Model Aviation's Sport Aviator
The e-zine for the new model pilot

Hangar 9 Mustang PTS

By Frank Granelli

Clean, the P-51 Mustang is a joy to throw around the sky. It's better behaved than most Sport Scale models its size, but "Marie" can perform with the best of them. Frank Costello photo.

The date is February 22, 1944. The skies over Europe are again aflame. It is Tuesday of "Big Week": the American air offensive to destroy the Luftwaffe. American B-17 and B-24 bombers of the 15th Air Force are nearing Regensburg to destroy German aircraft factories.

Suddenly, black dots appear on their noses. "German fighters, 4 o'clock" echoes over hundreds of intercoms. Closing speeds approach 500 mph as the dots become Me 109 fighters starting head-on attacks.

Crew members crouch behind tiny armor plates, knowing to expect the worst. Then, high in the Western sky, the sun flashes brightly off of bare aluminum as silver wings bank 90° and roll into their dives. At more than 450 mph, the Mustangs of the yellow-tailed 52nd Fighter Group race in front of the bombers, making the airways ahead safe. The Mustang Legend continues.

The date is June 4, 2005. It is Saturday and a 30-something-year-old man appears at the RC field with his young son. He has been here before. Even he is not sure why he has come back.

His imagination has been captured by the aerobatic airplanes that seem to rotate the sky itself, while Scale models subtly link the two aviation worlds. He has always had a "passing" interest in aviation, but today the field has given his interest concrete form.

He finally starts to talk to a few pilots—especially the one with the model of the North American P-51 Mustang, which was the hero of so many airplane movies he grew up with. He has wanted to fly one since he saw his first "airplane movie."

However, this man quickly learns that you can't learn to fly model aircraft with a Mustang. At least two years of flying one of those boxy, Cessna-looking typical trainers and then an advanced trainer is the minimum experience required before he can even think about buying the Mustang. He is disappointed but still not totally lost to us.

Then his son says, "I want to fly the fighter—not one of those stupid, old things." They walk away and we lose two potential new modelers.

How many times have RC instructors seen the sad disappointment on potential model pilots' faces when they have discovered the facts about learning to fly? Many understand it and buy that high-wing trainer. But that doesn't mean they are happy about it! Many others walk away, usually believing that the difficulties are being exaggerated or that three airplanes are too much, or they are let down because they can't "have it all" now.

If the date had been September 4, 2005, the outcome of that visit to the RC field might have been vastly better. You want to learn to fly with a Mustang? Great! Not only can you learn with one, but that same Mustang can teach you advanced piloting techniques while becoming

one of the best-performing Sport Scale aircraft available. It is three airplanes in one.

The Mustang PTS is a true RTF airplane with great photo-illustrated instructions and even a flight simulator.

Even better, this Mustang is an RTF. No building skills or special equipment is required. If you can spare 30 minutes to assemble the model, you can learn everything about RC piloting.

The cost is less than $400 for the airplane, radio, engine, and all airframe accessories, all factory installed. You save even more money since you will not need to buy that follow-up "advanced trainer" or Mustang kit; all three are in the Mustang PTS. There is definitely potential to grow our sport with this model.

Everything with the Mustang is prebuilt, and even a flight simulator is included. Unfortunately my computer does not have the right connection for the simulator cord, and an adaptor has not been located yet. This part of the review will have to be included on Model Aviation's Sport Aviator online magazine (www.masportaviator.com).

Assembly time really is less than 30 minutes. I finished the aircraft in 21 minutes using just a screwdriver and pliers. Well, I did use a wrench to make sure the propeller was tight, but that shouldn't count since it was.

Complete Assembly: The first job was the wing. As with a modern airliner, all the real secrets to this aircraft's performance are located there. Flaps, speed brakes, ailerons, bolt-on wing-mounting system, radiator scoop, and LE cuffs are part of the main wing, yet assembly time is only 10 minutes.

As a photo shows, each wing half slides onto an aluminum tube. There is an alignment pin to ensure that everything is true and it works as advertised. The entire wing is held together by a single nylon strap.

Everything on the wing except the wheels, even the servo leads, are factory installed. Slide the wing halves onto the aluminum tube and lock in place with two small screws.

Speed brakes are already attached to the landing gear. Just screw in place with the nylon straps. Make sure the bottom edge of the speed brake rests against the front screw as shown to prevent rotation.

