

F6F Hellcat

By Hal Andrews

Among naval aircraft, the WW II F6F *Hellcat* achieved a fighter record that remains unsurpassed: it was the fighter flown by Naval Aviators when credited with downing 5,155 enemy aircraft — by far the largest number credited to pilots flying any Navy fighter. This record was achieved in less than two years of combat operations, an indication of the intensity of air combat in the Pacific. It wasn't the fastest WW II fighter, and one can argue how it might have fared in the European air war, what the capabilities were in the second half of the Pacific war, or many other "what ifs," but the record stands.

The F6F was clearly the right airplane at the right time. An earlier appearance in Pacific combat would have been welcomed, but it would have been a different and less capable fighter, so even that issue joins the other "what ifs." And Grumman's record of getting the F6F from first contract into combat in only a little over two years, while incorporating post-Pearl Harbor combat dictated changes, was outstanding, even by the standards of that era. Admittedly, its roots trace back some additional years — but not the development of the final F6F.

In 1938, with the Grumman XF4F-2 in flight test, the Navy and Grumman began looking at putting a larger engine in the F4F. When it became clear that the F4F needed more wing area to take full advantage of its basic design and engine, resulting in the ultimately successful XF4F-3, the design studies for the follow-on shifted to reflect that experience.

In the 1939-40 time period, the Navy and Grumman focused their attention elsewhere for the next generation fighter — to Vought's inverted gull-

wing XF4U-1 and Grumman's twin-engine XF5F-1. But single-engine fighter studies continued at Grumman, taking into account growing European wartime experience. The advent of folding wings introduced with the F4F-4 pointed the way for another desirable feature on what was becoming a much larger carrier aircraft.

With considerable push from the Navy, designs concentrated on use of the 1,700-horsepower Wright R-2600 Cyclone 14. The R-2600 was also being incorporated in Grumman's XTBF-1 torpedo bomber, already being built. But with their F4F experience, Grumman's engineers didn't follow the usual fighter dictum — the smallest fighter possible — for their evolving design.

By the end of 1940, circumstances and the status of the design work reached the stage where serious Grumman-Navy discussions began for a new fighter project. The XF5F-1 attracted a lot of press attention, but it didn't look like a next fighter project for Grumman. With its usual desire for two competing models in development/production, preferably with different engines (so all its airplanes wouldn't be grounded in the event of engine problems), the Navy looked to Grumman for another answer. In June 1941, with details resolved, two R-2600-powered XF6F-1 prototypes were ordered.

Development proceeded normally during the rest of 1941, accelerating after December 7. By early 1942, plans had been initiated for production F6F-1s, while prototype construction was underway. Interest in turbosuperchargers for increased altitude performance led to the design of an XF6F-2 with a turbosupercharged R-2600. March brought a production contract. By this time, a 2,000-horsepower, P&W R-2800-powered version was recognized as more promising than the turbosupercharged R-2600 aircraft, and revision of the second XF6F-1 was initiated, as the XF6F-3 with an R-2800 engine. Production plans were also shifted to the -3 model.

The first flight of Grumman's new *Hellcat*, the XF6F-1, took place on June 26, 1942. Six weeks later, it was joined by the XF6F-3. The first production F6F-3 flew in September. With 10

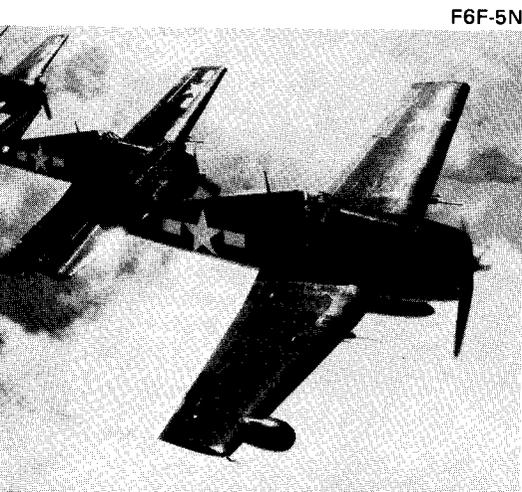
delivered by the end of the year, production increased rapidly in 1943, as Navy fighter squadrons were introduced to the Navy's newest fighter, and development testing continued.

A low-wing monoplane with wing-mounted, rearward-retracting landing gear, the cockpit was above the main fuel tank which placed the canopy high on the fuselage. Downthrust of three degrees for the engine and propeller improved the forward visibility. While many details changed as improvements were made, the configuration changed very little for all the production *Hellcats* to come.

