= North American XF @-@ 108 Rapier =

The North American XF @-@ 108 Rapier was a proposed long @-@ range , high @-@ speed interceptor aircraft designed by North American Aviation intended to defend the United States from supersonic Soviet strategic bombers . The aircraft would have cruised at speeds around Mach 3 (2 @,@ 300 mph ; 3 @,@ 700 km / h) with an unrefueled combat radius over 1 @,@ 000 nautical miles (1 @,@ 900 km ; 1 @,@ 200 mi) , and was equipped with radar and missiles offering engagement ranges up to 100 miles (160 km) against bomber @-@ sized targets .

To limit development costs , the program shared engine development with the North American XB @-@ 70 Valkyrie strategic bomber program , and used a number of elements of earlier interceptor projects . The program had progressed only as far as the construction of a single wooden mockup when it was cancelled in 1959 , due to a shortage of funds and the Soviets ' adoption of ballistic missiles as their primary means of nuclear attack . Had it flown , the F @-@ 108 would have been the heaviest fighter of its era .

= = Development = =

During the early 1950s , the USAF proposed a very high @-@ performance , long @-@ range interceptor . On 20 July 1955 , formal development of what became known as the Long @-@ Range Interceptor , Experimental (LRI @-@ X) was approved , planned as a F @-@ 102 Delta Dagger / F @-@ 106 Delta Dart replacement . The specification was laid down on 6 October 1955 , calling for an interceptor that could fly at 60 @,@ 000 ft (18 @,@ 000 m) at a speed of Mach 1 @.@ 7 (1 @,@ 122 mph (1 @,@ 806 km / h) , with a range of 1 @,@ 000 miles (1 @,@ 600 km) . It was to have a two @-@ man crew and at least two engines . A further consideration was that an integrated fire @-@ control system would be fitted , allowing the interception of a bomber at 60 nmi (110 km) and three targets to be destroyed during a single mission .

Of the eight interested companies , contracts for preliminary studies were issued to North American Aviation , Lockheed and Northrop on 11 October 1955 , five days after the specification 's release . Of the paper designs , the North American proposal , dubbed " NA @-@ 236 " , seemed the most promising . The NA @-@ 236 shared some similarities with the XF @-@ 108 , although the most obvious differences were the additions of two finlets at the midspan of the horizontal stabilizers , and canards . Political and budgetary difficulties led to the cancellation of the program on 9 May 1956 .

After considerable confusion , the program was reinstated on 11 April 1957 with North American awarded a contract for two prototypes . The designation F @-@ 108 was issued , also known as " Weapon System 202A " (WS @-@ 202A) . North American 's company designation was " NA @-@ 257 " , although it was basically identical to the NA @-@ 236 . At the time , Air Defense Command anticipated an order for 480 aircraft .

The resulting design went through considerable evolution , owing to both its cutting @-@ edge technology and continual redefinition of the USAF requirements . Early revisions prominently featured canards , with a span of 19 ft 10 in (6 @.@ 04 m) , and a wing of 53 @.@ 5 ° sweep . The aircraft in this configuration would have had a maximum takeoff weight of 99 @,@ 400 lb (45 @,@ 088 kg) with a 72 @,@ 550 feet (22 @,@ 113 m) operational ceiling . In addition to the F @-@ 108 's interceptor role , North American proposed it as an escort fighter for its own B @-@ 70 Valkyrie supersonic bomber prototype . Commonality between the B @-@ 70 bomber and the F @-@ 108 included the escape capsule and General Electric YJ93 engines . Another role considered was for the F @-@ 108 to be " gap @-@ fillers " for the Distant Early Warning (DEW) system ; because of its great speed , the F @-@ 108 could have scanned up to 278 @,@ 000 square miles (720 @,@ 000 km2) per hour .

From September 1958 , substantial engineering and design changes were implemented ; however , SAC had lost interest in the escort fighter concept . To accompany the B @-@ 70 all the way to its target and back , the F @-@ 108 in its initial concept would have , at best , marginal range . On 30 December 1958 , YF @-@ 108A preproduction aircraft on order were reduced from 31 to 20 test aircraft and the first test flight was delayed from February to April 1961 . The eventual design , which

was built as a full @-@ sized XF @-@ 108 mockup , was displayed to Air Force officials on 17 ? 20 January 1959 . The project was given the name " Rapier " on 15 May 1959 , following a contest by the Air Defense Command asking airmen for suggestions .

