= McDonnell XF @-@ 85 Goblin =

The McDonnell XF @-@ 85 Goblin was an American prototype fighter aircraft conceived during World War II by McDonnell Aircraft . It was intended to be deployed from the bomb bay of the giant Convair B @-@ 36 bomber as a parasite fighter . The XF @-@ 85 's intended role was to defend bombers from hostile interceptor aircraft , a need demonstrated during World War II . Two prototypes were constructed before the program was terminated .

The XF @-@ 85 was a response to a United States Army Air Forces ' (USAAF) requirement for a fighter to be carried within the Northrop XB @-@ 35 and B @-@ 36 , then under development . This was to address the limited range of existing interceptor aircraft compared to the greater range of new bomber designs . The XF @-@ 85 was a diminutive jet aircraft featuring a distinctive egg @-@ shaped fuselage and a forked @-@ tail stabilizer design . The prototypes were built and underwent testing and evaluation in 1948 . Flight tests showed promise in the design , but the aircraft 's performance was inferior to the jet fighters it would have faced in combat , and there were difficulties in docking . The XF @-@ 85 was swiftly canceled , and the prototypes were thereafter relegated to museum exhibits . The 1947 successor to the USAAF , the United States Air Force (USAF) , continued to examine the concept of parasite aircraft under Project MX @-@ 106 " Tip Tow " , Project FICON and Project " Tom @-@ Tom " following the cancellation .

= = Design and development = =

During World War II , American bombers such as the Boeing B @-@ 17 Flying Fortress , Consolidated B @-@ 24 Liberator and Boeing B @-@ 29 Superfortress were protected by long @-@ range escort fighters such as the Republic P @-@ 47 Thunderbolt and North American P @-@ 51 Mustang . These fighters could not match the range of the Northrop B @-@ 35 or Convair B @-@ 36 , the next generation of bombers developed by the United States Army Air Forces (USAAF) . The development cost for longer @-@ ranged fighters was high , while aerial refueling was still considered risky and technologically difficult . Pilot fatigue had also been a problem during long fighter escort missions in Europe and the Pacific , giving further impetus to innovative approaches .

The USAAF considered a number of different options including the use of remotely piloted vehicles before choosing parasite fighters as the most viable B @-@ 36 defense . The concept of a parasite fighter had its origins in 1918 , when the Royal Air Force examined the viability of Sopwith Camel parasite fighters operating from R23 airships . In the 1930s , the U.S. Navy had a short @-@ lived operational parasite fighter , the Curtiss F9C Sparrowhawk , aboard the airships Akron and Macon . Starting in 1931 , aircraft designer Vladimir Vakhmistrov conducted experiments in the Soviet Union as part of the Zveno project during which up to five fighters of various types were carried by Polikarpov TB @-@ 2 and Tupolev TB @-@ 3 bombers . In August 1941 , these combinations flew the only combat missions ever undertaken by parasite fighters ? TB @-@ 3s carrying Polikarpov I @-@ 16SPB dive bombers attacked the Cernavod? bridge and Constantsa docks , in Romania . After that attack , the squadron , based in the Crimea , carried out a tactical attack on a bridge over the river Dnieper at Zaporozhye , which had been captured by advancing German troops . Later in World War II , the Luftwaffe experimented with the Messerschmitt Me 328 as a parasite fighter , but problems with its pulsejet engines could not be overcome . Other late @-@ war rocket @-@ powered parasite fighter projects such as the Arado E.381 and Sombold So 344 were unrealized " paper projects " .

On 3 December 1942 , the USAAF sent out a Request for Proposals (RfP) for a diminutive piston @-@ engined fighter . By January 1944 , the Air Technical Service Command refined the RfP and in January 1945 , the specifications were further revised in MX @-@ 472 to specify a jet @-@ powered aircraft . Although a number of aerospace companies studied the feasibility of such aircraft , McDonnell was the only company to submit a proposal to the original 1942 request and later revised requirements . The company 's Model 27 proposal was completely reworked to meet the new specifications .