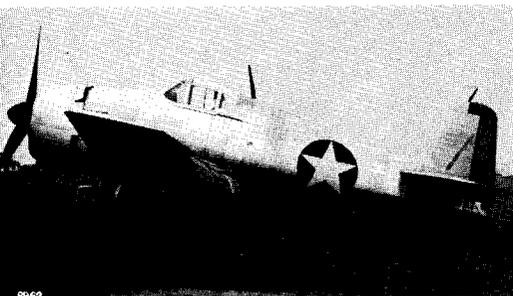
Changes dictated by tests and squadron experience were introduced into the production line as output climbed through 1943. In August, VF-5 and VF-9 pilots flew their *Hellcats* into combat for the first time and rapid transition of all Pacific CV fighter squadrons followed. Advances in radar led to two radar-equipped versions. Those with AIA/APS-6 airborne intercept radar in a nacelle, well outboard on the starboard wing, became F6F-3Ns, while others were -3Es with ASH/APS-4 search/attack radar in a "bomb unit" carried on a mid-span starboard wing rack. The British Royal Navy's Fleet Air Arm also received F6F-3s as *Hellcat Is* for operations from their carriers.

Provisions for water injection to increase combat power were added in late 1943, as production -10W engines fitted for it became available. Wing stub racks were added for bombs, or for additional fuel tanks, to supplement the single centerline belly tank that had become a standard operational feature. In April 1944, when necessary strengthening of the rear fuselage and horizontal stabilizer were incorporated, along with other improvements — including engine cowling changes to reduce drag and aileron spring tabs to reduce roll stick force in combat maneuvers — the designation of the production aircraft was changed to F6F-5. With the structural changes, dive speed and pull out restrictions on the *Hellcat* were removed.

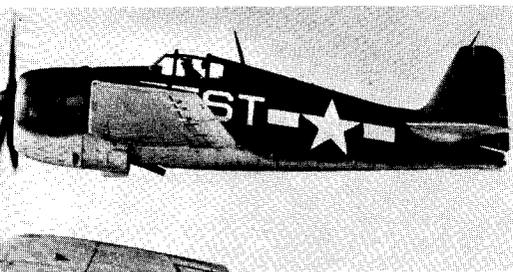
A four-cannon armament installation was tested on the first prototype. Already modified with an R-2800 engine as an XF6F-3, it was redesignated XF6F-4 when testing the cannon installation. While the four-cannon configuration didn't go into production, a two-cannon, four-gun armament could be fitted to later production F6Fs and was carried by many F6F-5Ns.



F6F-5N



XF6F-1



XF6F-2



XF6F-6



F6F-3



Continued interest in turbo-supercharged engines resulted in a -3 being fitted with one using the early XF6F-2 designation, though the engine used was an R-2800 rather than the original R-2600. The new "C" model R-2800 engine promised sufficient performance improvement to result in two F6F-5s being converted to XF6F-6s with -18W engines; they flew in summer 1944. Production changeover plans were shelved, however, and -5/-5N production continued to increase, reaching a peak of 605 delivered in March 1945.

Along with the *Hellcats'* principal role as day fighters and their growing night fighter use, both -3s and -5s were converted for photographic missions to -3Ps and -5Ps. They retained their wing gun armament. The British also received -5s and -5Ns as *Hellcat IIs* for RN carrier operations in the Far East.

After the March peak, with production of the F8F *Bearcat* getting underway and *Corsairs* finally assuming a larger role in U.S. carrier operations, F6F production began to drop off and -5Ns became a larger proportion of those delivered. Following the August VJ day terminations, a small group of nearly completed *Hellcats*, mostly -5Ns, were finished up in October and November 1945 to bring production to a close. With the two X prototypes, a total of 12,275 *Hellcats* were built. Unlike most WW II fighters, except for the two Xs and the first few production airplanes, all were rolled out of one plant — the largest number of a single model of fighter ever built in one factory.