= = = Cancellation = = =

Even as the XF @-@ 108 program was progressing well , there were signs that would ultimately lead to its eventual cancellation . Unconfirmed Soviet bomber threats , the overwhelming trend toward offensive and defensive nuclear missiles in the late 1950s and early 1960s , as well as rising costs , contributed to the termination of the XF @-@ 108 . The cancellation was announced on 23 September 1959 . North American continued refining the design through 1960 in hopes that the program might be revived . Despite the extra money and time spent on the Rapier , it was not wholly in vain ; the North American A @-@ 5 Vigilante supersonic reconnaissance bomber developed for the U.S. Navy retained the fuselage / weapon package and systems design of the Rapier . In many ways the Vigilante could be seen as the successful application of the Rapier design principles in a Mach 2 supersonic design .

Hughes Aircraft would continue the development of the advanced fire control system and the GAR @-@ 9 missile . Development of the F @-@ 108 radar and missiles was continued by the USAF and the system was eventually used in the Lockheed YF @-@ 12 program . The final configuration for the rear cockpit in the YF @-@ 12A looked similar to that of the F @-@ 108 since it incorporated the same displays and controls required for the Hughes ASG @-@ 18 fire control system .

= = Design = =

The initial F @-@ 108 configuration featured a very large " cranked " delta wing . There were fixed ventral stabilizers on the wings , mounted at mid @-@ span , and a tall all @-@ moving vertical tailfin , supplemented by two ventral stabilizers that extended when the landing gear retracted . Although some earlier versions of the design had separate tailplanes or forward canards , both were abandoned in the final design . The large fuselage and wing had two and five fuel tanks , respectively , giving an estimated combat radius of some 1 @,@ 100 nautical miles (2 @,@ 000 km) . Top speed was estimated at 1 @,@ 980 miles per hour (3 @,@ 190 km / h) , about Mach 3 , at 81 @,@ 800 feet (24 @,@ 900 m) . The aircraft was powered by two General Electric J93 turbojet engines , also used in North American 's XB @-@ 70 Valkyrie bomber , in the fuselage .

The F @-@ 108 was intended to carry the Hughes AN / ASG @-@ 18 radar , the U.S. ' s first pulse @-@ Doppler radar set . It was to have look @-@ down / shoot @-@ down capability , but could track only one target at a time . The radar was paired with an infra @-@ red search and tracking (IRST) system on the wing leading edges . The radar was used to guide the Hughes GAR @-@ 9 (later redesignated AIM @-@ 47) air @-@ to @-@ air missile , three of which would be carried on a rotary launcher in an internal weapons bay . The GAR @-@ 9 was a very large , long @-@ range weapon with its own radar set for terminal homing . It was intended to fly at Mach 6 , with a range of almost 112 miles (180 km) .

= = XQ @-@ 11 target drone = =

As part of WS @-@ 202A , a design for a high @-@ speed (Mach 3 +) aerial target for use in testing the F @-@ 108 's weapons system was proposed . The Wright Air Development Center requested the designation XQ @-@ 11 for the target design ; the request was denied due to the early stage of development , and the F @-@ 108 program was cancelled before further work was undertaken .

= = Specifications (XF @-@ 108) = =

Data from National Museum of the United States Air Force

General characteristics
Crew : two
Length : 89 @.@ 2 ft (27 @.@ 2 m)
Wingspan : 57 @.@ 4 ft (17 @.@ 5 m)
Height : 22 @.@ 1 ft (6 @.@ 7 m)
Wing area : 1 @,@ 865 ft ² (173 @.@ 4 m ²)
Empty weight : 50 @,@ 907 lb (23 @,@ 098 kg)
Max. takeoff weight : 102 @,@ 000 lb (46 @,@ 508 kg)
Powerplant : 2 × General Electric YJ93 @-@ GE @-@ 3AR afterburning turbojet
Dry thrust : 20 @,@ 900 lbf (93 @.@ 0 kN) each
Thrust with afterburner : 29 @,@ 300 lbf (130 @.@ 3 kN) each
Performance
Maximum speed : Mach 3 + , 1 @,@ 980 mph (1 @,@ 720 kn , 3 @,@ 190 km / h)
Range : 1 @,@ 271 mi (1 @,@ 104 nmi , 2 @,@ 033 km) combat
Ferry range : 2 @,@ 488 mi (2 @,@ 162 nmi , 4 @,@ 004 km)
Service ceiling : 80 @,@ 100 ft (24 @,@ 400 m)
Wing loading : 55 @.@ 9 lb / ft ² (183 @.@ 4 kg / m ²)
Thrust / weight : 0 @.@ 56
Armament
Guns : 4 x 20 mm cannon
Missiles : 3 × Hughes GAR @-@ 9A air @-@ to @-@ air missiles in a rotary weapons bay
Bombs : 4 @,@ 000 lbs