The initial concept for the Model 27 was for the fighter to be carried half @-@ exposed under the B @-@ 29 , B @-@ 35 or B @-@ 36 . The USAAF rejected this proposal , citing increased drag , and hence reduced range for the composite bomber @-@ fighter configuration . On 19 March 1945 , McDonnell 's design team led by Herman D. Barkey , submitted a revised proposal , the extensively redesigned Model 27D . The smaller aircraft had an egg @-@ shaped fuselage , three fork @-@ shaped vertical stabilizers , horizontal stabilizers with a significant dihedral , and 37 ° swept @-@ back folding wings to allow it to fit in the confines of a bomb bay . The diminutive aircraft measured 14 ft 10 in (4 @.@ 52 m) long ; the folding wings spanned 21 ft (6 @.@ 4 m) . Only a limited fuel supply of 112 US gal (93 imp gal ; 420 l) was deemed necessary for the specified 30 @-@ minute combat endurance . A hook was installed along the aircraft 's center of gravity ; in flight , it retracted to lie flat in the upper part of the nose . The aircraft had an empty weight just short of 4 @,@ 000 pounds (1 @.@ 8 t) . To save weight , the fighter had no landing gear . During the testing program , a fixed steel skid under the fuselage and spring @-@ steel " runners " at the underside of the wingtips were installed in case of an emergency landing . Despite the cramped quarters , a pilot was provided with a cordite ejection seat , bail @-@ out oxygen bottle and high @-@ speed ribbon parachute . Four .50 in (12 @.@ 7 mm) machine guns in the nose made up the aircraft 's armament .

In service , the parasite fighter would be launched and retrieved by a trapeze . With the trapeze fully extended , the engine would be airstarted and the release from the mother ship was accomplished by the pilot pulling the nose back to disengage from the hook . In recovery , the aircraft would approach the mother ship from underneath and link up with the trapeze using the retractable hook in the aircraft 's nose . The anticipated production shift would see a mixed B @-@ 36 fleet with both " fighter carriers " and bombers employed on missions . There were plans that , from the 24th B @-@ 36 onward , provisions would be made to accommodate one XF @-@ 85 , with a maximum of four per bomber envisioned . Up to 10 percent of the B @-@ 36s on order were to be converted to fighter carriers with three or four F @-@ 85s instead of a bomb load .

On 9 October 1945 , the USAAF signed a letter of intent covering the engineering development for two prototypes (US serial numbers 46 @-@ 523 / 4) , although the contract was not finalized until February 1947 . After the successful conclusion of two reviews of a wooden mock @-@ up in 1946 and 1947 by USAAF engineering staff , McDonnell constructed two prototypes in late 1947 . The Model 27D was re @-@ designated XP @-@ 85 , but by June 1948 , it was changed to XF @-@ 85 and given the name " Goblin " . There were plans to acquire 30 production P @-@ 85s , but the USAAF took the cautious approach ? if test results from the two prototypes were positive , production orders for more than 100 Goblins would be finalized later .

= = Operational history = =

During wind tunnel testing at Moffett Field , California , the first prototype XF @-@ 85 was accidentally dropped from a crane at a height of 40 ft (12 m) , causing substantial damage to the forward fuselage , air intake and lower fuselage . The second prototype had to be substituted for the remainder of the wind tunnel tests and the initial flight tests .

As a production series B @-@ 36 was unavailable , all XF @-@ 85 flight tests were carried out using a converted EB @-@ 29B Superfortress mother ship that had a modified , " cutaway " bomb bay complete with trapeze , front airflow deflector and an array of camera equipment and instrumentation . Since the EB @-@ 29B , named Monstro , was smaller than the B @-@ 36 , the XF @-@ 85 would be flight tested , half @-@ exposed . In order to carry the XF @-@ 85 , a special " loading pit " was dug into the tarmac at South Base , Muroc Field , where all the flight tests originated . On 23 July 1948 , the XF @-@ 85 flew the first of five captive flights , designed to test whether the EB @-@ 29B and its parasite fighter could fly " mated " . The XF @-@ 85 was carried in a stowed position , but was sometimes tethered and extended into the airstream with the engine off , for the pilot to gain some feel for the aircraft in flight .

