1 July - 31 December 1955

the HISTORY of the AIR FORCE FLIGHT TEST CENTER

EDWARDS AIR FORCE BASE, CALIFORNIA

AIR RESEARCH AND DEVELOPMENT COMMAND

UNITED STATES AIR FORCE

VOL. I

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WEAPON SYSTEM DEVELOPMENT AND TESTING: EVALUATION AND RECOMMENDATIONS

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RF-84F Photographic Reconnaissance Fighter: Phase IV Performance and Stability Test

The Phase IV performance and stability test of the RF-84F aircraft was conducted at the Air Force Flight Test Center between 14 October 1954 and 11 July 1955. The test aircraft was an early production model, USAF S/N 51-1840, with test instrumentation and ballast installed. Although most of the tests were conducted utilizing the J65-B-3 engine, a limited performance evaluation was made of the aircraft with a J65-W-7 engine installed. Eighty-four flights, totaling 96 hours and 40 minutes, were required to complete the test.[1]

Captain Virgil C. Givens, USAF, was the project pilot and Willie L. Allen was the project engineer. Upon the completion of the test, an approved technical report was published by Headquarters, Air Force Flight Test Center.[2]

The test program was authorized by Air Research and Development Command Test Directives 5261-F1 and 5261-F2.

The RF-84F was a photographic reconnaissance version of the F-84F fighter manufactured by the Republic Aviation Corporation, Farmingdale, New York. Unlike the F-84F which had a nose air in-take, the RF-84F had wing root in-takes which enabled the aircraft to carry several cameras in various combinations in the fuselage nose.[3] In addition to the cameras, the RF-84F was capable of carrying .50-in. machine guns for self-protection, two in each wing.

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1. Hq, AFFTC, "AFFTC-TR-55-29: RF-84F Phase IV Performance and Stability Test" dated Nov 1955, p. 1. See Tab TA in Vol 7, this history. (Hereinafter cited as AFFTC-TR-55-29.)
2. See the abridged technical report, Tab TA in Vol 7, this history. Front and side photographs of the aircraft are shown on p. 168. Aircraft dimensions are summarized on pp. 162-163.
3. See photographs of aircraft on p. 168, Tab TA, Vol 7, this history.

In 1954, modifications had been ordered on an undisclosed number of RF-84F's to enable them to be used in connection with the FICON VLR reconnaissance project. This project was the GRB-36/RF-84F weapon package which combined the global range of the 10-engined Convair B-36 with the high speed and maneuverability of the RF-84F. The B-36 was provided with a mechanism to enable the RF-84F to be launched and retrieved in mid-air. By that technique, the RF-84F could be carried 4,000 miles under the bomb-bay of the B-36, released 1,000 miles from the target, accomplish its photographic and reconnaissance mission, and then rejoin the carrier for the long journey home.

The RF-84F utilized in the Phase IV performance and stability test was an early production model manufactured previous to those for the FICON VLR project.

Upon the completion of the Phase IV performance and stability test, the project personnel evaluated the RF-84F and reported that "in general, the RF-84F aircraft was inferior in performance to fighters currently in service and appeared to be quite vulnerable to interception."[4] The performance of the aircraft was substantially the same as given in the Pilot's Handbook. Although the level flight high speed performance of the RF-84F in the clean configuration compared with that of the F-84F and the F-86H, the RF-84F had a number of limitations which would seriously reduce its operational effectiveness.

The test personnel believed that the most serious of these limitations was "the low thrust-weight ratio."[5] This was reflected in the long take-off roll required, the low service ceilings, and the low load factors attainable at high altitudes without loss of speed or altitude, and the poor acceleration of the aircraft.

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4. Quoted from Abstract, AFFTC-TR-55-29, Tab TA in Vol 7, this history.
5. Ibid.

The test pilot discovered that take-offs at high gross weights were hazardous even with the use of assisted take-off. As the project progressed, installation of the J65-W-7 engine in place of the J65-W-3 engine improved but did not remedy the limitation outlined above.

A severe pitch-up encountered in accelerated maneuvers at medium and high altitudes was reported by the project pilot. Longitudinal control was insufficient to permit normal recovery from this pitch-up when the aircraft was loaded to a mid or aft center of gravity position.

A range mission was flown with no external stores to confirm the range capabilities of the RF-84F. The range was found to be "366 nautical miles as computed from standard day data."[6]

In respect to level flight performance, the RF-84F exhibited a level flight speed capability with no external stores which was comparable to that of the "F-84F and F-86H aircraft. The level flight acceleration was not comparable with the F-86H, however."[7] Replacement of the J65-B-3 engine with the J65-W-7 engine did not increase speed. Cruise Mach numbers were as low as .690 with external stores installed. The maximum numbers obtainable in level flight with various loadings -- two 230-gallon tanks, two 450-gallon tanks, two 230-gallon tanks plus two flare pods, four 230-gallon tanks, and two 450-gallon tanks plus two flare pods -- were so low (.840, .806, .771, .690, and .733 respectively) that operational use of the RF-84F where air superiority was lacking was believed questionable.

