

= Ryan FR Fireball =

The Ryan FR Fireball was a mixed piston and jet powered fighter aircraft designed by Ryan Aeronautical for the United States Navy during World War II . It was the Navy 's first aircraft with a jet engine . Only 66 aircraft were built before Japan surrendered in August 1945 . The FR 1 Fireball equipped a single squadron before the end of the war , but did not see combat . The aircraft ultimately proved to lack the structural strength required for operations aboard aircraft carriers and was withdrawn in mid 1947 .

= = Design and development = =

Design of the FR 1 began in 1943 to a proposal instigated by Admiral John S. McCain , Sr. for a mixed piston powered fighter because early jet engines had sluggish acceleration that was considered unsafe and unsuitable for carrier operations . Ryan received a contract for three XFR 1 prototypes and one static test airframe on 11 February 1943 with the first two prototypes delivered in 14 months . Another contract was placed for 100 aircraft on 2 December 1943 and a later contract on 31 January 1945 increased the total of FR 1s on order to 700 .

The XFR 1 was a single seat , low wing monoplane with tricycle landing gear . A 1 @, @ 350 @-@ horsepower ( 1 @, @ 010 kW ) Wright R @-@ 1820 @-@ 72W Cyclone radial engine was mounted in the fighter 's nose while a 1 @, @ 600 lbf ( 7 @, @ 100 N ) General Electric I @-@ 16 ( later redesignated as the J @-@ 31 ) turbojet was mounted in the rear fuselage . It was fed by ducts in each wing root which meant that the wing had to be relatively thick to house the ducts and the outward @-@ retracting main landing gear . To simplify the fuel system , both engines used the same grade of avgas . Two self @-@ sealing fuel tanks were housed in the fuselage , one of 130 US gallons ( 490 l ; 110 imp gal ) and the other of 50 US gallons ( 190 l ; 42 imp gal ) . The cockpit was positioned just forward of the leading edge of the wing and the pilot was provided with a bubble canopy which gave him excellent visibility . The XFR @-@ 1 had the first laminar flow airfoil in a navy carrier aircraft .

The Fireball was armed with four .50 in ( 12 @. @ 7 mm ) M2 Browning machine guns with 300 rounds per gun . They were mounted in the center section of the wing , immediately outboard of the air intakes for the jet engine . Four 5 @-@ inch ( 127 mm ) rockets could be carried under each outer wing panel and two hardpoints were provided under the center section for 1 @, @ 000 lb ( 454 kg ) bombs or 100 US gal ( 380 l ; 83 imp gal ) drop tanks . Armor plates were provided in front and behind the pilot 's seat and for the oil cooler .

The first XFR @-@ 1 made its first flight on 25 June 1944 without its jet engine , but that was installed shortly afterward . The second prototype first flew on 20 September 1944 . Test flights confirmed wind tunnel tests that revealed a lack of longitudinal stability because the center of gravity had been miscalculated . In addition , the circular rear fuselage of the FR @-@ 1 gave less stability than the slab @-@ style fuselage of the Grumman F4F Wildcat that was used as a model for the stability calculations . A new tail with enlarged vertical and horizontal stabilizers was designed and retrofitted to the prototypes . The original Douglas double @-@ slotted flaps proved to be unsatisfactory during flight testing , but all three prototypes and the first 14 production aircraft were built with them before they were replaced with a single @-@ slotted flap .

The first prototype was lost in a crash at NAS China Lake on 13 October 1944 . Investigation showed that the wing structure was not strong enough to resist compressibility effects . This was cured by doubling the number of rivets in the outer wing panels . The second prototype crashed on 25 March 1945 when the pilot failed to recover from a dive from 35 @, @ 000 feet ( 10 @, @ 670 m ) , probably also due to compressibility effects . The third prototype crashed on 5 April when the canopy blew off during a high @-@ speed pass over Lindbergh Field .

Operational testing by the Naval Air Test Center at Naval Air Station Patuxent River that included carrier acceptability tests revealed additional problems . The piston engine tended to overheat until electrically operated cowl flaps were installed , the catapult hooks had to be moved and the nosewheel oleo shock strut had to be lengthened by 3 inches ( 76 mm ) . Carrier suitability tests

began aboard the escort carrier Charger in early January 1945 . The aircraft successfully made five catapult takeoffs using the piston engine as well as three takeoffs using both engines . No problems were reported when landing aboard the carrier .

The FR @-@ 1 Fireball was further developed into the XFR @-@ 2 which utilized a 1 @, @ 425 hp ( 1 @, @ 063 kW ) Wright R @-@ 1820 @-@ 74W in place of the -72W . One single airframe was converted to this configuration . No prototypes were built for the next proposed variant , the FR @-@ 3 , which would have used a General Electric I @-@ 20 turbojet . Both of these projects were canceled with the end of the war . The fastest Fireball was the XFR @-@ 4 , which had a Westinghouse J34 turbojet and was approximately 100 mph ( 161 km / h ) faster than the FR @-@ 1 . The turbojet 's air intakes were moved from the wing roots to the fuselage in front of the wing ; they were covered by electrically powered doors to lessen drag when the aircraft was flying only on its piston engine . The Fireball 's fuselage was lengthened by 8 inches ( 203 mm ) to accommodate the larger engine and the leading edge extension of the wing root that housed the air intakes was also removed . The XFR @-@ 4 was intended to serve as a testbed for the turbojet installation on the XF2R @-@ 1 Dark Shark . This was the final variant ; the piston engine was replaced with a General Electric XT31 @-@ GE @-@ 2 turboprop , but only one prototype was built .