McDonnell test pilot Edwin Schoch was assigned to the project , riding in the XF @-@ 85 while it was stowed aboard the EB @-@ 29B , before attempting a " free " flight on 23 August 1948 . After

Schoch was released from the bomber at a height of 20 @,@ 000 ft (6 @,@ 000 m) , he completed a 10 @-@ minute proving flight at speeds between 180 and 250 mph (290 ? 400 km / h) , testing controls and maneuverability . When he attempted a hook @-@ up , it became obvious the Goblin was extremely sensitive to the bomber 's turbulence , as well as being affected by the air cushion created by the two aircraft operating in close proximity . Constant but gentle adjustments of throttle and trim were necessary to overcome the cushioning effect . After three attempts to hook onto the trapeze , Schoch miscalculated his approach and struck the trapeze so violently that the canopy was smashed and ripped free and his helmet and mask were torn off . He saved the prototype by making a belly landing on the reinforced skid at the dry lake bed at Muroc . All flight testing was suspended for seven weeks while the XF @-@ 85 was repaired and modified . Schoch used the down period to undertake a series of problem @-@ free dummy dockings with a Lockheed P @-@ 80 Shooting Star fighter .

After boosting the trim power by 50 percent , adjusting the aerodynamics , and other modifications , two further mated test flights were carried out before Schoch was able to make a successful release and hookup on 14 October 1948 . During the fifth free flight on 22 October 1948 , Schoch again found it difficult to hook the Goblin to the bomber 's trapeze , aborting four attempts before hitting the trapeze bar and breaking the hook on the XF @-@ 85 's nose . Again , a forced landing was successfully carried out at Muroc .

With the first prototype 's repairs completed , it also joined the flight test program , completing captive flights . While in flight , the Goblin was stable , easy to fly , and recoverable from spins , although initial estimates of a 648 mph (1 @,@ 043 km / h) top speed proved optimistic . The first test flights revealed that turbulence during approach to the B @-@ 29 was significant , leading to the addition of upper and lower fins at the extreme rear fuselage , as well as two wingtip fins to compensate for the increased directional instability in docking . All the initial flights had the hook secured in a fixed position , but when the hook was stowed and later raised , the resulting buffeting added to the difficulty in attempting a hookup . To address the problem , small aerodynamic fairings were added to the hook well that reduced the buffeting when the hook was extended and retracted . When testing resumed , on the 18 March 1948 test flight , Schoch continued to have difficulty in hooking up , striking and damaging the trapeze 's nose @-@ stabilizing section , before resorting to another emergency belly landing . After repairs to the trapeze , Schoch flew the first prototype on 8 April 1949 , completing a 30 @-@ minute free flight test , but after three attempts , abandoned his efforts and resorted to another belly landing at Muroc .

Aware of the problems revealed in flight tests , McDonnell reviewed the program and proposed a new development based on a more conventional design promising a Mach 0 @.@ 9 capability , using alternatively a 35 ° swept wing and delta wing . McDonnell also considered adding a telescoping extension to the docking trapeze that would extend the device below the turbulent air under the mother ship . Before any further work on the trapeze , other modifications to the XF @-@ 85 , or continued design studies on its follow @-@ up could be carried out , the USAF canceled the XF @-@ 85 program on 24 October 1949 .