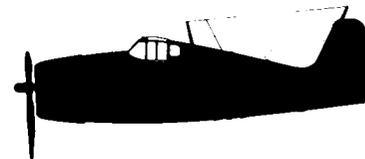
At war's end, the already underway conversion of remaining F6F-3s to -3K drones continued. Most -3s joined the rows of surplus aircraft waiting for the smelters. F6F-5s were standardized for postwar use, including conversion to -5K drones. Early use of -5Ks was in Operation Crossroads, the 1946 "atomic bomb" tests. Fighter squadrons, both Navy and Marine, continued to use -5s and -5Ns, while *Bearcats* and improved *Corsairs* came off the line and into the fleet. The first carrier jet fighters weren't far behind.

Hellcats became mainstays of fighter squadrons in the postwar Naval Reserve. Already widely used for advanced training, they took over the tactical training role in the training command. The -5Ks expanded their target role and explored potential assault drone operations, used by research and development and fleet organizations, as the missile age dawned. Other *Hellcats* became drone controller -5Ds.

As the Korean War unfolded, *Hellcats*

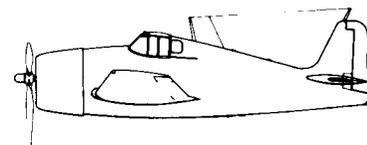
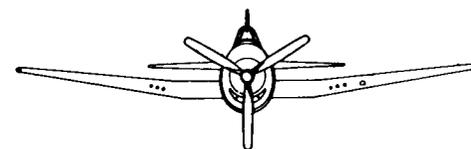
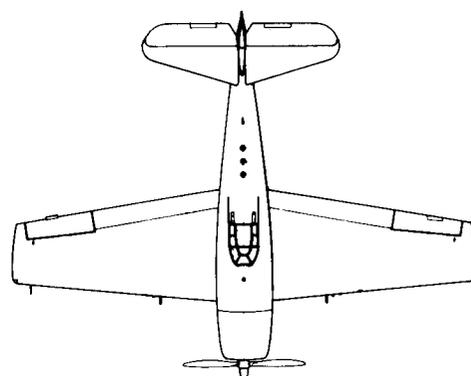
were out of the fleet, except for a limited number of -5Ns among the many types in composite all-weather fighter squadrons, -5Ds and -5Ks in utility squadrons, and a small group of -5Ks in a combat demonstration of assault drone potential against North Korean targets in August-September 1952.

From this time on, F6Fs were gradually phased out; the last from composite squadrons in late summer 1953 and from the advanced training command in spring 1956. Conversions to -5Ks at O&R Pensacola, Fla., ended in 1957. Four years later, in May 1961, the last flying Navy *Hellcat* made its final drone flight at Point Mugu, Calif. ■

