BELL'S LAST FIGHTER

In trying to improve on its P-59 jet fighter, Bell experienced more struggles with its XP-83 **WORDS:** TONY BUTTLER

ABOVE: This image of the first Bell XP-83 prototype, 44-84990, is well-known but remains one of the best of the type, since relatively few air-to-air photos of it appear to have been taken. VIA TONY BUTTLER

Being first doesn't always guarantee success. That much the Bell Aircraft Corporation discovered when it built its first jet fighter, and indeed America's first jet aircraft, the P-59 Airacomet. So disappointing was its performance that an initial military order was cut, and there was to be no combat employment. Clearly a major improvement was needed if Bell were to stay in the fighter game.

One objective for what became the XP-83 was to produce a jet fighter similar in appearance to the P-59 but with better performance. Some undesirable aerodynamic characteristics were to be eliminated, the new fighter was to be larger, and it would use more powerful engines. Early jet engines were heavy, lacked power and consumed fuel at a ferocious rate, which limited range and endurance quite severely. As the largest and heaviest jet fighter design flown to date, the XP-83 was intended to be the first of its breed to offer a decent amount of range.

The manufacturer's original proposal was called the D-16 Stratosphere Fighter, but later became the Model 40. Bell's chief design engineer was Robert J. Woods and on 29 March 1943, after his team had completed considerable background research into the merits of an aircraft powered by two General Electric I-40 engines, he and project engineer Edgar P. Rhodes took the Model 40 documents to Air Materiel Command at Wright Field, Ohio. This proposal was the result of a combined effort from the US Army Air Forces and Bell, and in AAF eyes the project became 'active' from this date onwards.

At Wright Field it was reviewed by the engineering division, which took the decision to switch from an interceptor fighter to a long-range escort fighter with greater capacity for fuel. The Model 40's layout was found to be easily adaptable to the necessary changes. For its part, Bell submitted revised proposals to Wright Field on 3 April, and the

project was gradually refined during the rest of 1943.

Bell was informed on 26 April that, because of combat experience, the design load factor for all fighter aircraft had been reduced from 8 to 7.33. This enabled the new fighter to carry the extra fuel for long-range escort duties with only minor modifications to the structure. However, during early August it became apparent that its structure weight had in fact been increasing beyond the original estimates. It was found that much of the additional weight had come from an inaccurate estimate of the structure required to fit the extensible-area landing flaps.

LEFT:
A pre-production YP-59A, complete with nose armament, in flight.
USAF

Another change concerned the gun armament. Originally 0.50in (12.7mm) machine guns were selected, but in late August 1943 it was established that .60-calibre (15.2mm) guns would be required for a future fighter. Layouts were prepared for a six-gun, .60-calibre Model 40 installation, preliminary studies showing that the best solution would involve four guns in the nose with two more in the fuselage sides. This was approved and Bell was instructed to make the modifications to the airframe. However, when more information on the gun mounting arrangement became available in January 1944 Bell realised that, by extending the nose by 15in (381mm), it would be possible to have all six guns housed in the nose in the same manner as the .50-calibre format. This presented less of an airframe structural problem and from a firepower standpoint was desirable, so Bell was told to drop the wing gun layout and to proceed with the six-gun nose.

All this effort had been carried out without a prototype order, but a contract was finally awarded on 11 March 1944 for two XP-83s against specification MX-511. On 5-6 June, a full-size mock-up was inspected at Bell's Buffalo factory, while a static test airframe was tested in Air Materiel Command's laboratory and found satisfactory in structural terms.

> ***"The XP-83 was the largest and heaviest jet fighter design to date"***

A new problem, however, concerned the tailplane. By early September 1944, data from the wind tunnel belonging to the National Advisory Committee for Aeronautics (NACA) at Langley Field had indicated that the XP-83 as designed would suffer from directional instability. In response Bell conceived a larger fin and rudder with the span increased by 16in (406mm), tests having indicated that this would overcome the issue. But since the fighter could be flown 'normally' and safely with the original fin and rudder, Air Materiel Command told Bell to introduce the larger tailplane only on the second prototype. Modifying the first airframe would push back the first flight date and, as it stood, directional stability was quite adequate for normal flying in this aircraft but not for aerobatics or spin recovery (action was taken to restrict the first XP-83 against entering spins). For the same reason the upgraded gun armament was held back to the second machine.