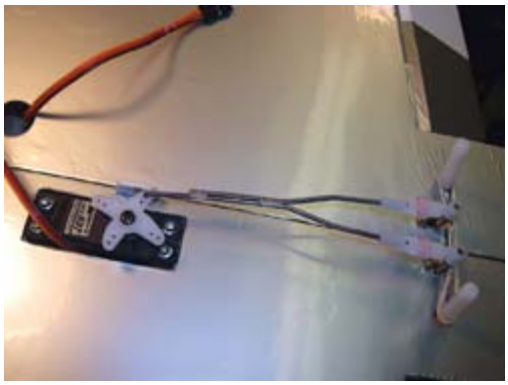
One wing half has a tab with two holes. The front hole sets the flaps to zero. Hooking the factory-made linkage to the rear hole provides 26° of flaps.

After joining the wing panels, bolt the landing gear in place as shown and then use the factory-made flap linkage rod to connect the flaps. The flaps use independent aileron-style torque tubes and are connected to a fixed wing tab, as shown. The clear-plastic wing droops are installed at the factory. The wing is finished at this point.

However, I strongly suggest that every potential Mustang pilot install the flap servo before the first flight. The mount is already there, and installation takes roughly five minutes.

Completing the fuselage involves bolting on the tail feathers, as shown. The control surfaces and control horns are already installed. Use the two lock nuts provided to bolt everything firmly in place.

Everything back there fit well, and it was good to see that the stabilizer's bolt holes were reinforced at the factory. Connect the two control rods to the middle hole on the control horns. The last step is to bolt the exhaust stacks onto the fuselage so that the 1,450-horsepower, 12-cylinder Merlin engine can make the ground shake.



Install the flap servo in the factory-prepared mount. Use the small end of the output arm and set maximum travel to 51% to provide 26° of flap.

Power and Control: No, there isn't a scaled-down V-1650-7 Packard-built Merlin engine under the "hood." This model is powered by a factory-installed Evolution Engines Trainer Power System.

At the system's heart is the reliable, powerful, ball-bearing Evolution Trainer Power System: a two-stroke glow engine. Perfect for beginners, this easy-starting power plant has mixture limiters built in that prevent damaging runs with mixtures that are set too lean.

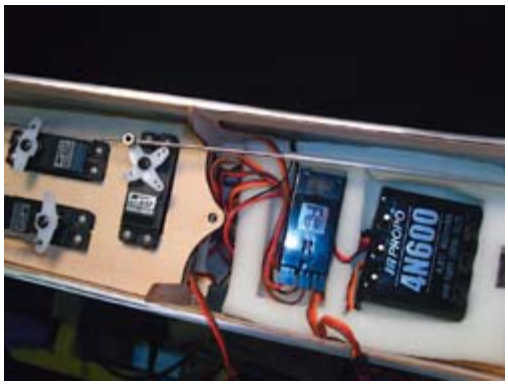
The .45 cu. in. engine will turn an APC 10 x 6 propeller at 13,600 rpm and an 11 x 5 propeller at 13,000 rpm on 15%-nitromethane sport fuel. However, the supplied propeller is a three-blade composite that the engine turns at 11,400 rpm. This three-blade propeller has a definite purpose; it is there to help ensure that the airspeed stays constant and not too fast.

Three-blade model propellers are less efficient than two-blade types. The less-efficient propeller helps slow the airplane in all flight regimes, including downhill and in landing approaches.

In addition, this propeller's pitch appears to be less than 6 inches but is unidentified. The lower pitch further reduces airspeed at all throttle settings. Since engine rpm is reduced under the three-blade's extra load, so are maximum airspeeds.

The radio compartment is factory built with a removable cover to get at the receiver and battery. The receiver is the popular JR R700 six-channel FM model.

The tail bolts on. Stabilizer bolt holes are reinforced, but apply thin cyanoacrylate to the two holes in the fuselage to harden them. Let dry before bolting everything together.



The three ball-bearing JR servos are factory installed. Radio and battery compartments are covered by top foam piece and held in place by full-length locking plate.

Onboard power is from JR's 4N600: a 4.8-volt, 600 mAh Ni-Cd battery pack. The five factory-installed servos are JR 537 ball-bearing sport units. The cored servo motor puts out 43 in.-oz. of torque while rotating a 60° arc in just .25 second.

