds for argument, even though SAC pointed out that the endorsed lower production rates would delay its conversion program by almost 1 year. As expected, the decision stood.

Contractual Arrangements 1957–1959

Reflecting the evolutionary production process, preceding B–52s were acquired through contracts that covered a variety of models. As a culmination of this process as well as continued developmental efforts, the B–52G was purchased under different conditions. Three procurement contracts were issued—AF33(600)-35992, funded in FY 57; AF33(600)-34670, in FY 58, and AF33(600)-37481, in FY 59. All 3 contracts involved B–52Gs only. The first one, a cost-plus-incentive fee contract with a sliding percentage of 6 percent, was initiated by letter contract on 29 August 1957 and finalized on 15 May 1958. It purchased 53 aircraft. The second and largest one was a fixed-price-incentive-firm (FPIF) contract for 101 B–52Gs. It was started by a letter contract on 14 June 1957, and also finalized on 15 May 1958.[63] The third and last B-52G contract, begun by letter contract on 5 September 1958, was concluded on 28 April 1959. It was a straightforward fixed-price-incentive (FPI) contract for 39 aircraft.

Enters Operational Service 1959

The B-52G entered service with the 5th Bomb Wing at Travis AFB, California. The wing received its first B-52G (Serial No. 47-6478) on 13 February, one day after SAC's last B-36 bomber was retired and the command became an all-jet bomber force. In May 1959, the 42d Bomb Wing also started getting B-52Gs. By the end of June, 41 of the new bombers had been received by SAC. The early B-52Gs and 13 more could not carry the Hound Dog missiles.[64] A post-production modification, completed in 1962, accomplished necessary alterations and fitted the 54 aircraft with the equipment required to support as well as fire the new weapons.

Special Tests 1960

B-52Gs, of necessity, played an important role in the Category III testing of both the Hound Dog and Quail missiles. A B-52G crew of the 4135th Strategic Wing accomplished the first SAC launch of a Hound Dog on 29 February 1960. On 8 June, a B-52G crew of the same wing repeated the performance with a Quail decoy. By the end of 1961, a respectable supply of the new missiles—225 Hound Dogs and 400 Quails—had already reached the SAC inventory. However, although the new AGM-28 Hound Dogs had become an important part of the B-52's striking power, the missiles were still highly unreliable.[65]

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[63] The May 1958 contract, as initiated in June 1957, evolved from the President's budget of December 1956, which set the B-52 program at 11 wings and a total of 603 aircraft. The last B-52G contract, started by letter contract in September 1958, and the subsequent procurement of B-52Hs (the last model) were not part of the 11-wing program. They could be viewed as added bonuses, prompted by new dissatisfaction with the B-58 program, concurrent fiscal limitations, and the B-58's high price.

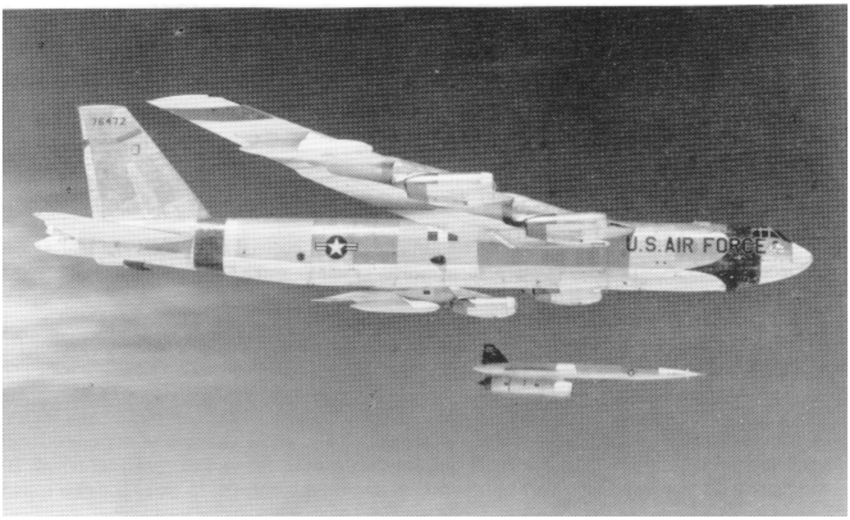
[64] Boeing could not be faulted for the omission. Because of the complexity and high cost of the Big Four modification package, refinement of the many changes under consideration consumed most of 1959. The Air Staff did not decide until the end of that year which B-52 models would be equipped, either in production or through retrofit, to carry the new missiles.