The command learned in late September 1944 that the XP-83's

BELOW:
One of a series of walk-round views taken on 8 February 1945, the day the XP-83 was rolled out, this head-on view shows the large air intakes and wide-track undercarriage. The fuselage itself was quite slim.
VIA GERALD BALZER

In snowy conditions at Bell's Buffalo airfield in New York, 44-84990 taxis out for a test sortie early in its career — possibly its maiden flight on 25 February 1945. In the background are P-63 Kingcobras in USAAF and Soviet markings. VIA GERALD BALZER

ABOVE LEFT TO RIGHT: A very rare image of the complete second prototype, 44-84991, with its extended nose and larger tailplane; and the first XP-83 is prepared for its ramjet flight trials, which only lasted one sortie before the aircraft was lost. One small Marquardt RJ30 ramjet, of just 21in (0.533m) diameter, was fitted beneath each wing. VIA GERALD BALZER

XP-83 DATA

POWERPLANTS
Two GE J33-GE-5 (I-40) turbojets, 3,750lb thrust each

DIMENSIONS

Length:	First prototype 44ft 10in (13.66m), second prototype 45ft 2in (13.77m)
Wingspan:	53ft 0in (16.15m)
Wing area:	431 sq ft (40.08 sq m)

WEIGHTS

Gross:	24,090lb (10,927kg)
Max take-off:	27,500lb (12,474kg)

PERFORMANCE

Maximum recorded speed (44-84990):	522mph (840km/h) at 15,660ft (4,773m)
Cruising speed:	441mph (710km/h) at 15,660ft (4,773m)
Range with external fuel:	1,750 miles (2,816km) at cruise speed
Service ceiling (44-84990):	42,300ft (12,893m)

ARMAMENT
First prototype, six 0.50in (12.7mm) machine guns; second prototype, six 0.60in (15.2mm) machine guns. Two 1,000lb (454kg) bombs, one per wing instead of external tanks. Fitting of four 20mm or one 37mm cannon in nose considered.

airframe weight had risen to an alarming extent. In-depth investigations determined that this had been caused by using a type of flap which increased the weight far in excess of its aerodynamic benefit, using existing parts such as landing gear struts to save time and reduce construction costs, and a failure by Bell to redesign components in the name of reducing their heaviness. Studies established that a redesign could remove around 1,400lb (635kg) of the measured 2,000lb (907kg) of excess weight. Considerations towards abandoning the XP-83 due to this were dropped.

At around the same time, new NACA data showed that a redesigned windshield and canopy would provide a 7mph (11km/h) increase in maximum speed. By now, though, construction of the first XP-83 was at an advanced stage. Once more, no effort was made to incorporate this alteration into the first aircraft. Instead, the revised canopy and any possible weight savings would feature on the second machine, thereby making this aircraft a clear improvement over XP-83 number one.

The two XP-83 prototypes carried AAF serials 44-84990 and 44-84991. The first was completed on 8 February 1945, and it made a 45-minute maiden flight from Niagara Airport, next to Niagara Falls, on 25 February. Bell chief test pilot Jack Woolams was in the cockpit, and the sortie passed satisfactorily until the fuel in the front fuselage tank became exhausted. Woolams found the booster pump for the rear fuselage tank had failed and was forced to cut the power back drastically to prevent the engine from stopping. He landed safely and the problem was fixed, but then on flight two fuel was seen to be escaping through the vent system. Woolams felt the first XP-83 had satisfactory flight characteristics but was underpowered and unstable.