Few RTF aircraft offer ball-bearing servos. But then, few RTF aircraft are guided by a computer transmitter.

The Mustang's transmitter is JR's five-channel XF421, which is a great introductory computer radio. It features digital travel adjustments, basic mixing (including "flaperon"), easy servo reversing, and memory storage for two aircraft. Few RTFs feature such an advanced transmitter. The XF421 is powered by a 600 mAh Ni-Cd pack and is compatible with most transmitters for a "buddy" link via the included trainer cord.

But is this really a trainer? So it was easy to put together. But come on; it is a Mustang after all. Even the Army Air Force didn't put pilots in Mustangs until they went through primary and advanced trainers. And they were sending people out to get shot at!

Look at the heavily tapered wing with the narrow-chord wingtips. Tell me that won't tip-stall into a snap roll at the first provocation. And that semisymmetrical-airfoil wing is small for a 6.5-pound trainer. Landing speeds will have to be high. The airplane is so streamlined that everything will be happening fast.

So they hung some gizmos all over the wing, but how much can they help? You can't even see that stuff near the wingtips, so how was this fighter transformed into a typical trainer? Skull sweat and good design, that's how.

Each "gizmo" has a design purpose, and each one worked as intended. The "speed brakes" mounted on the landing gear add drag, reducing the top speed while preventing the airplane from gaining a great deal of airspeed when the nose starts to point earthward. The wing flaps, set at 26°, create more drag to further slow the airplane while increasing the wing's lifting force.

Working together, both devices make it easy to set up correct landing approaches. Those invisible—in the air or when trying to photograph the darn things—clear-plastic LE cuffs also increase wing lift; first by increasing the wingtip area and second by acting as a "flat-bottom" section of the symmetrical-airfoil wing. The increased wingtip area reduces tip-stalling to zero.

But the best way to find out whether or not this is a typical trainer is to fly it. So we did. In fact, 12 pilots flew it during 57 test flights. Therefore, some of what follows is opinion—sometimes educated, sometimes otherwise.

The net result is that the Mustang PTS flies identical to a typical trainer. It is slow and gentle with no bad tendencies. It flies like a trainer but does not take off or land like one. This difference is perhaps the Mustang's greatest benefit to the new RC pilot. Let's go through some flights.

Start the engine. All the Evolution Alpha engine ever required was to prime the carburetor and then rotate the spinner cone backward. It started every time without using an electric starter.

Taxiing is beyond easy. The landing gear, with those gigantic tires, is canted so far forward that it is beyond impossible to tip the airplane onto its nose. The gear is widely spaced for

excellent ground handling. Ground steering is positive and not sensitive.

The takeoff roll requires nontrainer technique. With rudder throw set as instructed and with the three-blade propeller providing extra torque, full right rudder is required for a straight takeoff roll.

Start the airplane rolling slowly and put in full right rudder while going to full power. The airplane rolls straight down the runway. If you are late with the rudder, it may be impossible to get back to the runway heading.

This teaches the student pilot from the start how to manage rudder during the takeoff rolls of future, more powerful aerobatic and Scale models. Rolling any aircraft down the runway on takeoff will hold no mystery for the PTS pilot.

As soon as the Mustang PTS breaks ground, it goes into full training mode. The climbout is gentle and noncritical.

The Mustang PTS is so easy to land that one-wheel crosswind touchdowns are routine, even in extreme nose-high attitudes. Make sure to carry some power in the approach. Costello photo.

Mismanage the elevator, even to stalling the airplane, and the Mustang mushes on up, climbing slightly with each oscillation. There is no tip-stalling tendency or nose drop. Release full up and the airplane goes back to flying, slowly climbing to altitude with plenty of time for the new pilot to think ahead.

Cruise flight requires approximately 60% throttle. Straight flight is stable. Turns with banks up to roughly 45° require minimum up-elevator to hold altitude. Steeper banks take approximately 30% of the available up-elevator to remain level.

Letting the nose drop in the turn, as most student pilots would, produces little noticeable speed increase, and there is never a tendency to “balloon,” or raising the nose while losing airspeed, as most trainers do once the wings are leveled. This is a good thing since it reduces pilot workload.

Even during tight turns at slow airspeeds there is never a tendency to tip stall or roll out of the turn. The Mustang stays put as directed, remaining tolerant of any abuse—even full crossed-control stalls, right aileron, and left rudder.

