= Lockheed YF @-@ 22 =

The Lockheed / Boeing / General Dynamics YF @-@ 22 was an American single @-@ seat , twin @-@ engine fighter aircraft technology demonstrator designed for the United States Air Force (USAF) . The design was a finalist in the USAF 's Advanced Tactical Fighter competition , and two prototypes were built for the demonstration / validation phase of the competition . The YF @-@ 22 won the contest against the Northrop YF @-@ 23 , and entered production as the Lockheed Martin F @-@ 22 Raptor . The YF @-@ 22 has similar aerodynamic layout and configuration as the F @-@ 22 , but with differences in the position and design of the cockpit , tail fins and wings , and in internal structural layout .

In the 1980s , the USAF began looking for a replacement for its fighter aircraft , especially to counter the advanced Su @-@ 27 and MiG @-@ 29 . A number of companies , divided into two teams , submitted their proposals . Northrop and McDonnell Douglas submitted the YF @-@ 23 . Lockheed , Boeing and General Dynamics proposed and built the YF @-@ 22 , which , although marginally slower and having a larger radar cross @-@ section , was more agile than the YF @-@ 23 . Primarily for this reason , it was picked by the Air Force as the winner of the ATF in April 1991 . Following the selection , the first YF @-@ 22 was retired to a museum , while the second prototype continued flying until an accident relegated it to the role of an antenna test vehicle .

= = Design and development = =

In 1981 , the U.S. Air Force developed a requirement for an Advanced Tactical Fighter (ATF) as a new air superiority fighter to replace the F @-@ 15 Eagle and F @-@ 16 Fighting Falcon . This was made more crucial by the emerging worldwide threats , including development and proliferation of Soviet MiG @-@ 29 and Su @-@ 27 " Flanker " -class fighter aircraft . It would take advantage of the new technologies in fighter design on the horizon including composite materials , lightweight alloys , advanced flight @-@ control systems , more powerful propulsion systems and stealth technology . In 1985 the Air Force sent out technical requests for proposals to a number of aircraft manufacturing teams . The formal request for proposal (RFP) was issued in July 1986 , and two contractor teams , Lockheed , Boeing and General Dynamics , along with Northrop and McDonnell Douglas , were selected on 31 October 1986 to undertake a 50 @-@ month demonstration phase , culminating in the flight test of the two teams ' prototypes , the YF @-@ 22 and the YF @-@ 23 .

The YF @-@ 22 was designed to meet USAF requirements for survivability , supercruise , stealth , and ease of maintenance . Because Lockheed 's submission was selected as one of the winners , the company , through its Skunk Works division , assumed leadership of the program partners . It would be responsible for the forward cockpit and fuselage , as well as final assembly at Palmdale , California . Meanwhile , the wings and aft fuselage would be built by Boeing , with the center fuselage , weapons bays , tail and landing gears built by General Dynamics . Compared with its Northrop / McDonnell Douglas counterpart , the YF @-@ 22 has a more conventional design ? its wings have larger control surfaces , such as full @-@ span trailing edge , and , whereas the YF @-@ 23 had two tail surfaces , the YF @-@ 22 had four , which made it more maneuverable than its counterpart . Two examples of each prototype air vehicle (PAV) were built for the Demonstration @-@ Validation phase : one with General Electric YF120 engines , the other with Pratt & Whitney YF119 engines .

The YF @-@ 22 was given the unofficial name " Lightning II " after Lockheed 's World War II @-@ era fighter , the P @-@ 38 Lightning , which persisted until the mid @-@ 1990s when the USAF officially named the aircraft " Raptor " . The F @-@ 35 later received the Lightning II name in 2006 .

The first YF @-@ 22 (PAV @-@ 1 , serial number 87 @-@ 0700 , N22YF) , with the GE YF120 , was rolled out on 29 August 1990 and first flew on 29 September 1990 , taking off from Palmdale piloted by David L. Ferguson . During the 18 @-@ minute flight , PAV @-@ 1 reached a maximum speed of 250 knots (460 km / h ; 290 mph) and a height of 12 @,@ 500 feet (3 @,@ 800 m) , before landing at Edwards AFB . Following the flight , Ferguson said that the remainder of the YF @-@ 22 test program would be concentrated on " ... the manoeuvrability of the aeroplane , both

supersonic and subsonic " . The second YF @-@ 22 (PAV @-@ 2 , s / n 87 @-@ 0701 , N22YX) with the P & W YF119 made its maiden flight on 30 October at the hands of Tom Morgenfeld .

