



# Flying the **FM-2 Wildcat**

**A Modern Pilot's Personal Perspective**

BY MIKE HEINY SR.

**I fully realize** that the following dissertation on preflight, takeoff, cruise, and landing will be seen by experienced pilots as monotonous overkill—and too much detail. My thought here, however, is explain the airplane to the non-warbird pilot, paying special attention to the detail freaks, and to show the complexities and idiosyncrasies of even the simplest of World War II fighters. Note that the following is based on an FM-2 Wildcat with the original Bakelite brakes and a hard-rubber carrier tailwheel. After about 50 hours, we exchanged the original brake shoes for heavy-duty truck lining and found a pneumatic tailwheel. These two things vastly improved the ground handling.

Of the 7,860 Grumman-designed Wildcats built, 5,280 of them were built by the Eastern Aircraft Division of General Motors.  
(Photo by David Leininger)



This aircraft was not designed for speed (47% power = 564hp, 27 inches/1,900rpm = 195mph; and 80% power = 960hp, 35 inches/2,300rpm = 215 mph). The wing design does give good lift, so plus or minus 2 or 3mph will result in the need for a trim change, both pitch and yaw. I have spent many cross-country hours entertaining myself by trying to trim the Wildcat to fly hands-off. This aircraft has very light elevator forces, however, and the ailerons are heavy and will require two hands to roll at more than 200mph. The rudder is effective throughout the speed range, but the forces are heavy. One thing I must say about the Wildcat is that no fighter, then or now, will turn inside of it. Its overall flight characteristics are straightforward and benign. In flight, it handles much like a 1,350hp AT-6/SNJ.

### Prestart Checks

Let's start by sitting in the aircraft and locking the canopy open in the second-to-last full open position at my right shoulder because, with the shoulder straps tight, I cannot reach it with my left hand to close it when it's locked in full open. Visually check that the wing-folding lock tabs located on the top of the wing center section are down. Check

(vacuum operated), blower shift locked "Low," pitch trim set to 0 units, roll trim set to 6 units right, rudder trim set to 1 1/2 units nose right, throttle open 1/2, mixture "Idle Cut Off," quadrant friction snug, magnetos off, boost pump off, electric propeller "Breaker In," selector "Automatic," propeller vernier knob forward, all flight instruments checked and set, ambient manifold pressure noted, Hobbs meter read and recorded, cowl flaps full open, and all electrical switches off or set. (Note: The original electrical breakers are a bit different from the modern ones. They do not pop out when tripped, so you cannot tell by feel which one has popped unless your finger is on it when it pops and you feel it, or the area is very quiet and you hear a very light metallic "ping." If you have an electric problem in flight, push in each one firmly.)

### The Start

The master switch is on. The pre-oiler is on for 30 to 45 seconds for the first flight of the day. (Gotta oil those bearings.) Boost pump is on at 16 to 18psi, and steady. Oil and fuel quantity is checked, and the engine was pulled through two full revolutions on walk around. Clear prop! The starter and primer spring-loaded toggles are located side by side on the electrical panel, and are operated by your right index finger simultaneously. Move your left hand to the mag switch and right index finger under the start toggle, with the tip of the finger also reaching the primer. It helps if you have six fingers.

Starter toggle up, engine turning, count six blades, mags to both, primer toggle up (on), hold until the engine is running smoothly. When the engine fires, you'll be treated to the delicious sound of a Wright radial waking up. Release the starter toggle, and check for oil pressure. With the engine running on the primer, move the mixture to "Auto Lean" and, at the same time, stop the primer; if the engine stumbles, the primer may be tickled as needed. Keep the engine running at the lowest possible rpm (900 to 1,000), and try to keep the oil pressure under 110psi while cold. Turn the boost pump off, and turn the radios on. I do not taxi until the oil temp is 40°C and the engine accelerates smoothly.

### Taxi and Prep for the Run-Up

With the chocks pulled, tailwheel unlocked, and stick full aft, allow the aircraft to move

**FLYING THIS FIGHTER IS A FATIGUING PROCESS DUE TO THE HEAT AND VIBRATION PRODUCED BY THE RELIABLE WRIGHT 1820. I ALSO FIND THE NOISE LEVEL TO BE HIGHER THAN A MUSTANG.**

that the gear ratchet selector is down. We are now ready for start. Brakes checked and held. There is no parking brake, so have chocks in place as well as a trained fireguard stationed and ready to put out any fire.