The aileron boost system was connected for the first time on flight six, when Woolams attempted to reach high Mach numbers in a shallow dive. At about Mach 0.72, severe vibration of the instrument panel was experienced, followed immediately by aileron buffeting. To try and cure this the aileron mass balance was increased from 100 per cent to 125 per cent, which subsequent test flying showed had raised the critical Mach number from 0.72 to 0.735. The same phenomena was encountered again at this higher figure, but any plans to put the XP-83 into production had meanwhile dissipated, so there were no further attempts to resolve it.

No difficulty was encountered with the aileron boost system itself during this flight, but, according to the pilot, the XP-83's "centering characteristics were poor and […] there was a marked tendency to over control since the stick forces decreased greatly after the first movement of a fraction of an inch". Modifications brought no real improvement, and indeed the pilot twice reported aileron lock, but on each occasion he was able to overpower the boost system and land safely. This latter situation could never be duplicated on the ground and thus remained unsolved. Problems were also experienced with closing the landing gear 'flipper' doors, the mechanism

that worked them having to be redesigned to prevent the doors from sagging downwards during flight at high speeds.

AAF flight tests to determine the XP-83's "official performance" began on 9 June 1945 with 44-84990. However, the next day they were interrupted by a fire which started after a ruptured fuel line allowed the fuselage to fill with fuel after landing. The XP-83 suffered only slight damage. A second delay came after the pilot cut off the hydraulic pumps while the engines were running on the ground. The brakes operated hydraulically and 44-84990 rolled forward into a fire truck, minor damage being caused to the port wing. In both cases Bell's engineers repaired the aircraft quickly.

The first XP-83 was accepted by the AAF on 11 October 1945, and service pilots made few unfavourable comments about the aeroplane. The principal weaknesses were the undesirable characteristics of the aileron boost system, plus the sloshing of fuel back and forth inside the large fuselage tanks which gave an impression of longitudinal instability. A most unusual characteristic was that the XP-83 refused to slow down, its sleek aerodynamic shape coupled with the lack of drag brakes meaning pilots had to fly very long, flat landing approaches.

> ***"AAF pilots made few unfavourable comments"***

After official testing 44-84990 was returned to Bell, but with no P-83 production programme the aircraft was reassigned to engine research under the control of Air Materiel Command's Power Plant Laboratory. A new engineer's 'cockpit' was fitted into the fuselage to the rear of the pilot and an experimental 21in (0.533m)-diameter Marquardt RJ30 ramjet engine was attached under each wing on a short pylon. It was hoped that sufficient speed could be reached using J33 jet power alone to enable the ramjets to be started up, after which the main engines would be shut down to leave the XP-83 flying purely on ramjet power. The engineer would monitor the behaviour and running of the ramjets. The chosen flight crew for these trials comprised Bell test pilot Chalmers H. 'Slick' Goodlin and flight test engineer Charles L. Fay.

The initial flight of this new programme took place on 4 September 1946, and turned into a near-disaster. Because of a fuel leak, the starboard ramjet caught fire on ignition and exploded. The wing was damaged, and the fire soon spread to and engulfed the entire wing. With the starboard aileron lost and the threat of a fuel explosion, Goodlin and Fay bailed out after gaining sufficient altitude, both parachuting to safety. The first XP-83 was destroyed when it crashed in flames on a farm some four miles (6.5km) south of Amherst, New York.

XP-83 number two's maiden flight, again from Niagara Airport, was made on 19 October 1945. The objective of its flying programme was to test thoroughly the 0.60in (15.2mm) gun installation. However, during the very early flights — and because of malfunctions with the weapons themselves — considerable trouble was experienced just in getting the guns to fire. Once these had been overcome, a series of three or four flights brought a successful conclusion to the contractor's flight test programme.

On 27 June 1946, 44-84991 was accepted by Air Materiel Command at Bell's factory and ferried to Wright Field for official testing of the gun installation, the aircraft having been assigned to the command's Armament Laboratory. The trials were conducted throughout 1946, both at Wright Field and at Eglin Field in Florida, and were still ongoing in early January 1947, at which stage no criticism of the gun fit had been made. Having completed its tenure at Wright Field, the surviving XP-83 was declared surplus in 1948, withdrawn from flight status and subsequently scrapped.