[65] In contrast, the ADM-20 Quail's performance was excellent. In 1963, all Quail decoys were modified for low-level flying. This relatively simple modification added a barometric switch for terrain avoidance and altered the missile's wiring system.

Structural Modifications 1961–1964

Intensive structural testing, conducted by Boeing and the Air Force in 1960, again confirmed that hard usage shortened the structural life of the B-52 aircraft. The B-52Gs and B-52Hs differed significantly from predecessor models, but design changes incorporated in the new bombers made them even more susceptible to fatigue damage. Briefly stated, the changes had been made to extend the aircraft's range, which essentially meant that while the B-52G and B-52H bombers were lighter than preceding B-52s, their fuel loads had been increased. Moreover, the overall decrease in structural weight had been achieved primarily by using an aluminum alloy in the aircraft's wings. While testing did not question the intrinsic strength of the wing, it pinpointed areas of fatigue. No one could forecast accurately when the wing failures would happen, but low-level flying and the structural strains that occurred during air refueling were expected to speed up fatigue considerably.[66] The anticipated problem appeared serious enough for SAC to impose stringent flying restrictions on the new aircraft, pending approval of necessary modifications. In May 1961, the Air Staff endorsed a $219

[66] It was estimated that under fairly similar circumstances, the operating stress placed on the new wing was approximately 60 percent higher than the stress inflicted on the wing of preceding B-52s.



A GAM-77 Hound Dog missile was launched from under a B-52's wing over Eglin AFB, Florida.

million modification program for all B-52G and B-52H wing structures.[67] The program provided for Boeing to retrofit the modified wings during the airplanes' regular IRAN schedule, except for the last 18 B-52Hs, which would get their modified wings on the Wichita production lines. Started in February 1962, the program was completed by September 1964, as scheduled.

Other Structural Improvements 1964–1972

While ECP 1050 had strengthened the wings of the B-52Gs and B-52Hs by September 1964, as already noted, ECP 1128, a major engineering change proposal approved in the same year for the entire B-52 fleet, had just begun.[68] Concurrently, MADREC, a previously described improvement program that also covered most B-52s, was in progress. In addition, various modifications, addressed to specific B-52 models, were either underway or about to start. In spite of such projects, the Air Force believed that major efforts would still be required in the ensuing years to keep extending the structural life of the critically needed B-52G and B-52H bombers. Hence, the Air Staff in October 1967 approved ECP 1195, an engineering change studied by SAC since 1965. Eventually known as the B-52 Stability Augmentation and Flight Control program, the $69 million modifications installed a number of new devices in the bombers. Necessary kits, contracted for in December 1967, began reaching the Air Force in mid-1969, and their installation required 2 years. Meanwhile, ECP 1185, due to cost about $50 million and actually initiated in May 1966, had started to replace the aircraft's fuselage side skin, crown skin fasteners, and upper longerons. Completion of these latest engineering changes, accomplished as usual during the aircraft's regular IRAN schedule, was expected to ensure the structural safety of the B-52G and B-52H airframes through the 1980s.

Special Modifications 1970–1975

In line with current plants to retain the B-52Gs and B-52Hs for years

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[67] The wing structural improvement program, carried out as ECP 1050, replaced the wing box beam with a modified wing box that used thicker aluminum. It also installed stronger steel taper lock fasteners in lieu of the existing titanium fasteners; it added brackets and clamps to the wing skins, added wing panel stiffeners, and made at least a dozen other changes. Finally, a new protective coating was applied to the interior structure of the wing integral fuel tanks.

[68] Shortly before the beginning of ECP 1128, the Air Force had directed that the tail section of all B-52s be reinforced in order to withstand turbulence during low-level penetration tactics. Started in September 1963, this engineering modification (ECP 1124-2) was due to spread over several years.

to come, the Air Force in 1970 decided to equip these bombers with the Boeing-developed AGM-69A nuclear-tipped short-range attack missile (SRAM).[69] Required modifications and the addition of necessary equipment, such as wing pylons, launch gear, rotary launchers, and new avionics would be accomplished by 2 air materiel areas. Oklahoma City would modify all B-52Gs; San Antonio, all B-52Hs. This long-term, $400 million retrofit program began on 15 October 1971, when 1 B-52G entered the Oklahoma City modification center. In March 1972, a SRAM-equipped B-52G was delivered to the 42d Bomb Wing at Loring AFB, Maine. The 42d became SRAM-operational in August, the first of 19 wings programmed to acquire the versatile missiles.[70] Each modified B-52G and H bomber could carry up to 20 SRAMs, 12 externally and 8 inside the rear of the bomb bay.