Next, I adjust the rudder pedals all the way forward and lock, then look back and make sure the rudder is neutral. The seat is adjusted to the highest setting for taxi visibility, and belts are buckled and tightened. The headset is plugged in on the right above the radios. Make sure the headset leads are placed behind your right shoulder and arm where they are out of the way. You don't want them to interfere with the gear-handle cranking motion. A failing grade here will result in the cord wrapping around the crank handle, thus cranking your head down and the gear up. I'm talking from experience here!

Now, going around the cockpit from left to right: fuel selector on, flaps handle up



The FM-2 was powered by a Wright R-1820 single-row engine of 1,350hp, as opposed to the twin-row Pratt & Whitney R-1830 of 1,200hp. External changes included the removal of the air scoop on top of the cowling and a taller tail to handle the higher horsepower. (Photo by David Leininger)

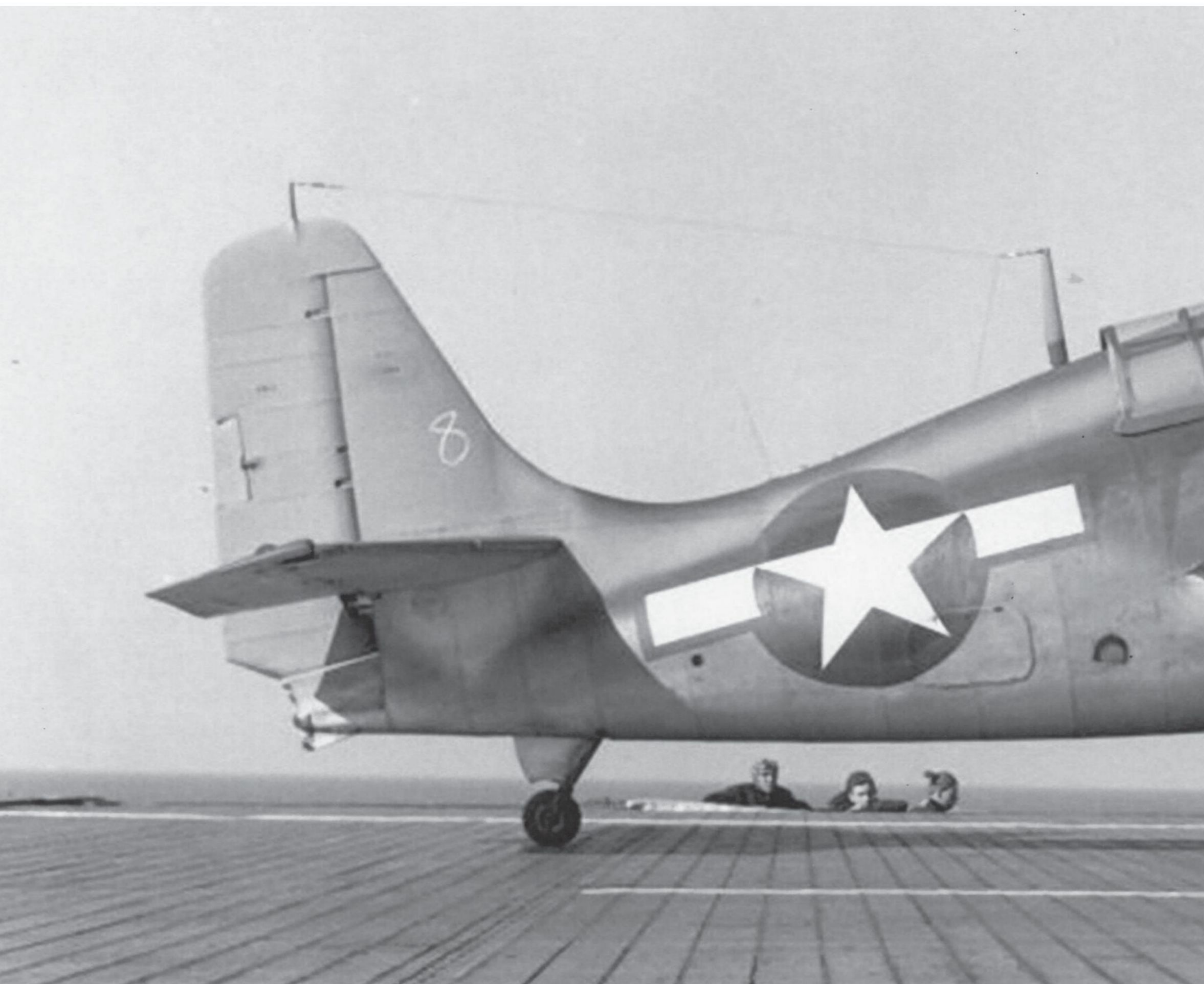
## FLYING THE FM-2 WILDCAT

ahead slowly and test the brakes. While taxiing, there are a multitude of things to learn about this aircraft. The taxi direction is controlled by differential braking. Because of the narrow breaking-moment arm, however, the ability to stop a turn, once it is started, is very poor. This is because each main wheel is only 36 inches from the centerline of the aircraft. The soft, single-action Oleos are what make the Wildcat appear to waddle as a brake is applied because they tend not to return to neutral after being compressed. This is quite apparent when a turn is fully developed; the braking required to stop it will shock you. My taxi limit is a wind speed of 15 knots. It takes only 5 knots of wind at 90 degrees to lift the wing and fully collapse the downwind Oleo, which is disconcerting to say the least. The center of gravity is now shifted toward the downwind wheel approximately 3 inches,

reducing brake authority. If you think you want to land in a 6-knot/90-degree crosswind, neither you nor the Wildcat would be pleased with the outcome! But in a no-wind condition, the aircraft taxis in a conventional manner much like an SNJ.

With the run-up area reached and the aircraft turned into the wind, hold brakes firmly and check the tailwheel lock for run-up. By the way, if you do not lock the tailwheel on run-up and during the power check a brake goes right to the floor with no warning, the result will be a circle that gives the word "pirouette" a whole new meaning. That guy in the C-182, the one who pulled up close to goggle the blue fighter, well, that's the one screaming obscenities on the radio about the 10-foot-diameter Veg-O-Matic on the front of "the funny-looking blue airplane" swinging in his direction. Trust me on this one.