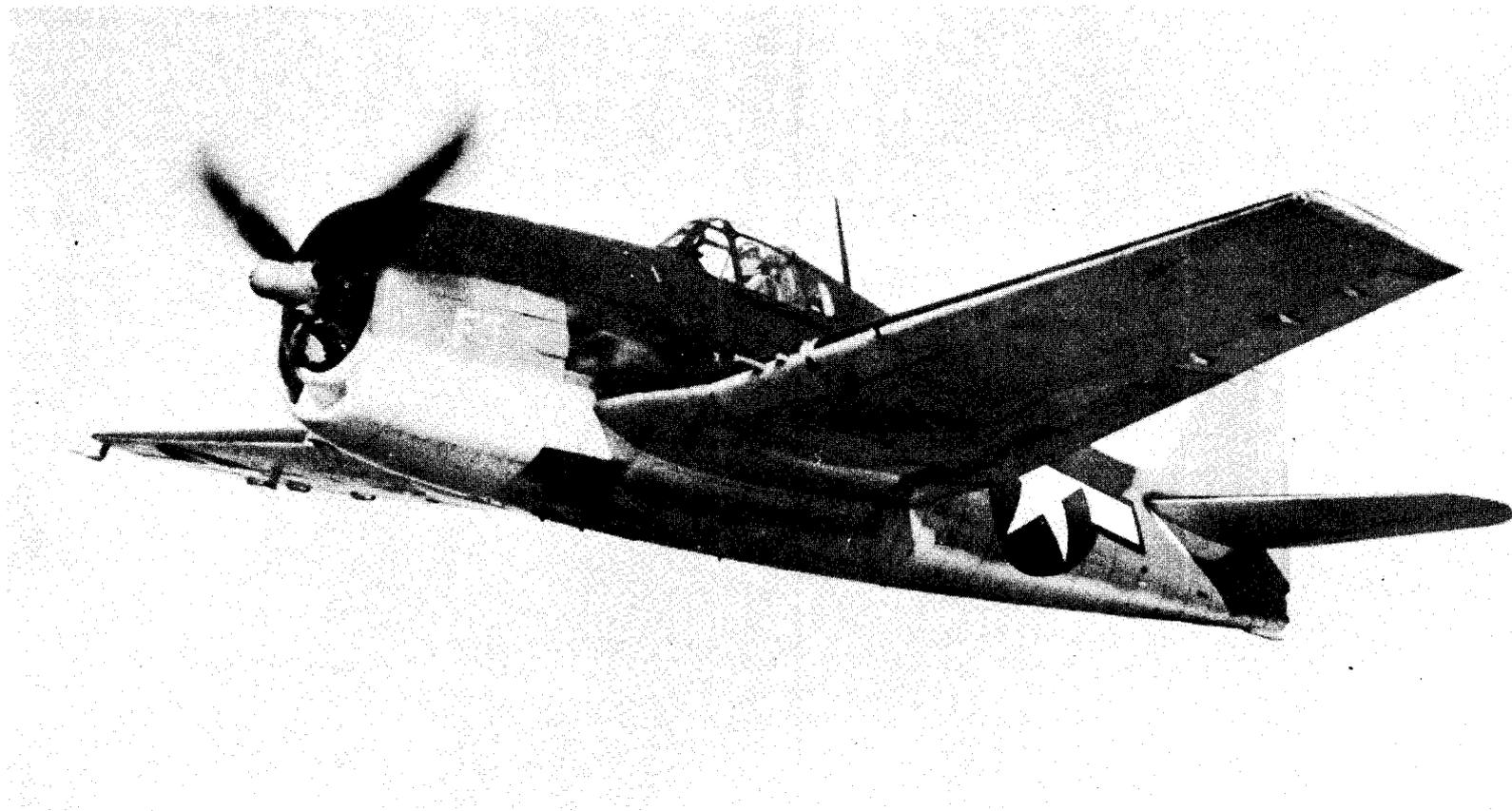


	F6F-3	F6F-5
Span	42'10"	42'10"
Length	33'7"	33'7"
Height	13'1"	13'1"
Engine: P&W R-2800-10W, 2,000 hp		
Maximum speed (mil)	370 mph	380 mph
Service ceiling	37,200'	37,300'
Maximum range		
Clean	1,090 mi	1,130 mi
150-gal. tank	1,590 mi	1,650 mi
Armament:	Six .50 machine guns or two 20mm cannon and four guns; up to two 1,000-lb. bombs; and six five-inch rockets.	

Crew: One



DECLASSIFIED



STANDARD AIRCRAFT CHARACTERISTICS

F6F-5 "HELLCAT"

GRUMMAN

UNCLASSIFIED

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MISSION AND DESCRIPTION

The F6F-5 airplane is a general purpose fighter intended to destroy enemy aircraft and installations. It is capable of bombing and rocket attacks. It is now a second-line fighter and trainer, having been superseded by the F8F as a first-line aircraft.

It is designed for catapulting and for arrested landings aboard a carrier. The airplane is conventional in design and structure, with aluminum alloy two-spar wing and monocoque fuselage. Landing gear, slotted blow-up flaps, gun charging and oil cooler doors are hydraulically operated. Spring type balancing tabs are provided on both ailerons. The left tab is controllable in flight by the pilot. The rudder and elevators are provided with trim tabs adjustable in flight by the pilot. Capacity of 16 gallons of water is supplied for water injection.

Service use started in 1944.

DIMENSIONS

WING AREA.....334 sq. ft.
 SPAN.....42' - 10"
 LENGTH.....33' - 7"
 HEIGHT.....14' - 5"
 TREAD.....11' - 0"
 M.A.C.....8' - 1"

WEIGHTS

Loadings	Lbs.	L.F.
EMPTY.....	9,238.....	
BASIC.....	10,035.....	
DESIGN.....	11,000.....	7.0
COMBAT.....	12,740.....	6.6
MAX.T.O.....	15,300.....	5.5
MAX.LAND.....	15,000.....	

All weights are actual.