Southeast Asian Deployment 1972

As SAC strove to preserve the might of its primary bombers, the war in Southeast Asia continued unabated. Since 1965, when the B-52Fs had first arrived in Southeast Asia, B-52 conventional bombing operations had increased from year to year. The purpose of the bombing was not always the same, the theaters of operation also varied, but the task always grew. B-52Gs did not enter the war before mid-1972; yet, their short-lived participation did not prove easy. On 18 December, as ordered by President Nixon, B-52Gs and the older B-52Ds began to bomb military targets in the Hanoi and Haiphong areas of North Vietnam. The bombing operation, nicknamed Linebacker II, ended on 29 December, after a Christmas pause of 24 hours.[71] In this attack on Haiphong and Hanoi, the B-52s encountered awesome defenses. In 11 days, 15 B-52s were shot down by surface-to-air missiles.

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[69] The 2,300-pound AGM-69A SRAM measured 14 feet in length and 18 inches in diameter. The internally guided, solid-propellant missile could be flown at supersonic or subsonic speeds and set to follow either a high-altitude semi-ballistic trajectory or a low-altitude profile. It could strike targets ahead of the launch aircraft or turn in flight to hit installations to the side or behind the bomber.

[70] SAC's 2 wings of FB-111As would also be equipped with the new missiles, at an estimated cost of $43 million.

[71] SAC B-52s terminated over 8 years of conventional bombing operations in Southeast Asia on 15 August 1973, when all U.S. bombing of targets in Cambodia ceased.

Southeast Asian Losses 1972

SAC lost 7 B-52Gs in Southeast Asia, all of them during 1972.[72] Six of the planes were hit by enemy surface-to-air missiles over North Vietnam, with 4 of them going down around Hanoi and the other 2 crashing in Thailand. The seventh B-52G loss was only indirectly caused by the war. The plane, after taking off from Andersen AFB, Guam, crashed into the ocean, presumably because of materiel failure.

Modernization 1972–On

Ensuring the durability of an airframe was a difficult and costly problem; a worse one, on both counts, was to cope with the enemy's technological developments. In the early seventies, many improvements in electronic countermeasures, initially limited to the Southeast Asia-committed B-52Ds, were extended to the B-52Gs and B-52Hs. These various projects centered essentially on the installation of more efficient jammers to ease the penetration of enemy defenses. One project, Rivet Rambler, was a 2-phase modification accomplished on all B-52Ds by 1971 and specifically directed against the SA-2 radars. In 1973 the Rivet Rambler modification of the B-52G and H bombers was almost completed, but the resulting improvements soon would be nearing obsolescence. Because of the experience gained in Southeast Asia, particularly as a result of the Linebacker II strikes against heavily defended targets, SAC wanted more than ever to equip the B-52Gs and B-52Hs with truly advanced ECM transmitters and jammers. An improved warning system was also needed: one that could detect threats from surface-to-air missiles, anti-aircraft artillery, and airborne interceptors. The Air Staff had already endorsed most of SAC's new requirements. Modification 2525, due to provide more efficient airborne early warning countermeasures, had been approved in June 1971; modification 2519, known as Rivet Ace and due to upgrade the aircraft's

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[72] Two B-52Gs had been lost years before in highly publicized accidents. The first occurred on 17 January 1966, when a B-52G collided with a KC-135 tanker during a high-altitude refueling operation and both aircraft crashed near Palomares, Spain. The release of some radioactive material required removal of some 1,400 tons of slightly contaminated soil and vegetation to the the United States for disposal. A lost nuclear weapon, finally located by a U.S. Navy submarine about 5 miles from the shore and approximately 2,500 feet under water, was recovered intact on 7 April. Then, on 22 January 1968, a B-52G with 4 nuclear weapons aboard crashed and burned on the ice of North Star Bay, while attempting an emergency landing at nearby Thule Air Base, Greenland. An extensive clean-up operation to remove all possible traces of radioactive material was completed on 13 September.