**Wildcats flew through the entire war, with the FM-2 "wilder" Wildcat working off smaller Jeep carriers. (Photo courtesy of Jack Cook)**



## The Run-Up

First, set the seat height for flight (for me, it's at the bottom). Move stick full aft and power to 1,600rpm, with the oil temp at 45°C at 75/80psi, fuel pressure at 16psi, and cylinder head temp above 90°C. The Wildcat is now ready for full run-up:

**1.** Controls free to all limits.

**2.** Boost pump on at 16-18psi.

**3.** All vacuum flight instruments are erect and set; cycle the flaps and check symmetry by the indicators on the upper surface of each wing. This will verify that the vacuum pump is operational; there is no vacuum gauge.

**4.** Trims: rudder 1 1/2 units right, elevator 0.0 units, and aileron 6 units right.

**5.** Cowl flaps full open.

**6.** Propeller forward and in automatic.

**7.** For the first flight of the day, at 1,800rpm, shift blower to high (feel bump). Note a slight drop in rpm and an increase in manifold pressure (MP). Creep the throttle forward and increase MP to the ambient setting previously noted, approximately 30 inches, 2,350rpm. Check pressures and temps. Shift blower to "Low" and "Lock." Note an increase in rpm to 2,500 and 1 1/2 inches drop in MP. These changes indicate a clean clutch release and shift back to low blower.

**8.** Power check: MP back to ambient, approximately 30 inches/2,500rpm.

**9.** Propeller check at 1,800rpm, pull prop control full out, 200rpm drop, prop control full forward and 1,800rpm. Check voltmeter for generator load in all prop cycling. Loss of the generator is a "no-go" or a "land-as-soon-as-possible" item. Prop selector switch from auto to manual, push to the left and hold for a 200rpm drop, return to the auto position and 1,800rpm. Beware of taking off with a propeller in the manual, fixed position. When full power is applied, the prop will over speed badly because it is no longer a constant-speed but a fixed-pitch prop. A takeoff with the prop in manual can be done safely with experience

and understanding of the Curtiss electric propeller.

**10.** Mag check at 2,000rpm, with a maximum drop of 100rpm.

**11.** Back to idle (1,000rpm) for pre-takeoff check. Radios set, running lights on, shoulder straps tight, throttle friction lock set. (If you forget to set the friction, it will remind you when you change hands to retract the gear by reducing the power to idle.) Canopy locked open, directional gyro set, flaps up, mixture full rich, prop auto, boost pump on, tailwheel unlocked. Before takeoff, set cool-air vent to blow under the seat. In the event of an engine fire, the air vent could become a blowtorch pointed at your family business.







