B-29 Design/Development

Engines

Wright Aeronautical Corporation. R-3350 Duplex Cyclone engine - twin row, supercharged, air-cooled, radial engine with 18 cylinders and displacement of 3,350 cubic inches.

Two General Electric B-11 superchargers, one on each side of each nacelle.

2,200 hp R-3350-23 16 ft 7" four-blade Hamilton Standard hydromatic constant-speed, full feathering propellers

R-3350-57 Specs

Type: Air-cooled, 18-cylinder twin-row radial engine
Country/Date: U.S.A., 1942
Rating: 2,200 hp @ 2800 rpm
Displacement: 3,350 cu. in.
Weight: 2,779 lbs.
Bore & Stroke: 6.125" & 6.3"

The immensely powerful Wright R-3350 was chosen as the powerplant for the B-29. Four of these massive engines provided the power to move each B-29. Problems with overheating were legendary but were overcome with numerous field modifications and changes in engine use. Altogether the R-3350 went through tens of thousands of design changes during its early development. Pilots learned to use as much of the runway as possible and build up speed to help cool the engines before slowly climbing for altitude.

Work on the engine began in January 1936 and the first one ran in May 1937. It was similar in design to the company's R-2600 14-cylinder radial, sharing the same bore and stroke but adding two more cylinders per row for additional displacement. A three-piece forged aluminum (later changed to steel) crankcase, cast heads and a magnesium supercharger case to reduce weight.

Downdraft carburetion on early engines yielded mixture inconsistencies between the front and rear cylinder rows, which was solved on later models by changing to a direct fuel injection system.

Wright Aeronautical built a new facility at Woodbridge, NJ for the R-3350 and shifted production at their Cincinnati plant exclusively to the Wright engine. Total output between these two plants approached 13,800.

Chrysler's Dodge Chicago Division, supplied over 18,400 engines from their Chicago, IL location.

As design problems were overcome the R-3350 saw its time between overhauls increase from 100 to 400 hours by the end of the war. Almost all of the engine nacelles, as big as a fighter fuselage, were made by the Fisher Body division of General Motors. Cleveland facility.

Remote-Controlled Gunnery System

Four companies competed for the contract including Bendix, General Electric, Sperry, and Westinghouse. General Electric developed the system used in the B-29 consisting of four turrets and a tail mount.

M5 Director General Electric fire control system

The bomber is provided with a system of electrically powered gun turrets which are operated by a sighting system in order to concentrate a broadside fire on enemy planes approaching from any angle. One of the vital elements of this sighting system is the mechanical-electrical computer whose function it is to make instant corrections for the speed of the bomber, the speed and direction of the attacking plane, altitude, temperature, windage, gravity, and the ballistics of the gun projectile. In addition, it makes correction for parallax - the distance between the sighting station and the remotely located guns.

Production of M5 Director by the Singer Company Elizabethport Works

Starting in September 1943, weekly production stepped up gradually, reaching a rate of approximately 250 complete Computers per week at the end of 1944, and over 500 per week in July 1945, at which time a total of 20,794 complete Computers had been shipped out of the factory. About one-third of these Computers have been Double Computers, incorporating two computer mechanisms.

In the Spring of 1945 the Double Computer was discontinued but the cancellation of this quantity was partly compensated for by some increase in the requirements of the Single Computer.

Pressurization

Fuselage was 112" (2.84m) in diameter. Pressurization allowed the crew to experience the air pressure equivalent of 8,000 ft altitude at 30,000 ft. Two main pressurized compartments were connected by a 40 ft (m) tunnel 34" () in diameter located above the two bomb bays. The tail gunner was isolated in a small pressurized tail section. Two 6 inch pipes from the aft section pressurized the tail.

The Wing

Boeing "117" wing. The success of this wing design came largely from its enormous flaps, equivalent to 1/5 the area of the entire wing. At the time, the two wing spars were the longest and heavist Duralumin extrusions ever used in a production aircraft. Fuel was carried in fourteen outer-wing, eight inner-wing, and four bomb bay tanks, giving a maximum capacity of 8168 US gallons. An early modification added four tanks in the wing center section, bringing total fuel capacity to 9438 US gallons.

Radar / Navigation

AN/APQ-13 (H2X) radar enclosed in a 30" radome X-Band Bombing Radar "Mickey" manufactured by Bell The AN/APQ-13 radome was located at the bottom of the fuselage, between the bomb bays. On airplanes with modified bomb bays (such as SB-29's etc.) often the radome would be moved forward in the lower forward turret position. The latter

was of course deleted.

AN/APQ-7 EAGLE 3 cm radar better target definition this wing shaped antenna in a housing installed underneath the forward sction of the fuselage. It spanned 17 ft, had a 31" chord and was about 8" thick weighing nearly 1,000 pounds. X-BAND Search & Bombing Radar "Eagle Mk.1"; manufactured by Western Electric

AN/APN-4 LORAN (LONge RANge) radar navigation system manufactured by Philco. 1.950 MHz. consisted of two units each about 1 ft x 2 ft by 2.5 ft. One unit was the power supply while the other contained the oscilloscope display tube, timing circuits and receiver. Together they weighed about 80 pounds. By 1945 the APN-9 came into use at an amazing weight reduction - it only weighed 40 pounds.