FUEL AND OIL

Gals.	No. Tanks	Location
250	3	Fus.; Prot.
150	1	Fus., Drop
300	2	Wing, Drop

FUEL GRADE.....100/130
 FUEL SPEC...MIL-F-5572

OIL

CAPACITY (Gals.).....19
 GRADE.....1100/1120
 SPEC.....MIL-O-6082

ELECTRONICS

RANGE RECEIVER AND
 MF TRANS. & REC.....AN/ARC-5
 VHF COMMAND.....AN/ARC-1
 IFF.....AN/APX-1
 HOMING.....AN/ARR-2

POWER PLANT

NO. & MODEL...(1) R-2800-10W
 MFR.....Pratt and Whitney
 SUPERCH.....2 Stage, 2 Speed
 PROP. GEAR RATIO.....2:1
 PROP. MFR.....Ham. Std.
 PROP. DES. NO.....6501A-0
 BL./DIA.....3/13'-1"

RATINGS

	Bhp @ Rpm	@ Alt.
T. O.	2,000 2,700	S. L.
MIL.	2,000 2,700	1,000'
	1,800 2,700	15,500'
	1,650 2,700	22,500'
NORM.	1,675 2,550	5,500'
	1,625 2,550	17,000'
	1,550 2,550	22,500'

SPEC. NO. N-8056
 (See Note)

ORDNANCE

GUNS

No.	Size	Location	Rds.
2	20 mm	Wings	450
4	.50 cal.	Wings	1,600

*Some planes have 6-.50 cal. guns instead of mixed battery

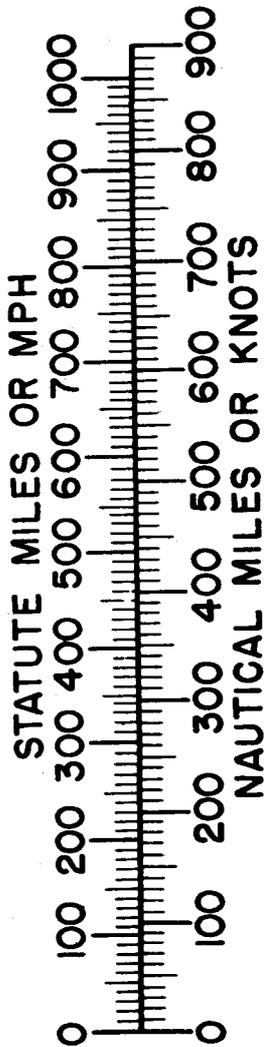
BOMBS AND ROCKETS

Type	Size	Location	No.
Bombs	2,000#	Fuselage	1
Bombs	500#	Fuselage	1
Torp. Mk.13-3		Fuselage	1
A.R.	11.75"	Fuselage	1
Bombs	1,000#	Wings	2
Bombs	250#	Wings	2
Bombs	100#	Wings	6
A.R.	11.75"	Wings	2
HVAR	5"	Wings	6

FIRE CONTROL

Illum. Sight.....Mk. 8
 MAX. BOMB CAPACITY..4,000 lbs.

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PERFORMANCE SUMMARY

LOADING CONDITION	(1) FIGHTER 1-150 Gal. Tank			
TAKE-OFF WEIGHT	lbs.	13,797		
Fuel (Fixed/Drop)	lbs.	1,500/900		
Bombs	lbs.	—		
Wing/Power Loading (A)	lbs/sq.ft; lbs/bhp.	41.3/8.9		
Stall Speed—Power off	kn.	79.2		
Stall Speed—Power off - No Fuel	kn.	72.0		
Stall Speed—Power on	kn.	72.2		
Maximum Speed/Alt (B)	kn/ft.	308/23,900		
Take-off Distance, deck — calm	ft.	799		
Take-off Distance, deck 25 kn.	ft.	384		
Take-off Distance, Airport	ft.	—		
Rate of climb — sea level (B)	ft/min.	2,010		
Service Ceiling (B)	ft.	35,100		
Time-to-climb 10,000 ft. (B)	min.	5.2		
Time-to-climb 20,000 ft. (B)	min.	11.2		
Combat Range/V av 15,000 ft.	n.mi./kn.	950/178		
Combat Radius/V av (F-1)	ft. n.mi./kn.	340/173		
LOADING CONDITION	(2) COMBAT	(3) COMBAT	(4) COMBAT	
GROSS WEIGHT	lbs.	12,740	12,740	12,740
Engine power		Combat	Military	Normal
Fuel	lbs.	1,500	1,500	1,500
Bombs/Tanks		None	None	None
Max. speed at sea level	kn.	276	273	260
Max. speed/Alt	kn/ft.	330/23,400	330/23,400	325/24,100
Combat speed/Alt	kn/ft.	318/15,000	311/15,000	302/15,000
Rate of climb SL	ft/min.	2,980	2,850	2,290
Ceiling for 500 fpm R/C	ft.	33,700	33,700	32,900
Time-to-climb/Alt.	min/ft.	7.7/20,000	8.4/20,000	9.7/20,000