The shorter tail and an air scoop on the cowl identify this as a Grumman-built F4F.  
(Photo by John Dibbs/planepicture.com)



## WILDCAT SPECIFICATIONS

Crew	1
Length	28 feet, 0 inches
Wingspan	38 feet, 0 inches
Height	9 feet, 2 1/2 inches
Wing area	260 square feet
Empty weight	5,895 pounds
Loaded weight	7,975 pounds
Maximum takeoff	8,762 pounds weight
Engine (FM-2)	Wright R-1820 single-row radial
Horsepower (FM-2)	1,350
Engine (F4F)	Pratt & Whitney R-1830-76 double-row radial
Horsepower (F4F)	1,200

### Takeoff and Cruise

The FM-2 gear can be stopped while cranking it up any time it's necessary, and the ratchet will hold it in place. When cranking the gear to down, there is no ratchet to hold it, so you must hold onto the handle; if you do not, the spinning handle is fully capable of breaking

your hand, wrist, or knee. F4Fs had no ratchet and had to be held at all times while in transit, either up or down.

When cleared into position to hold, align yourself at the very end of the runway. This will serve you well in the aftermath of a rejected takeoff. This aircraft does not respond kindly to an abort at rotation speed due to the rapidly changing dynamics of deceleration and very high three-point ground speed. If you add in any adverse winds, you'll quickly find out why this WW II fighter is not named "Kittycat" but "Wildcat." Check that the tailwheel is locked by tapping the breaks left, right. Set your seat as low as possible. This moves your shoulder closer to the gear crank, allowing a smooth, uninterrupted cranking motion, even with the shoulder straps pulled tight.

Cleared for takeoff, stick full aft, power is brought up smoothly and continuously to 46.5 inches/2,500rpm. The aircraft accelerates briskly, and aft stick pressure will build rapidly to the point where it must be released to allow the tailwheel to fly off, approximately 8 to 12 inches. The aircraft

The Wildcat bore the brunt of early combat in the Pacific Theater, and pilots developed tactics, such as the "Thatch Weave," to counter the threat presented by the Zero. (Photo courtesy Jack Cook)



will lift off very shortly thereafter. You will also find that right-rudder pressure varies dramatically throughout the takeoff. After a positive rate of climb and a quick look to see that everything is in the green, move the left hand from the throttle to the stick and the right to the gear selector (ratchet) lever, pushing it forward to select "Up." Tap the brakes to stop the wheels from spinning

while grasping the gear crank handle and applying pressure down (counterclockwise—feel the click) to release the ratchet mechanism, then turn the crank handle to the right

(clockwise) 28 3/4 turns until the wheels are pressed firmly into the wells.

Do not let the airspeed exceed 95mph. At more than 100mph and full takeoff power, the pilot does not have sufficient arm strength to crank the landing gear into the fully retracted position because of the air loads. Retract the gear as soon as possible because if there is a problem resulting in a landing not terminating on the runway, you do not want the gear down. Due to the short distance from the spinner to cockpit, the Wildcat will more than likely complete the landing inverted. If the wheels are in the down position, you can be assured of looking up at your feet and 126 gallons of fuel.

With the gear up and climbing at 120mph, change the right hand from the crank handle to the stick and the left to the throttle. Reduce power to 33 inches/2,300rpm. Change hands again; the right cranks the cowl flaps closed (28 turns clockwise). Close the canopy below 125mph; any speed above this will result in a buzzing-type vibration throughout the aircraft that I cannot believe will lead to any good. While climbing, keep an eye on the temperatures. Do not allow them to climb above 320°F for cylinder head temp (CHT), 1,450°F for exhaust-gas temp (EGT), and 90°C for oil. Climbing at 120mph will result in 3,000fpm to cruising altitude. Leveling off is straightforward: Lower the nose, and set 1 unit of nose-down trim and 1/2 unit left-rudder trim; the aileron trim will remain stable throughout the flight. At 195mph, set 27 inches/1,900rpm/auto lean/boost pump off. Check temps: CHT @ 280°F, EGT @ 1,580°F, and oil @ 80°C. While on extended cruise flights, I switch the Curtiss Electric out

of "Auto" and into "Manual." This is to check that the electric-propeller pitch brakes are working properly. With a malfunction of the prop motor and the brakes inoperative, the blades will return to the low-pitch stop (high rpm), overspeeding the engine and producing great drag on the aircraft. All this simply means that you are now on final approach to the crash site. Good luck.