Spins are difficult and require power to develop. Rotation stops immediately once power or elevator input is reduced. Snap rolls are more like giant barrel rolls, taking approximately three seconds to complete.

Straight inverted flight is barely possible, but level inverted turns are not; the airplane runs out of down-elevator. The rudder is notably ineffective, making knife-edge flight impossible. So far the Mustang PTS flies like every other typical trainer.

Power-off stalls are amazing. The wings stay level, aileron control remains, and the model just floats through the sky, defying gravity and common sense. True, it comes down, but slowly—maybe 200 feet per minute or maybe less.

Starting from roughly 400 feet up, with the engine at high idle—2,800 rpm—and holding full up-elevator, the Mustang PTS floats the entire available flight length of the field, which was approximately 1/4 mile, and is still roughly 100 feet from the ground.

This is not a recommended landing technique because there could not be a “flare,” breaking the descent before touchdown, and the airplane would be damaged. But add a bit of power to the approach and reduce the elevator input, and it could almost be. And that brings me

to landing the Mustang PTS.

Landing is different from that of a typical trainer, which is usually executed by cutting the engine to idle while approximately 75 feet high and 100 feet away from the runway and then gliding in. However, the Mustang PTS's speed brakes, flaps, and LE droops provide a good amount of drag.

Therefore, this airplane is landed as most high-performance sport and Scale aircraft are, using engine power. The approach and touchdown are flown slowly at trainerlike airspeeds, but approximately 30% engine power is needed to "glide" to the runway.

The Mustang PTS teaches the new pilot now—not later—how to land all those high-performance sport and Scale airplanes waiting in his or her future. Mastering the power landing, with its intricate dance of power for altitude and elevator for airspeed control, can be difficult to learn once the power-off typical trainer landing becomes habit. This will not happen to the Mustang PTS pilot.

The Mustang's extra drag is why I suggest installing operating flaps from the start. There isn't a great deal of glide with everything hanging out in the slipstream. If the engine runs out of fuel or quits, the runway is unreachable unless it happens to be close when the propeller goes rigid. Raising the flaps dramatically extends gliding distance, allowing the airplane to "make the field" in such situations.

Using the transmitter's travel-adjust feature, set maximum flap movement—channel 5—to 51%. This provides the same 26° of flap deployment as the fixed mounting point would.

Three student pilots who had not yet soloed flew the Mustang PTS in the air only, using the "buddy box" system. Two flew without the instructor's having to take control, and the third, having flown only a small electric-powered trainer, needed instructor help only three times in the eight-minute flight. All pronounced the Mustang PTS to be a great trainer and felt they could easily learn to fly with one.

Five newly soloed pilots flew the airplane and felt the same way. Four club instructors gave the model a fair workout, and all thought they could easily teach new pilots how to fly with it.

Is it a typical trainer? Yes, but with a twist.

Learning to fly with the Mustang PTS is as easy as learning on a typical trainer, but the process will require two or three hours of extra airtime to learn the advanced takeoff and landing skills. But after soloing the Mustang PTS pilot will have those additional advanced skills and graduate flight school a better flier, enjoying more complete piloting skills for the experience.

Beyond Training: The idea behind the Progressive Training System (the "PTS" in Mustang PTS) is that the airplane can quickly be reconfigured for more advanced performance as the pilot's skills advance. Once the new pilot solos and has mastered basic skills, the Mustang PTS is ready to take him or her to the next step.

According to Hangar 9, the first step is to remove the landing-gear speed brakes. I believe the first step is increasing the amount of elevator travel to 105% up and 120% down. Rudder movement should be set to 150%. The ailerons are factory set at 75% travel, so move those limits to 100%.

With all that done, the airplane becomes more critical of improper elevator inputs and will actually drop the nose in the stall. Ground handling becomes more sensitive and less than full right rudder is required for takeoff.

The roll rate quickens, but not that much. It becomes possible to spin the airplane without using engine power to aid rotation entry. Inverted flight, straight and turns, becomes possible, but no Outside Loops yet!

After mastering this setup, remove the speed brakes which are held in place with two plastic tie wraps. Cut them with a hobby knife (be careful) or use wire clippers. Removing the speed brakes increases the Mustang's airspeed by roughly 15%. Loop diameter increases from 50 feet to somewhere near 75 feet. The airplane's airspeed become more pitch related as well.