6. AFFTC-TR-55-29, p. 7; see Tab TA in Vol 7, this history.
7. Ibid., p. 6.

As mentioned previously, high gross weight take-offs in the RF-84F were critical. Rocket assist was necessary to accomplish take-offs on average length runways of 8,000 feet with gross weights greater than 22,500 pounds, especially if ambient temperatures were high or if obstacles had to be cleared.

The 14AS or 14DS bottles had a duration of 14.5 seconds on a standard day. The procedure of firing the bottles at speeds that allowed them to burn out at a height of 50 feet was critical because a dangerous flight condition was encountered when burn-out occurred before the gear was retracted.

After burn-out, a sink occurred and the airplane had a very low acceleration. Take-off characteristics with assisted take-off were further aggravated by the fact that the center of gravity position was aft of the 24 per cent design limit when four 230-gallon tanks were carried. All these factors combined to make take-offs at high gross weights hazardous.

It was also discovered that the rate of climb of the RF-84F with all loadings was low when compared with current fighters (F-86H and F-100 types). The combat and service ceilings were low also when external stores were aboard.

The following table compares the rate of climb of the RF-84F with the F-84F, F-86D, F-86H, and the F-100A:[8]

(See next page)

8. Ibid., p. 5. Additional information is given in AFFTC Technical Reports 54-15, 53-26, 54-4, 54-26. In Library, Air University.

Table #1: A Comparison of Climb Data of the RF-84F with other aircraft

	RF-84F	F-84F	F-86D	F-86H	F-100A
R/C at SL -ft/min (EST)	6,600	6,850	12,900	13,000	20,000
R/C at 30,000 ft - ft/min	3,250	3,300	4,900	6,000	13,500
Combat ceiling - ft (R/C 500 ft/min)	43,500	43,000	47,000	48,500	54,200
Time to climb from SL to 45,000 ft (in minutes)	17.5	21	9.3	8.2	3.4
Gross weight at SL	18,390	18,300	16,810	18,900	24,000

Test personnel found that directional stability was unsatisfactory in all configurations tested. Also, the wheel brakes were unacceptable because of poor controllability. Attempts at maximum braking almost invariably resulted in skidding and blowing tires.

It was recommended that the flight handbook be revised to reflect the hazards of high gross weight take-offs and that an immediate study be made to fully define the flight boundaries of the severe and uncontrollable accelerated stall pitch-up that occurred at high Mach numbers.

It was also recommended that a number of modifications be incorporated into the RF-84F's already in service as soon as feasible from the engineering standpoint.

It was also recommended that the earlier type engines be replaced with J65-W-7 engines, directional stability be improved, lateral control effectiveness at high indicated airspeeds be improved, the pilot's ejection seat be modified to provide operation from either handle, the wheel braking system be modified, the power boost control system be modified to eliminate the dead spot or stick neutral position.

Other recommendations would decrease the rearward travel of the control stick to provide easier operation when full stabilizer travel was required, decrease the rudder initial breakout forces and increase the force gradient after breakout, improve the bullet proof glass in the windshield to eliminate an optical illusion, modify the wing flap control for better operation of the flaps, improve the pilot's seat belt to facilitate adjustment, and increase the power of the taxi light.

Test personnel also listed 12 items in the cockpit which they believed should be modified in any future model changes.

YH-16 Transport Helicopter: Phase II Flight Evaluation

The YH-16 was a 40-passenger twin-engined helicopter designed and built for the Air Force by the Piasecki Helicopter Corporation, Morton, Pennsylvania.

The Phase II test was performed on Serial Number 50-1269 at the contractor's plant at the Philadelphia International Airport. The test was authorized by Air Research and Development Command Test Directive 5183-F1, F2 and F3, dated 24 March 1953. On 29 April 1955, Headquarters, Air Force Flight Test Center initiated the project by publishing Project Assignment Directive 55-18.[9]

The purpose of the Phase II Test was "to determine compliance with contractual requirements and to determine, quantitatively, the performance, and qualitatively, the handling characteristics of the helicopter."[10]

Major August Vincenzi, USAF, was project pilot and V. Keith Putnam was project engineer. Upon the completion of the test, Headquarters, Air Force Flight Test Center published a technical report describing the test and

9. Hq, AFFTC, "Project Assignment Directive 55-18: Phase II Testing of the YH-16 Helicopter" dated 29 Apr 1955; see Tab R in Vol 3, The History of the AFFTC, Jan - Jun 1955, in Library, Air University. (Hereinafter cited as PAD 55-18.)
10. PAD 55-18, p. 2.