radar warning receivers, was approved in December of the same year. However, none of these projects would start before mid-1973, and all were scheduled to take several years. There were many reasons for the implementation delays. Technical difficulties had to be worked out, unexpected requirements were likely to materialize, and new components had to be tested for quality as well as compatibility within any given avionics system. An example was Rivet Ace. Within the span of 2 short years, this fairly unsophisticated modification had become a very ambitious endeavor. In mid-1973, although the transformed modification project was about to start, serious problems remained. Components, due to be added to the aircraft's radar warning receivers, had been tested with success, but the system's new surface-to-air missile detection equipment was still defective. Meanwhile, other projects fared well. B-52s were being modified to carry the SRAM, as scheduled, even though a new modification was being done simultaneously. This additional project would give the aircraft an electro-optical viewing system, which made use of forward-looking infrared and low-light-level television sensors. The new system would make low-level flying much easier, and a B-52H, modified by the San Antonio Air Materiel Area, had already been returned to operational duty by mid-1973. Another improvement considered in mid-1973 consisted of fitting the B-52's bombing and navigation system with automated offset units. Such devices, SAC believed, would ease significantly the synchronized bombing of several targets.

End of Production — 1961

B-52G production ended in early 1961. The Air Force accepted the last 2 aircraft in February.

Total B-52Gs Accepted — 193

The B-52G was the major production model of the B-52 series. All 193 aircraft were built at the Wichita plant.

Acceptance Rates

Fifty B-52Gs were accepted in FY 59 (between October 1958 and June 1959); 106 in FY 60 (between July 1959 and June 1960); 37 in FY 61 (between July 1960 and February 1961).

Front view of a B-52, showing the television sensors of the new electro-optical viewing system developed to enhance low-level flight.

Flyaway Cost Per Production Aircraft — $7.69 million

Airframe, $5,351,819; engines (installed), $1,427,611; electronics, $66,374; ordnance, $6,809; armament (and others), $840,000.

Average Maintenance Cost Per Flying Hour — $1,025.00

Subsequent Model Series — B-52H

Other Configurations — None

Operational Status — Mid-1973

The Air Force in July 1973 retained 175 of 193 B-52Gs, purchased almost 15 years before. These efficient bombers were undergoing modification, with more changes to come in the future.

Record Flight 1960

On 14 December 1960, a B-52G of the 5th Bomb Wing, Travis AFB, California, completed a world record-breaking flight of 10,078.84 miles without refueling. The flight lasted 19 hours and 44 minutes. The previous closed course record, established in 1947 by a B-29, covered only 8,854 miles.

B-52H

Manufacturer's Model 264-261

Previous Model Series — B-52G

New Features

The B-52H did not differ outwardly from the B-52G, except for the shape of its nacelles, slightly altered because of the new engine's larger inlets. Internally, however, there were several important changes. The B-52H featured Pratt and Whitney's 17,000-pound thrust TF-33-P-3 turbofan engines (without water injection system), new engine-driven generators, ECM equipment improved up to the state of the art, and an enhanced fire-control system—the AN/ASG-21. This new system operated a Gatling gun-type of multi-barrel cannon in a remote-controlled tail mounting for rear defense.[73] The AN/ASG-21 also controlled forward-firing penetration rocket launchers. In addition, the B-52H had better cabin arrangements for low-level penetration flights and was equipped to carry the never-to-be GAM-87 Skybolts.[74]

Configuration Planning — January 1959

An outgrowth of the B-52G, the B-52H design was initiated in January 1959, 1 month before SAC received its first B-52G. Although no great innovations resulted, some airframe changes had to be made to take care of the new model's special features. The B-52H was due from the start to incorporate the TF-33 turbofan engine, a modified J57 already adopted by

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[73] The Gatling gun, the world's first practical machine gun, dated back to the Civil War. The B-52H's ultra-modern version of this 100-year-old weapon was hydraulically operated and electronically controlled. The 6-barreled gun could spew out a stream of 20-mm shells at the rate of 4,000 rounds per minute.

[74] Instead of Skybolts, the B-52Hs carried decoys and missiles identical to those of the B-52Gs.

commercial jet transports. The new aircraft was also designed to carry 4 Douglas GAM-87A Skybolts, which would be a marked improvement over previous B-52s. Had the Skybolt survived, it would have characterized the B-52H as the first manned bomber capable of serving as a flying platform for launching 2-stage solid propellant ballistic missiles with a range of 1,150 miles, fitted with nuclear warheads.