On 2 December 1943 , orders for 100 production FR @-@ 1s were placed , with a follow @-@ up order of 1 @, @ 000 additional fighters in January 1945 . All of the contracts were contingent on the aircraft successfully completing carrier trials . Only 66 Fireballs were completed by November 1945 as orders for 1 @, @ 044 FR @-@ 1s were canceled on VJ Day .

= = Operational history = =

One squadron , VF @-@ 66 , received its first Fireballs in March 1945 , but they never saw combat . On 1 May , three of the squadron 's aircraft were craned aboard the carrier Ranger to attempt to qualify seven pilots , but two of the fighters were damaged while landing . One missed the arresting gear and hit the crash barrier while the other aircraft 's nose gear collapsed . The following month the pilots qualified and were on pre @-@ embarkation leave when the Japanese surrendered . The squadron was decommissioned on 18 October with all pilots and aircraft transferred to VF @-@ 41 .

On 6 November 1945 , a Fireball of VF @-@ 41 became the first aircraft to land under jet power on an aircraft carrier , albeit unintentionally . After the radial engine of an FR @-@ 1 failed on final approach to the escort carrier Wake Island , the pilot managed to start the jet engine and land , barely catching the last arrestor wire before hitting the ship 's crash barrier . The squadron was attempting to qualify its pilots for carrier operations during this time , but only 14 of its 22 pilots made the six required takeoffs and landings . A number of accidents occurred when the nose gear failed on landing , but the pilots were at least partly responsible as they were slamming the nose gear onto the deck after landing on the main gear .

The squadron qualified on the escort carrier Bairoko in March 1946 , but nose gear problems persisted and cut the cruise short . Ryan installed a steel fork for the nose wheel , but inspections also revealed evidence of partial wing failures so the aircraft was limited to maneuvers not to exceed 5 Gs . VF @-@ 41 suffered three fatal accidents in 1946 before being redesignated as VF @-@ 1E on 15 November 1946 . One Ensign collided with the target banner during gunnery practice and spun into the water . A few months later , the squadron commander was performing a barrel roll when his wing broke off and he struck another Fireball , killing both pilots .

VF @-@ 1E conducted carrier qualification in March 1947 aboard the escort carrier Badoeng Strait and only eight pilots successfully qualified , not least because the FR @-@ 1s were proving to be too fragile to endure repeated carrier landings . During one brief deployment in June aboard Rendova , one aircraft broke in two during a hard landing . Subsequent inspections of the squadron 's aircraft showed signs of structural failure and all the Fireballs were withdrawn by 1 August 1947 .

After the withdrawal of the type from service , except for a few examples retained for modifications and testing , the FR @-@ 1s were scrapped .

== Variants ==

XFR @-@ 1

Military designation of the Prototype Model 28 aircraft , three built .

FR @-@ 1 Fireball

Single @-@ seat fighter aircraft , 66 built .

FR @-@ 2

Conversion with a Wright R @-@ 1820 @-@ 74W replacing earlier piston engine , one aircraft modified .

FR @-@ 3

Proposed variant with a General Electric I @-@ 20 replacing earlier jet engine ; never built .

XFR @-@ 4

Variant with Westinghouse J34 ; one built .

XF2R @-@ 1

Final variant with Westinghouse J34 and General Electric XT31 @-@ GE @-@ 2 turboprop replacing the piston engine ; one built .

== Operators ==

United States

United States Navy

The " Firebirds " squadron was known under three names :

VF @-@ 66 ( March 1945 ? 15 October 1945 )

VF @-@ 41 ( 15 October 1945 ? 1 August 1947 ) , redesignated VF @-@ 1E on 15 November 1946 .

== Survivors ==

Only a single example , FR @-@ 1 BuNo 39657 , still survives . Deployed first to the NASA Ames Research Center , the aircraft served as an instructional airframe at a technical school before being acquired by the Planes of Fame Air Museum at Chino , California in the 1960s . After restoration to static display condition , 39657 was rolled out at Chino on 13 June 2009 .

== Specifications ( FR @-@ 1 ) ==

Data from United States Navy Aircraft since 1911 and Ryan FR @-@ 1 Fireball and XF2R @-@ 1 Darkshark

General characteristics

Crew : one

Length : 32 ft 4 in ( 12 @. @ 19 m )

Wingspan : 40 ft 0 in ( 12 @. @ 19 m )

Height : 13 ft 11 in ( 4 @. @ 24 m )

Wing area : 275 ft <sup>2</sup> ( 25 @. @ 6 m <sup>2</sup> )

Empty weight : 7 @, @ 689 lb ( 3 @, @ 488 kg )

Loaded weight : 11 @, @ 652 lb ( 5 @, @ 285 kg )

Powerplant :

1 x General Electric J31 @-@ GE @-@ 3 turbojet , 1 @, @ 600 lbf ( 7 @. @ 1 kN , 700 kgf )

1 x Wright R @-@ 1820 @-@ 72W Cyclone radial engine , 1 @, @ 350 hp ( 1 @, @ 060 kW )

Performance

Maximum speed : 404 mph ( 276 mph with piston engine alone ) ( 650 km / h ( 444 km / h ) )

Cruise speed : 152 mph ( piston engine alone ) ( 246 km / h )

Range : 1 @, @ 620 mi ( 2 @, @ 610 km ) ( with 2 drop tanks )

Service ceiling : 43 @, @ 100 ft ( 13 @, @ 137 m )

Rate of climb : 29 @ 7 ft / s ( 9 m / s ) ( Piston engine only , with 1 drop tank )

#### Armament

4 × .50 in ( 12 @ 7 mm ) M2 Browning machine gun with 300 rpg

2 × 1 @ 000 lb ( 454 kg ) bombs

8 × 5 @- inch ( 127 mm ) rockets under wings