In the end the XP-83's performance was judged as relatively poor and, apart from its range, the type offered no major advantages when compared with other fighters soon to be available. It appears there was never any real chance of production which meant that, after qualified success with the P-39 and P-63, the XP-83 proved to be Bell's fighter swansong. A

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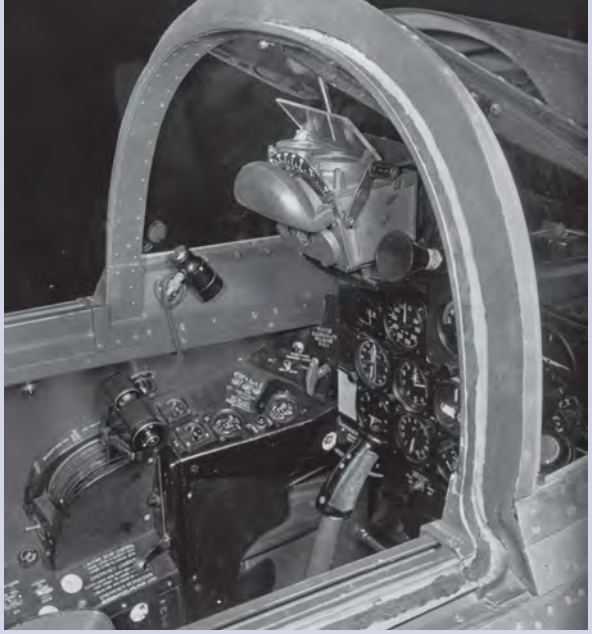
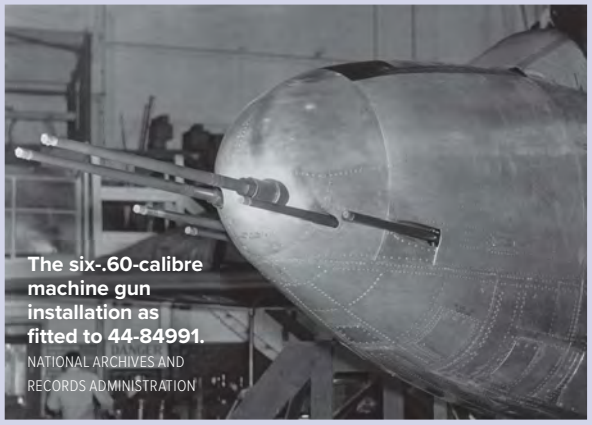


The XP-83's cockpit, in this case the second prototype.
NATIONAL ARCHIVES AND RECORDS ADMINISTRATION

XP-83 IN DETAIL

The Bell XP-83 had an all-metal structure, built primarily in aluminium light alloy and with a semi-monocoque fuselage. The cantilever wing was covered in stressed skin, had 2° of dihedral and was swept to an angle of 8° at the leading edge. Both the tailplane and fin were also of the cantilever type and made of aluminium or magnesium; indeed, all the control surfaces used metal construction. "Extensible-area high lift devices" (landing flaps) were fitted, and both the rudder and port aileron had trim tabs. The ailerons were of the internal pressure-balanced type and the rudder and elevators were balanced by symmetrical leading-edge overhangs. A stick-type control system was used with push-pull tubes to the elevator and to the ailerons, and push-pull tubes and a cable to the rudder. A hydraulic aileron boost system was employed.

The pilot had a pressurised and air-conditioned cockpit and the engines were mounted under each wing root, which left the chunky fuselage almost entirely free for fuel and guns. Although designed as a single-seater, for its later ramjet trials the first XP-83 had an engineer's station in the fuselage with an entrance door underneath. The main gear of the tricycle undercarriage retracted inboard and the nose gear aft. Internal fuel capacity was 1,150 US gallons (4,353 litres) in five tanks — three in the fuselage and one in each wing — while another 300 US gallons (1,136 litres) could be carried in two underwing-mounted external tanks, one per wing.



The six-.60-calibre machine gun installation as fitted to 44-84991.
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