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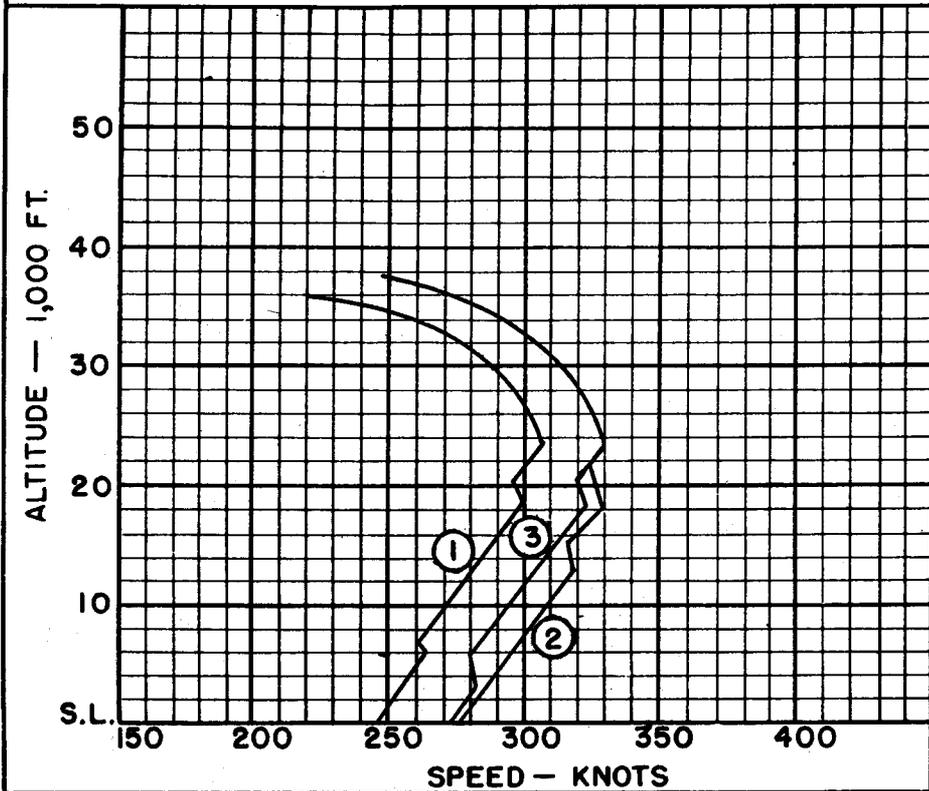
- (A) HHP at Maximum Critical Altitude
- (B) Normal HHP

Performance is based on flight test of F6F-3 and F6F-5 airplanes.

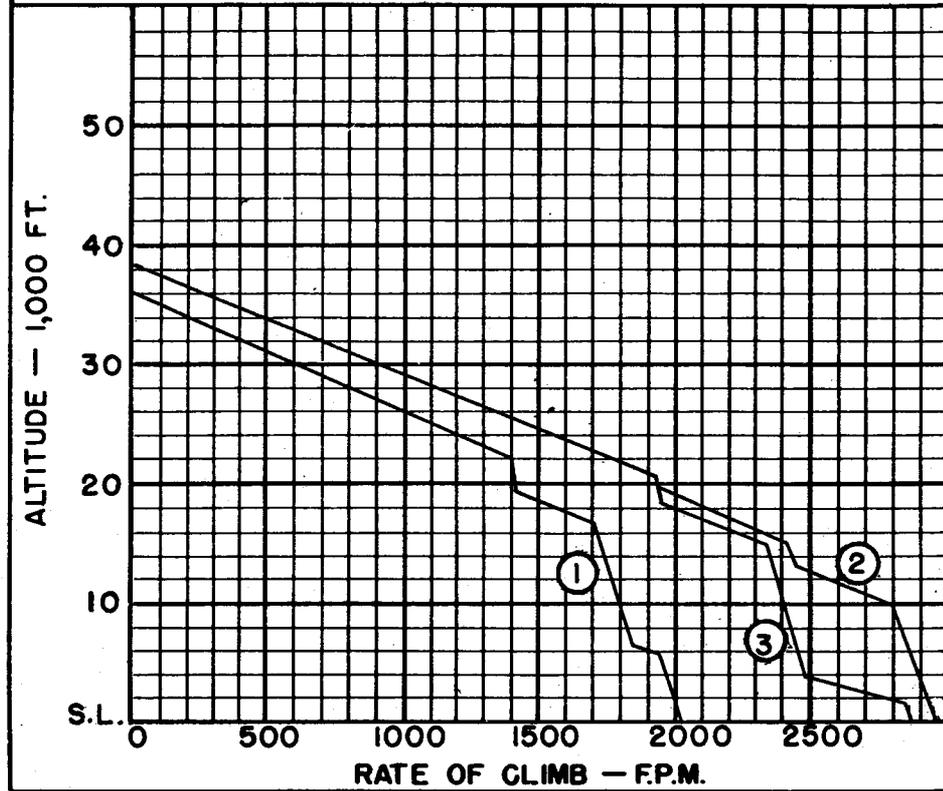
 Range and radius are based on F6F-5 flight test fuel consumption data increased by 5%.