Final Procurement 1959-1962

Like the B-52Gs, the B-52Hs were bought under individual contracts. Two FPI contracts—AF33(600)-38778, funded in FY 60, and AF33(600)-41961, funded in FY 61—accounted for the entire B-52H lot. The first procurement, initiated by letter contract on 2 February 1959, was finalized the following year, on 6 May 1960. It covered 62 B-52Hs. The second B-52H contract was started by a letter contract on 28 July 1960, but was not finalized until the latter part of 1962. There were good reasons for the delay. This was the end of the B-52 procurement and the contract only purchased 40 more B-52Hs. The Air Force could not be sure this would be enough.[75]

First Flight (Prototype) 10 July 1960

The YB-52H's first flight was entirely successful. Ensuing flight tests showed that the new TF-33 turbofan engines would allow the new plane to surpass the B-52G's range. Take-off would also be improved and require about 500 feet less ground roll than the B-52G.

First Flight (Production Aircraft) 6 March 1961

The Air Force accepted the first B-52H in the same month the plane initially flew, but left it with Boeing for testing. By the end of June 1961, B-52H flight tests had confirmed that the TF-33-P-3 engines were working even better than expected. Moreover, even though the new Emerson ASG-21

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[75] These were difficult times. In September 1962, an Air Force recommendation to expand the North American XB-70 program into a full-scale weapon system development was rejected by Secretary of Defense McNamara. In December, President John F. Kennedy confirmed that further development of the Skybolt, an air-to-surface ballistic missile earmarked for the B-52H, was definitely canceled.

fire-control system and the Sunstrand 120 KVA constant speed alternator drive needed perfecting, they both were tactically operable.

Enters Operational Service — Mid-1961

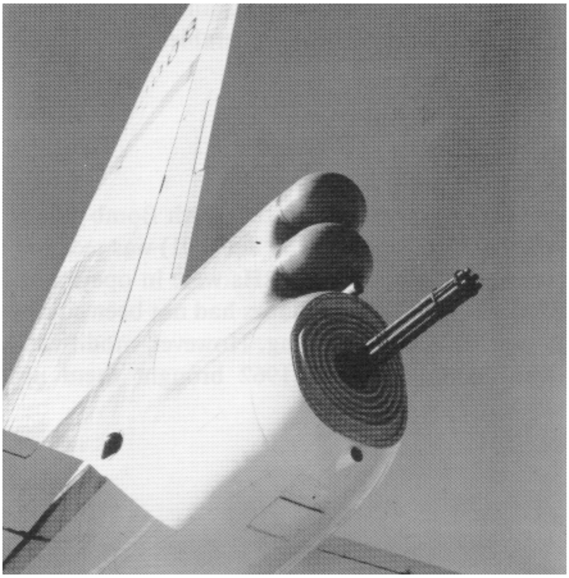
The B-52H entered operational service with the 379th Bomb Wing, at Wurtsmith AFB, Michigan. The first plane (Serial #60-001) was received by the 379th on 9 May. By the end of June, 20 B-52Hs were in operation. In contrast to all other B-52Hs, 18 of those early planes had not been equipped during production for all-weather, low-level flying. However, modifications accomplished between April and September 1962 brought them up to standard.

Engine Problems — 1961-1964

While both the B-52F and B-52G had failed to live up to original range estimates, the B-52H's new TF-33-P-3 turbofan engines gave the aircraft a better range increase than anticipated. Moreover, as indicated by recent B-52H flight tests, some of the new engine's problems appeared to be solved, and remaining malfunctions were being worked out. Yet, despite several engineering fixes, the TF-33 in late 1961 still created difficulties. Throttle creep, hang or slow start, flameout, and uneven throttle alignment were some of the most frequent troubles. In addition, the engine consumed too much oil, turbine blades failed and inlet cases often cracked. By mid-1962, even though most of these early problems had been corrected, Hot Fan, a depot maintenance and overhaul project, was underway. This $15 million modernization effort, involving the accomplishment of 35 technical orders, had 2 essential purposes. The Air Force wanted the TF-33 to be more reliable, and it did not want the engine to fail before 600 hours of operation. Curtailed by the Cuban Missile Crisis of October 1962, when all B-52s stood on alert, Hot Fan was not resumed until January 1963. However, the Oklahoma City Air Materiel Area accelerated its overhaul schedule, and although Hot Fan covered 894 TF-33 engines, the project was practically completed before the end of 1964.