Since cruise airspeed is higher, all the controls become that much more sensitive. Everything else remains basically the same; there are still no bad habits.

These two small changes move the Mustang approximately one-third of the way toward offering Sport Scale piloting challenges. It remains docile in every way, but things happen faster and the airplane is a bit more responsive. This is a great intermediate stage that usually requires

purchasing an advanced trainer.

The next step is to raise those flaps. Either hit the transmitter switch or reset the mechanical flaps to the “zero” hole on the wing tab. Now things change a little more.

Airspeed increases to roughly 50% more than the original speed. The airplane will pick up speed if the nose points below level. Roll rate increases, and all the controls become more sensitive. There are no trim changes when flaps are deployed.

Without flaps and speed brakes, throttle control during landing approaches becomes more critical. Takeoffs require longer ground runs, so rudder-control difficulties increase. Loop diameters increase to approximately 100 feet, and good stall turns are now possible. For the first time knife-edge flight and Slow Rolls are manageable. However, the airplane remains docile and has no unwelcome surprises awaiting the unwary pilot.

The LE droops are held in place with clear tape. Peel the tape away, and the droops are history. Before removing these lift devices, the pilot should be comfortable with the airplane’s handling and be able to easily manage the increased performance up to this point. Without the droops, the Mustang loses the PTS label and matures into a P-51 Mustang fighter.

True, the Mustang remains an excellent-flying Sport Scale aircraft—maybe one of the best for its size—but when all the training aids are gone, so is the safety net. If you pull a turn too tightly, with too much up-elevator, the P-51 will drop the bottom wing, rotating into the turn. There is no snap roll, but the wing drop is quick.

Single stalls remain controllable with a straight-ahead nose drop, but holding the aircraft into multiple deep stalls, with no flaps, will eventually lead to a snap roll. Spin rotation is fast, but recovery still happens as soon as the controls are centered. Keep the nose level, or below, during final approach, or unfortunate surprises may await the pilot if the airspeed is permitted to drop too far.

However, performance also increases. Full-speed “strafing runs” are exciting as they originally were. Loops approach 125 feet in diameter. Slow rolls are great, but it is still nearly impossible to hold knife-edge flight. So move the rudder control rod to the innermost hole in the control horn, and welcome to Four Point Rolls.

Outside Loops are easy but do require small rudder input at the top to remain on heading. Inverted flight, multiple inverted to inverted rolls, and outside snap rolls (down-elevator used from inverted flight) are pretty, but not so fast that they are difficult to manage. Inverted spins rotate more slowly than upright; recovery is just as easy.

The last step is to replace the three-blade propeller with a two-blade performance propeller such as the APC 10 x 6 or 11 x 5 or an equivalent. At these maximum power levels, the Evolution Alpha rockets the P-51 along at a respectable top speed.

Loops top 150 feet in diameter and rolls become fast. Flying Inside and Outside Avalanches—Loops with snap rolls at the top—are fun, and knife-edge flight is better but remains rudder-limited. Field-length Slow Rolls are eye-catching.

The 10 x 6 propeller increases approach speeds, requiring an idle of less than 2,200 rpm. I recommend the 11 x 5 as the best choice.

However, there is a price for this increased performance. A truly reliable idle near 2,300 rpm is required for manageable landing approaches, or just use the flaps. Airspeeds at all throttle settings are faster. The aircraft accelerates much faster when taking off, so the whole maneuver happens quickly. The P-51 gains speed in any descent mode. All these characteristics are common to most Sport Scale models, but this aircraft handles the increased performance a little better than most others do.

Most P-51s do not fly around with big wheels hanging out the bottom, so mechanical retracts might be in this airplane’s future. That upgrade will take some engineering on my part. I wonder how far this PTS concept can be pushed.

With the training gizmos removed, the Mustang in this trainer starts to shine through. Inverted flight and Outside Loops from level are comfortable to do. Costello photo.

To find out what else happened with this model, check the Sport Aviator Web site. Since most MA readers are pilots who have some experience, this review focused more on the PTS upgrades. MA Associate Editor Michael Ramsey has written an excellent Mustang PTS review for Sport Aviator that focuses on the airplane as a typical trainer, and it includes all the performance numbers for the various PTS configurations. MA

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