Combat conditions include fuselage bomb shackles and "T" bracing, faired wing bomb-racks and sway bracing.

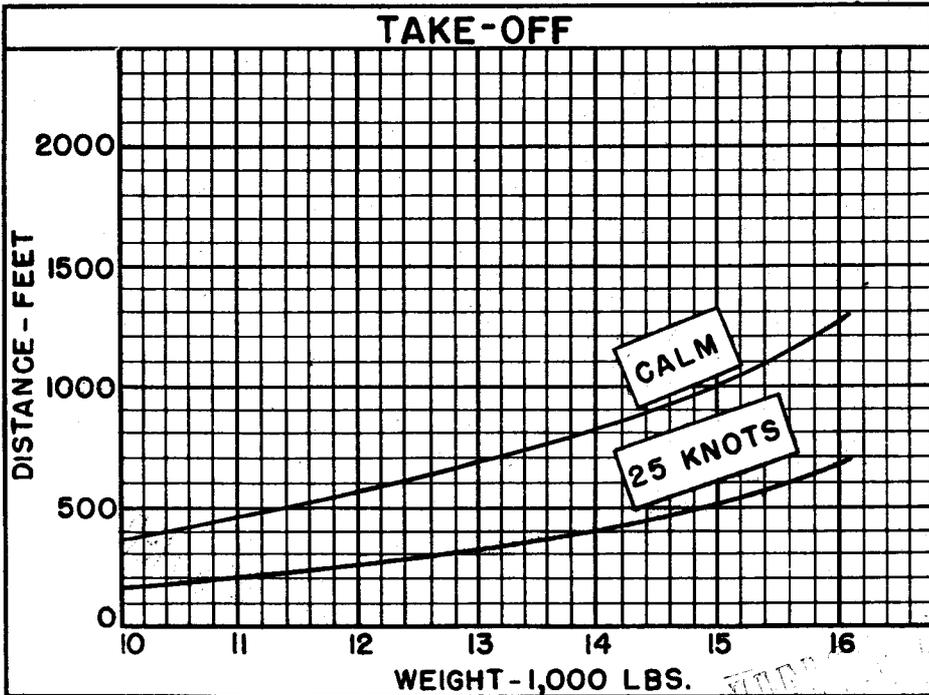
SPEED



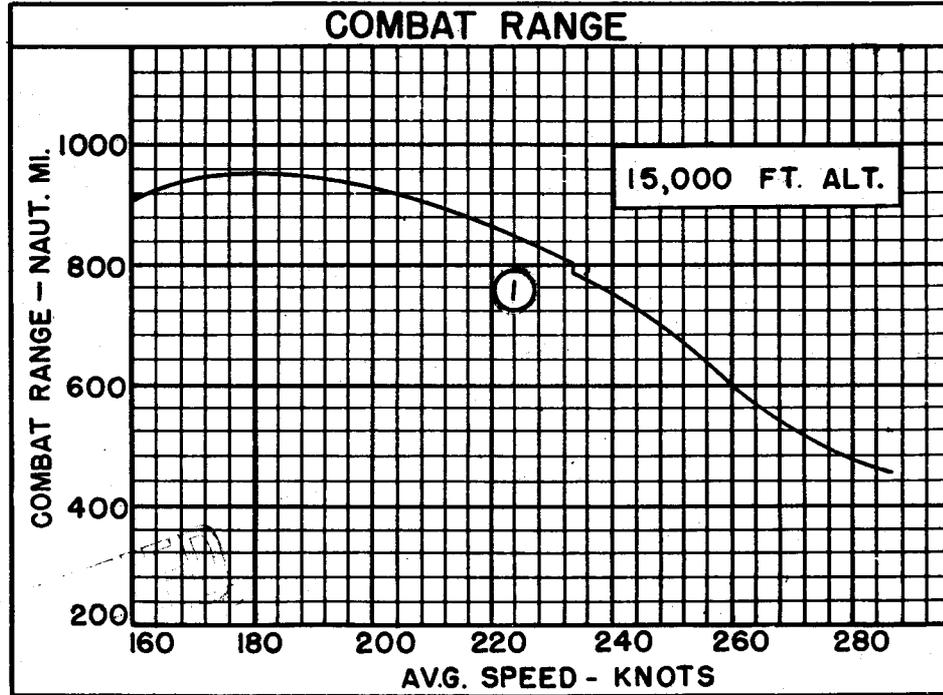
CLIMB



TAKE-OFF



COMBAT RANGE



LOADING CONDITION COLUMN NUMBER

9

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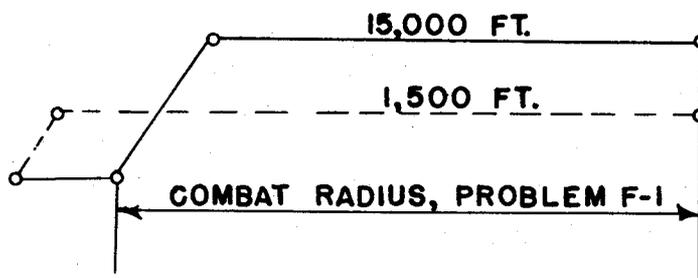
Water is available for approximately 15 minutes at combat power.

Provisions are incorporated for fuel transfer from droppable to main tanks after take-off.

FIGHTER COMBAT RADIUS FORMULA NO. F-1

<u>WARM-UP</u> 20 min. at 50% normal rated rpm	<u>RENDEZVOUS</u> 20 min. at sea level at 60% N.S.P. Auto Lean	<u>CLIMB</u> to 15,000 ft. at 60% N.S.P. Auto Lean	<u>CRUISE-OUT</u> at 15,000 ft. Vel. for Max. Range Auto Lean	<u>DROP TANKS</u> and BOMBS FIRE ROCKETS	<u>COMBAT</u> 20 min. at 15,000 ft. 10 min. combat 10 min. Mil.Pr. and descend	<u>CRUISE-BACK</u> at 1,500 ft. 170 kts. TAS Auto Lean	<u>RESERVE</u> 60 min. at Vel. for Max. Range Auto Lean