Other Early Difficulties — August 1962

B-52Hs were still being assigned to SAC when a serious and ill-timed problem came to light. In August 1962, again shortly before the Cuban



The ASQ-21 Gatling gun, mounted in the B-52H's tail, provided remote-controlled defense.

A Boeing B-52H, equipped with 4 Douglas GAM Skybolt ballistic missiles.

Missile Crisis, 2 of the B-52Hs at Homestead AFB, Florida, developed cracks where wings and fuselage joined. Boeing and the Air Force focused attention on the taper lock fasteners, which under high stress and in the B-52's operational environment were susceptible to corrosion. They soon determined that the "primary contributing cause for these cracks was the use of taper lock fasteners throughout the forging." In September, Boeing came up with a repair and rework package to take care of the problem. The next month, engineers of Air Force System Command's Aeronautical Systems Division set up requirements to evaluate the impact of stress corrosion on all primary structural materials. Project Straight Pin, the modification package developed by Boeing, was not allowed to linger. Rework centers were immediately established at Moses Lake, Washington; Wichita, Kansas; and at the San Antonio Air Materiel Area's shops. There, maximum interference wing terminal fasteners were replaced with those having extremely low interference, and cracked fitting holes were "cleaned up" by oversize reaming. Although SAC suspended diversion of its airplanes to the modification centers during the Cuban Crisis, Straight Pin was virtually completed by the end of 1962.

Continued Problems 1962–1964

An older stress corrosion problem came to life again in August 1962. Two main landing gear outer cylinders failed on B-52D and B-52F aircraft, the latest in a series of similar incidents with B-52Gs and B-52Hs since the end of 1959. While SAC asked for redesigned cylinders, Air Force engineers noted that a quicker and safer alternative would be to make use of another alloy, one that would be less susceptible to stress corrosion. This gave way to a new study and test program to further investigate current and potential stress corrosion problems. Meanwhile, to prevent other incidents, anti-corrosion coating was applied to all components of the landing gear. Progress was also made to cure most of the B-52H's other early ills. By mid-1962, failure of the aircraft's Sunstrand constant speed drive was becoming a problem of the past. During the same period, a long-standing SAC requirement, only endorsed for the B-52Hs, was finally extended to all B-52s. Started in January 1963 and completed in March of the following year, this retrofit project put 2 cartridge starters in every B-52.[76] The modification was expensive, which accounted for SAC's difficulties in

[76] The installation of cartridge starters was not simple. The aircraft's electrical system had to be modified to accommodate the new starters and new valves. In addition, duct covers had to be redesigned and nickel cadmium batteries had to be added.

getting it approved for the entire B-52 force, but it was important. Besides giving crews the means to start their engines faster, it would allow dispersed or post-strike B-52s to take off from airfields lacking certain ground support equipment, electrical power carts in particular.

Structural and Other Improvements 1964-On

As already noted, all B-52G structural modifications were extended to the B-52Hs. These aircraft were also included in the many B-52G modernization programs of the early seventies. Like the Gs, the B-52Hs were being equipped to carry the new SRAMs; they were being fitted with electro-optical viewing systems, low-light television cameras, and forward-looking infrared scanners. Finally, they were due to receive better electronics and more sophisticated components to improve both their offensive and defensive systems. A new project, initially triggered by the relatively slow start of the B-52H's TF-33 engines, was also underway. Despite the cartridge starter retrofit that had been accomplished between 1963 and 1964, SAC was still dissatisfied with the time it took for the B-52 to take off. The recently approved Quick Start project, now only concerned with the B-52G and H bombers, would make the ground alert force far less vulnerable to surprise attacks. Quick Start specifically consisted of putting a quick start device on each of the aircraft's 8 engines, thereby ensuring take-off in almost no time.

End of Production 1962

Production ended in the fall of 1962,[77] SAC receiving on 26 October the last B-52H (Serial #61-040). This plane went to the 4137th Strategic Bomb Wing at Minot AFB, North Dakota.

Total B-52Hs Accepted 102

The 102 B-52Hs accepted by the Air Force, like the B-52Gs, were built in Wichita.