Two main reasons contributed to the cancellation . The XF @-@ 85 's deficiencies revealed in flight testing included a lackluster performance in relation to contemporary jet fighters , and the high demands on pilot skill experienced during docking revealed a critical shortcoming that was never fully corrected . The development of practical aerial refueling for conventional fighters used as bomber escort was also a factor in the cancellation . The two Goblins flew seven times , with a total flight time of 2 hours and 19 minutes with only three of the free flights ending in a successful hookup . Schoch was the only pilot who ever flew the aircraft .

= = Further developments = =

Despite the cancellation of the XF @-@ 85 , the USAF continued to examine the concept of parasite aircraft as defensive fighters through a series of projects including Project MX @-@ 106 " Tip Tow " , Project FICON , and Project " Tom @-@ Tom " which involved fighter aircraft attached to bomber aircraft by their wingtips . Project FICON (" fighter conveyor ") emerged as an effective

Convair GRB @-@ 36D and Republic RF @-@ 84K Thunderflash combined bomber @-@ reconnaissance @-@ fighter , although the role was changed to that of strategic reconnaissance . Project FICON drew heavily on data from the abortive XF @-@ 85 project and closely followed McDonnell 's recommendations in designing a more refined trapeze . A total of 10 converted B @-@ 36s and 25 reconnaissance fighters saw limited service with the Strategic Air Command in 1955 ? 1956 , before being supplemented by more effective aircraft and satellite systems .

= = Aircraft on display = =

After the program 's termination , the two XF @-@ 85 prototypes were stored , before being surplussed and relegated to museum display in 1950 .

46 @-@ 0523 - National Museum of the United States Air Force at Wright @-@ Patterson Air Force Base near Dayton , Ohio . Following the cancellation of the program , the aircraft was transferred to the museum on 23 August 1950 and was one of the first experimental aircraft to be displayed at the new Air Force Museum . For several decades , the aircraft was displayed alongside the museum 's Convair B @-@ 36 . In 2000 , the aircraft was moved to the museum 's Experimental Aircraft Hangar . Museum staff and visitors objected to this move , believing the aircraft should be displayed alongside the B @-@ 36 to properly represent its original design intentions .

46 @-@ 0524 - Strategic Air and Space Museum in Ashland , Nebraska . It was originally transferred to the Norton Air Force Base (near San Bernardino , California) in 1950 , still in a damaged state after its last emergency landing . When the base museum was closed and its collection dispersed , the second XF @-@ 85 prototype languished in an unrestored condition as part of the Tallmantz private collection in California , until being acquired by Offutt AFB . It is now refurbished and displayed on its ground @-@ handling trestle , nestled under the wing of a B @-@ 36J bomber (serial number 52 @-@ 2217) .

= = Specifications = =

Data from Experimental & Prototype U.S. Air Force Jet Fighters , Boeing , National Museum of the United States Air Force .

General characteristics
Crew : 1
Length : 14 ft 10 in (4 @.@ 5 m)
Wingspan : 21 ft 1 in (6 @.@ 4 m)
Height : 8 ft 3 in (2 @.@ 5 m)
Wing area : 90 sq ft (8 @.@ 3 m ²)
Empty weight : 3 @,@ 740 lb (1 @,@ 700 kg)
Loaded weight : 4 @,@ 550 lb (2 @,@ 050 kg)
Max. takeoff weight : 5 @,@ 600 lb (2 @,@ 500 kg)
Powerplant : 1 × Westinghouse XJ34 @-@ WE @-@ 22 turbojet , 3 @,@ 000 lbf (13 @.@ 3 kN)
Performance
Maximum speed : 650 mph (estimated) (565 knots ; 1 @,@ 069 km / h)
Service ceiling : 48 @,@ 000 ft (14 @,@ 600 m)
Rate of climb : 12 @,@ 500 ft / min (3 @,@ 800 m / min)
Wing loading : 51 lb / sq ft (247 kg / m ²)
Thrust / weight : 0 @.@ 66
Armament
4 x .50 cal in (12 @.@ 7 mm) M3 Browning machine guns