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$$\text{RADIUS} = \text{CLIMB} \div \text{CRUISE-OUT} = \text{CRUISE-BACK}$$



Spotting: 200 ft. length is required to spot 30 airplanes on the 96 ft. wide deck immediately aft of the forward ramp on CV-9 class carriers.

Performance based on engine power determined in flight test as follows:

<u>COMBAT</u>	<u>MILITARY</u>	<u>NORMAL</u>
2,030/2,700/ S. L.	1,960/2,700/ 3,400'	1,710/2,550/ 6,200'
2,110/2,700/13,100'	1,840/2,700/18,200'	1,690/2,550/19,000'
1,930/2,700/15,700'	1,670/2,700/23,400'	1,580/2,550/24,100'
1,940/2,700/18,000'		

DECLASSIFIED

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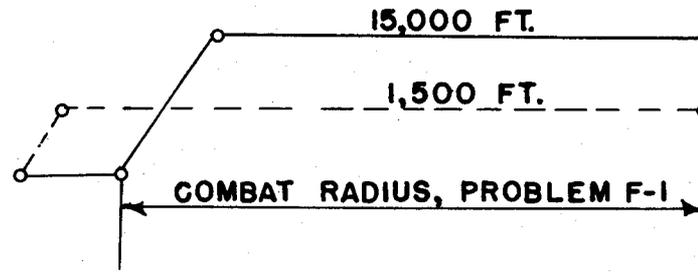
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<u>TAKE-OFF</u> 1 min.	Auto Lean	Auto Lean	Auto Lean				

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