The oscilloscope screen was about four inches in diameter and would display a station master and associated slave signal from about 1500 miles over water and 600 miles over land. With practice a fix could be determined in about three minutes. As an example, the minimum error for navigating the 1400 miles to Japan from Tinian was about 28 miles. With two successive fixes ground speed, drift, and ETA could be determined. The relative simplicity of LORAN and the fact that it could be used regardless of weather made it invaluable as an navigational tool until the aircraft arrived over Japan when airborne radar provided a more accurate fix. For some unknown reason the Japanese either never tried or failed to jam any of the LORAN systems.
By the end of World War II there were 75 standard LORAN stations serving the needs of aircraft and vessels in operation with over 75,000 receivers in use.
AN/APN-9 LORAN (LONge RANge) radar navigation system manufactured by RCA; replaced AN/APN-4

AN/APG-15B gun laying radar fire control in tail radome S-Band Tail Gun Radar 2000 yard range.

Production

Plant	# B-29s built
Boeing-Wichita	1595
Bell-Atlanta	652
Martin-Omaha	515
Boeing-Renton	998
Totals	3760

Month	# Built	Month	# Built
1943 July	7		
1943 August	4		
1943 September	15	1944 September	122
1943 October	13	1944 October	125
1943 November	18	1944 November	163
1943 December	35	1944 December	190
1944 January	54	1945 January	221
1944 February	57	1945 February	260
1944 March	60	1945 March	291
1944 April	51	1945 April	321
1944 May	88	1945 May	350
1944 June	82	1945 June	370
1944 July	75	1945 July	375
1944 August	94	1945 August	319

Totals	3760

Flight Testing

Maintaining The Superfortress

Responsibility for crew training was assigned to Col. LaVerne G. Saunders of the Second Air Force. Four airfields in Kansas (Smoky Hill, Pratt, Great Bend and Walker) were to handle this task. The burst of activity that took place between March 10 and April 15, 1944 came to be known as the Battle of Kansas.

Into Action

Operation Matterhorn

First B-29 Raid: Bangkok June 5, 1944

First B-29 Attack on Japan June 15, 1944

Flying the Hump

The Marinas - a new home for bombing Japan

Bomb Tonnage Dropped by 20th Air Force B-29s with sorties

Date	Bomb Tonnage			Sorties	
	Total	HE	Incendiary	Airborne	Effective
1944 June	547	501	46	166	131
1944 July	209	209	-	114	102
1944 August	252	184	68	171	145
1944 September	521	521	-	217	199
1944 October	1,669	1,023	646	310	279
1944 November	2,205	1,758	447	611	514
1944 December	3,661	3,051	610	930	787
1945 January	3,410	2,511	899	1,009	887
1945 February	4,020	2,401	1,619	1,331	1,189
1945 March	15,283	4,105	11,178	3,103	2,892
1945 April	17,492	13,209	4,283	3,487	3,246
1945 May	24,285	6,937	17,348	4,562	4,226
1945 June	32,542	9,954	22,588	5,581	5,243
1945 July	42,551	9,388	33,163	6,464	6,168
1945 August	21,029	8,438	12,591	3,331	3,145
Totals	169,676	64,190	105,486	31,387	29,153

Airfield Construction

Bases in Kharagpur, India and Pengshan Cheng-tu, China
Tinian West Field

Rescuing Downed Airmen

SB-29 nicknamed "Super Dumbo." 16 B-29s modified EDO Corporation 29 ft 9" type A-3 lifeboat. The lifeboat carried survival supplies: food, water, radios, and maps. At the peak of the air-sea rescue effort 14 submarines, 21 Navy seaplanes, nine B-29 Super Dumbos and five surface vesssels patrolled the waters between Japan and the Mariana Islands. This effort yielded excellent results: of the 1,310 B-29 crew members known to have gone down or ditched at sea, 654, or 50 percent were rescued.

Escorts for the B-29s

The Sunsetters VII Fighter Command P-51 Mustangs. Iwo Jima, a small island about 750 miles from Japan. On April 7, 1945 over 100 Mustangs escorted a like number of B-29s from the Maranias, on a daylight raid to Tokyo. The Sunsetters shot down 21 Japanese planes while losing two Mustangs and three B-29s. In mid-April strafing P-51s swept over airfields on Kyushu, the first of 33 such raids.

F-13A Photo-Reconnaissance

F-13A was the designation given to the photo-reconnaissance version of the B-29. A photo reconnaissance system designed by the Air Technical Service Command and Fairchild Photographic Company was installed in B-29 and B-29A aircraft pulled from the assembly lines. All 'Foto' B-29s were designated F-13A, no matter what type of B-29 they were based on.

At the Continental Air Lines Denver Modification Center a bank of six cameras were installed behind and below the aft crew compartment. These included three K-17Bs, two K-22s, and a single K-18 camera sighting through square windows cut into the bottom and sides of the rear fuselage. Sighting was made through a modified B-3 Driftmeter in the bombardier compartment and operated by the Photo-Navigator. Fuel tanks were installed in the rear bomb bay while the front bomb bay could hold either photo flash bombs or a cargo platform with additional film or special cameras.

All defensive armament was retained and the standard eleven man crew was supplemented with a Photo-Navigator and a cameraman. The first F-13A, Tokyo Rose, arrived in the Marinas on October 13th 1944 and flew the first recon mission over Tokyo the same day. The photos proved invaluable during the later attacks on the Japanese capitol. F-13As of the 1st and 3rd Photo Reconnaissance Squadrons (PRS) operated from both China and the Marinas until the end of the war.

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