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[77] This marked the end of a production run which had begun some 9 years before. Wanting to keep the production door ajar, at least for a while, the Air Force negotiated with Boeing a supplemental agreement to the final B-52H production contract—AF33(600)-41961. Signed on 17 October 1962, this $770,283 agreement ensured that Boeing, the prime contractor, would store the Wichita B-52H tooling until July 1963. Selected B-52 subcontractors, using government-owned facilities, would do the same.

Acceptance Rates

The Air Force accepted 20 B-52Hs in FY 61 (from March through June 1961); 68 in FY 62 (between July 1961 and June 1962); and 14 in FY 63 (the last 5 during October 1962).

Flyaway Cost Per Production Aircraft — $9.28 million

Airframe, $6,076,157; engines (installed), $1,640,373; electronics, $61,020; ordnance, $6,804; armament (and others), $1,501,422.

Average Maintenance Cost Per Flying Hour — $1,182.00

Subsequent Model Series — None

Other Configurations — None

Operational Status — Mid-1973

The Air Force inventory in July 1973 still counted 99 B-52Hs—against an initial contingent of 102. Like the B-52Gs, B-52Hs were undergoing modifications to extend their service-life as well as their efficiency.

Record Flights — January 1962

On 10-11 January, a B-52H of the 4136th Strategic Wing, Minot AFB, North Dakota, completed a record-breaking 12,532.28-mile unrefueled flight from Kadena Air Base, Okinawa, to Torrejon Air Base, Spain. This flight broke the old "distance in a straight line" world record of 11,235.6 miles held by the U.S. Navy's propeller-driven "Truculent Turtle." Weighing 488,000 pounds at takeoff, the B-52H flew at altitudes between 40,000 and 50,000 feet with a top speed of 662 miles per hour on the Kadena-Torrejon flight route.

June 1962

On 7 June, a B-52H of the 19th Bomb Wing, Homestead AFB, Florida, broke the world record for distance in a closed course without landing or refueling. The closed course began and ended at Seymour Johnson AFB, North Carolina, with a validated distance of 11,336.92 miles. The old record of 10,078.84 miles had been held by a B-52G of the 5th Bomb Wing since 1960.

Program Recap

The Air Force bought 744 B–52s—prototype, test, and reconnaissance configurations included. Precisely, the B–52 program counted 1 XB–52, 1 YB–52 (first flown on 15 April 1952, almost 6 months ahead of the experimental B–52), 3 B–52As (restricted to testing), 50 B–52Bs (27 of which could also be used for reconnaissance), 35 B/RB–52Cs, 170 B–52Ds, 100 B–52Es, 89 B–52Fs, 193 B–52Gs, and 102 B–52Hs. Six years of development preceded the beginning of production which, after a slow start around 1953, did not end until October 1962.

TECHNICAL AND BASIC MISSION PERFORMANCE DATA

B-52 AIRCRAFT

Manufacturer (Airframe)	Boeing Airplane Co., Seattle, Wash., and Wichita, Kans.
(Engines)	The Pratt & Whitney Aircraft Division of United Aircraft Corp., East Hartford, Conn.
Nomenclature	Strategic Heavy Bomber
Popular Name	Stratofortress

	B-52B	B-52C/D	B-52E	B-52F	B-52G	B-52H
Length/Span (ft)	156.6/185	156.5/185	156.5/185	156.5/185	157.6/185	156/185
Wing Area (sq ft)	4,000	4,000	4,000	4,000	4,000	4,000
Weights (lb)						
Empty	164,081	177,816	174,782	173,599	168,445	172,740
Combat	272,000	293,100	292,460	291,570	302,634	306,358
Takeoff[a]	420,000	450,000	450,000	450,000	488,000	488,000
Engine: Number, Rated Power per Engine, & Designation	(8) 11,400-lb st (max) J57-P-1WA	(8) 12,100-lb st (max) J57-P-19W	(8) 12,100-lb st (max) J57-P-19W or -29WA	(8) 13,750-lb st (max) J57-P-43W -WA, or -WB	(8) 13,750-lb st (max) J57-P-43WB	(8) 17,000-lb st (max) TF-33-P-3
Takeoff Ground Run (ft)						
at Seat Level[b]	8,200	8,000	8,000	7,000	8,150	7,420
Over 50-ft Obstacle	10,500	10,300	10,300	9,100	10,400	9,580
Rate of Climb (fpm) at Sea Level	2,110	2,225	2,225	2,300	2,150	3,000
Combat Rate of Climb[c] (fpm) at Sea Level	4,760	5,125	5,125	5,600	5,450	6,270
Service Ceiling at Combat Weight (100 fpm Rate of Climb to Altitude)	47,300	46,200	46,200	46,700	47,000	47,700