= = Operational history = =

= = = Evaluation = = =

During the flight test program , unlike the YF @-@ 23 , weapon firings and high (60 °) angle of attack (AoA , or high @-@ Alpha) flights were carried out on the YF @-@ 22 . Though not a requirement , the aircraft fired AIM @-@ 9 Sidewinder and AIM @-@ 120 AMRAAM missiles from internal weapon bays . Flight testing also demonstrated that the YF @-@ 22 with its thrust vectoring nozzles achieved pitch rates more than double that of the F @-@ 16 at low @-@ speed maneuvering . The first prototype , PAV @-@ 1 , achieved Mach 1 @.@ 58 in supercruise , while PAV @-@ 2 reached a maximum supercruise speed of Mach 1 @.@ 43 ; maximum speed was in excess of Mach 2 @.@ 0 . Flight testing continued until 28 December 1990 , by which time 74 flights were completed and 91 @.@ 6 airborne hours were accumulated . Following flight testing , the contractor teams submitted proposals for ATF production .

On 23 April 1991 , the YF @-@ 22 was announced by Secretary of the Air Force Donald Rice as the winner of the ATF competition . The YF @-@ 23 design was stealthier and faster , but the YF @-@ 22 was more agile . It was speculated in the aviation press that the YF @-@ 22 was also seen as more adaptable to the Navy 's Navalized Advanced Tactical Fighter (NATF) , but the US Navy abandoned NATF by 1992 . Instead of being retired , as with the case of PAV @-@ 1 , PAV @-@ 2 subsequently flew sorties following the competition ? it amassed another 61 @.@ 6 flying hours during 39 flights . On 25 April 1992 , the aircraft sustained serious damage during a landing attempt as a result of pilot @-@ induced oscillations . It was repaired but never flew again , and instead served as a static test vehicle thereafter . In 1991 , it was anticipated that 650 production F @-@ 22s would be procured .

= = = F @-@ 22 production = = =

As the Lockheed team won the ATF competition , it was awarded the engineering , manufacturing and development (EMD) contract , which would ultimately allow it to proceed with production of operational aircraft . The EMD called for seven single @-@ seat F @-@ 22A and two twin @-@ seat F @-@ 22Bs . On 9 April 1997 , the first of these , Spirit of America , was rolled out . During the ceremony , the F @-@ 22 was officially named " Raptor " . Due to limited funding , the first flight , which had previously been scheduled for mid @-@ 1996 , occurred on 7 September 1997 . Flight testing for the F @-@ 22 continued until 2005 , and on 15 December 2005 the USAF announced that the Raptor had reached its initial operational capability (IOC) .

In many respects , the YF @-@ 22s were different from production F @-@ 22s . Contrary to the F @-@ 117 Nighthawk , which was initially difficult to control because of small vertical stabilizers , Lockheed over @-@ specified the fin area on its YF @-@ 22 . Therefore , the company reduced the size of those on F @-@ 22s by 20 ? 30 percent . Lockheed recontoured the shape of the wing and stabilator trailing edges to improve aerodynamics , strength , and stealth characteristics ; the wing and stabilitor sweep was reduced by 6 ° from 48 ° . Finally , to improve pilot visibility , the canopy was moved forward 7 inches (178 mm) , and the engine intakes were moved rearward 14 inches (356 mm) .

= = Aircraft disposition = =

87 @-@ 0700 ? Air Force Flight Test Center Museum , Edwards Air Force Base , California .
87 @-@ 0701 ? used by Lockheed as static test model .

= = Specifications (YF @-@ 22) = =

Note some specifications are estimated .
Data from Baker , Aronstein
General characteristics
Crew : 1 (pilot)
Length : 64 ft 6 in (19 @.@ 65 m)
Wingspan : 43 ft 0 in (13 @.@ 1 m)
Height : 17 ft 9 in (5 @.@ 39 m)
Wing area : 830 sq ft (77 @.@ 1 m^2)
Empty weight : 33 @,@ 000 lb (14 @,@ 970 kg)
Loaded weight : 62 @,@ 000 lb (28 @,@ 120 kg)
Powerplant : 2 × Pratt & Whitney YF119 @-@ PW @-@ 100 or General Electric YF120 @-@ GE @-@ 100 afterburning turbofans
Dry thrust : YF120 : 23 @,@ 500 lbf (104 kN) each
Thrust with afterburner : 30 @,@ 000 lbf / 35 @,@ 000 lbf (133 kN / 156 kN) each
Performance
Maximum speed : At altitude : Mach 2 @.@ 2 (1 @,@ 260 knots , 1 @,@ 450 mph , 2 @,@ 335 km / h)
Supercruise : Mach 1 @.@ 58 (910 knots , 1 @,@ 040 mph , 1 @,@ 680 km / h) (military power only)
Combat radius : 696 nmi (800 mi , 1 @,@ 480 km)
Service ceiling : 65 @,@ 000 ft (19 @,@ 800 m)
Maximum g @-@ load : + 7 @.@ 9 g