**THIS AIRCRAFT DOES NOT RESPOND KINDLY TO AN ABORT AT ROTATION SPEED DUE TO THE RAPIDLY CHANGING DYNAMICS OF DECELERATION AND VERY HIGH THREE-POINT GROUND SPEED. IF YOU ADD IN ANY ADVERSE WINDS, YOU'LL QUICKLY FIND OUT WHY THIS WW II FIGHTER IS NOT NAMED "KITTYCAT" BUT "WILDCAT."**

Flying this fighter is a fatiguing process due to the heat and vibration produced by the reliable Wright 1820. I also find the noise level to be higher than a Mustang. Maximum flight time is two hours, with a half-hour reserve from the 126-gallon fuel cell under the seat—the first hour at 60gph, then 40gph. I normally limit my long cross-country trips to six hours a day flight time. My thinking is that when I am landing this aircraft, I would like as many things in my corner as possible. Also, when planning a cross-country trip, my stops are predicated on the airport with crossing runways as much as distance. When nearing an airport, I listen for winds and runway. I still ask for the location of the windsock, however, then make an overhead approach to make my own assessment of what the wind and runway alignment and velocity are. Be prepared to go someplace else!

### The Landing

As with all good things, every flight must come to an end. Having selected and confirmed a runway, suitable ramp, or taxiway into the wind, I proceed as follows: Unless instructed otherwise, I maintain cruise speed at the initial and into the overhead because the aircraft speed can be reduced so quickly. At 800 feet above the airport, midfield, I make the break to the downwind. In the break, the power is reduced to 19 inches. Never reduce the power below 1 inch per 100 hundred rpm (e.g., 19 inches/1,900rpm), except in the final approach and landing. This holds true for any high-performance aircraft engine.

The vacuum flap actuators on this aircraft are stronger on the left side, so you get the



Down and dirty, and in the groove! Getting the gear up and down in a Wildcat is a very physical maneuver. (Photo by Budd Davisson)

left flap at 150mph and the right at 125mph. Be prepared to counter this with the ailerons, mixture auto rich, boost pump on, tailwheel locked. Change hands, gear selector down, unload the crank handle and crank the gear to the down position, check canopy open and locked. Trim the aircraft for 120mph. Opposite the point of landing, check power and trim for 100mph. Initiate your turn to

**IN A GOOD LANDING ROLLOUT, THE WILDCAT RUDDER WILL LOOK LIKE A SALMON GOING UPSTREAM. MAKE IT GO STRAIGHT!**

base, maintaining the appropriate rate of descent to the point of intended landing. When I turn final, I use a crab to verify any crosswind and kick it out in the flair (not too much crosswind, however). Over the fence, closing the throttle smoothly, slowing to 80mph, prop forward in the flair. Remember the taxi problems I mentioned earlier? Well, when landing, they all hold true; however, they will come at you 10 times faster, so get your feet ready. In a good landing rollout, the

Wildcat rudder will look like a salmon going upstream. *Make it go straight!* If you don't make directional corrections quickly and concisely and you wait until you clearly see a directional problem, I suggest that you push the flight-attendant call button and ask for a cup of coffee because you're now a passenger!

You do not want to paint it on because, if you do, the Oleos will not collapse together; as one collapses, the aircraft will appear to be moving in that direction and suck you into making a correction for something that did not take place. This is called "pilot-induced tracking oscillation" and will lead to several things—all bad. Due to the midwing design, the visual clues make the height above the runway appear higher than it is, so I flare (visually) about 4 to 5 feet high. The flare should be held until full-stall landing and the aircraft settles firmly with the Oleos collapsed together. In a no-wind condition, the aircraft will roll out straight. The rudder is effective, so do not be in a hurry to introduce braking. If braking is needed, however, don't be bashful about its use. You may only have one shot at recovering from a directional problem. At the end of the rollout, be sure that you have control before unlocking the tailwheel. After clearing the runway, retract the flaps, open the cowl flaps, mixture auto lean, boost pump off, and raise the seat to the top for taxi. Then, breathe deeply and praise the Wildcat gods!

Normally, by the time you get to your shutdown area, the temps will have stabilized and started down. During the pre-shutdown scavenging, at 1,400rpm for one minute, check the mags—not for a particular drop but for loss of a mag so that you won't get a surprise on the next start-up. On the completion of scavenging, retard the throttle

smoothly to close, followed immediately by setting the mixture to idle cutoff. The reason for this procedure is to maintain pressures in the cylinders and minimize the reverse dynamics of the propeller driving the engine.

Now, think back over what you've just read and picture yourself a 20-year-old Marine pilot just out of flight school. You're soaked in sweat after surviving a dogfight and are trying to land in a near-hurricane on Henderson Field on Guadalcanal. The Wildcat held the line, and the FM-2 version of the F4F held the record for the most kills per aircraft in the Pacific—almost all flown by kids. †