Combat Ceiling[c] (ft) (500 fpm Rate of Climb to Altitude)	46,550	45,800	45,800	46,000	46,000	46,200
Average Cruise Speed (kn)	453	453	453	453	453	453
Max Speed at Optimum[a c] Altitude (kn/ft)	546/19,800	551/20,200	551/20,200	553/21,000	551/20,800	547/23,800
Combat Radius (nm)	3,110	3,012	3,027	3,163	3,550	4,176
Total Mission Time (hr)	13.50	13.22	13.27	14.03	15.7	17.50
Armament	4 20-mm M24A1s or 4 50-mm M-3s	4 50-mm M-3 guns	4 50-mm M-3 guns	4 .50-cal M-3 guns	4 .50-cal M-3 guns	1 20-mm M-61 gun
Crew	6	6	6	6	6	6
Max Bombload (lb)	43,000[d]	50,000[e]	50,000[e]	50,000[e]	50,000[f]	50,000[f]

Abbreviations

cal = caliber
fpm = feet per minute
kn = knots
max = maximum
nm = nautical miles
st = static thrust

[a] Limited by structure.

[b] Takeoff power, i.e., maximum power of an airplane's engine or engines available for takeoff.

[c] Military power, i.e., maximum power or thrust specified for an engine by the manufacturer or by the Air Force as allowable in flight under specified operating conditions for periods of 30 minutes duration.

[d] Or 1 MK-6 and 2 MK-21 special weapons.

[e] For example, 27 1,000-lb bombs, 4 1,200-lb ADM-20 Quails, and 2 10,000-lb AGM-28 Hound Dog missiles, or MK-28, MK-41, MK-53, and MK-57 special weapons.

[f] For example, 27 1,000-lb bombs, 4 1,200-lb ADM-20 Quails, 2 10,000-lb AGM-28 Hound Dogs or up to 20 2,200-lb AGM-69A SRAM missiles. Bombload could also consist of MK-28, MD-41, MK-53, and MK-57 special weapons.

BASIC MISSION NOTE

All basic mission's performance data are based on maximum power, except as otherwise indicated.

Combat Radius Formula:

B–52B, B–52C, B–52D, and B–52E: Took off and climbed on course to optimum cruise altitude at normal power. Cruised out at long-range speed, increasing altitudes with decreasing weight (external tanks being dropped when empty). Climbed to reach cruise ceiling 15 minutes from target. Ran-in to target at normal power, dropped bombs, conducted 2-minute evasive action and 8-minute escape at normal power. Cruised back to base at long-range speed and optimum altitudes (as an alternate, a 45,000-foot ceiling could be maintained on the return leg with no radius penalty). Range-free allowances included fuel for 5 minutes at normal power for take-off allowance, fuel for 2 minutes at normal power for evasive action, and fuel for 30 minutes maximum endurance at sea level plus 5 per cent of the initial fuel load for landing reserve (the landing reserve range at optimum speed and altitude).

B–52F, B–52G, and B–52H: Took off and climbed on course to optimum cruise altitude at normal power. Cruised out at long-range speed (the long-range speed being maximum speed for 99 percent maximum miles per pound of fuel), increasing altitude with decreasing weight (external tanks being dropped when empty). Climbed to reach cruise ceiling 15 minutes from target. Ran-in to target at normal power, dropped bombs, conducted 2-minute evasive action and 8-minute escape at normal power. Cruised back to home base at long-range speeds, increasing altitude with decreasing airplane weight. Range-free allowances included 5-minute normal-power fuel consumption for starting engines and takeoff, 2-minute normal-power fuel consumption at combat altitude for evasive action, and 30 minutes of maximum endurance (4 engines) fuel consumption at sea level plus 5 percent of initial fuel for landing reserve. The prescribed fuel reserve for the basic mission was equivalent to the following reserve range at best range conditions: B–52F, 810 nautical miles; B–52G, 808 nautical miles (884 nautical miles, Alternate in-Flight); B–52H, 974 nautical miles (1,060 nautical miles, Alternate in-Flight).