

## Hobbico NexSTAR – The Next Step



Hobbico's NexSTAR was the first, and we think still the only, complete RC Training System available. The NexSTAR training system includes the RTF aircraft complete with engine and radio installed plus an onboard "autopilot," Real Flight NexSTAR-only flight simulator and an excellent training video. Sport Aviator reviewed this training system when it was first released and the article remains available, (as do all Sport Aviator articles) in Sport Aviator's "On The Flight Line" Section. If you have not read the first article, you might want to read it before reading this follow-up story. Just click here: [Hobbico's NexSTAR Select](#).

The NexSTAR airframe itself has several exclusive features. First, it sported one very good engine, the O.S. Max 46 AXi. This ball-bearing equipped, "ABC-style" premium engine is almost identical to O.S.'s new .46 AX. The only difference is a minor change, possibly in the timing, to make the engine start even more easily than does the quick starting .46 AX.

The NexSTAR also features drooped leading edges on the out board wing sections (photo 1). In the original article, we proposed that these drooped tips were utilized to maintain aileron control at very low airspeeds. We will see how that guess worked out. The NexSTAR also has slotted flaps or speed brakes, like the Dauntless Dive Bomber of WW II (photo 2). These flaps, we suggested, help to control airspeed rather than provide extra lift. Another theory that will need checking.



Photo 1



Photo 2

So we packed the NexSTAR off to the field with a screwdriver to remove the flaps and a knife to cut away the clear tape that holds the drooped leading edges in place. We also installed the Eagle Tree Flight Data Recorder to try to get a better understanding of the effects either of these airframe devices might have.

The planned tests included flying the NexSTAR with the flaps removed but with the drooped leading edges in place. That flight was followed by removing the drooped leading edges as well, resulting in a "clean" airframe. The final test flights had just the flaps installed. Since we already had extensively flown the NexSTAR with both devices installed, we will use that data as the base comparison.

We obtained some interesting results. But also, you should know that the data was not all obtained on the same day and in the same place. The flight data recorder was only able to record the first two test flights before running out of memory. The third flight's data was incomplete and had to be repeated very early the next morning just before a rain storm. We also repeated the flights in another location 2 days later. This second location had an elevation about 400 ft. higher than the first. For these reasons, we feel that the data obtained is only about 90% accurate.

In addition, the original data was obtained months ago. But the weather conditions then were similar to now; late November with temperatures in the high 40's. However, the humidity level then was much lower. I think the data is valid, even with the error factor, as we averaged everything out as much as possible.

<b><u>NexSTAR Flight Data</u></b>				
<b><u>Flight Parameters</u></b>	<b><u>Flaps/droop edge</u></b>	<b><u>Droop only</u></b>	<b><u>Flaps only</u></b>	<b><u>Clean</u></b>
T/O Speed	23 mph	30 mph	34 mph	30 mph
Climb Out	1,200* @ 25**	1,500 @ 30	1,800 @ 34	1,800 @ 37
Cruise Speed	32 mph	44 mph	40 mph	47 mph
Best Training Speed	32 mph	44 mph	40 mph	47 mph
Top Speed	53 mph	62 mph	58 mph	67 mph
Dive Speed	57 mph	60 mph	60 mph	73 mph
Rate of Climb	1,900 fpm	1,900 fpm	1,900 fpm	2,300 fpm
Stall Speed	< 6 mph	17 mph	22 mph ***	22 mph ***
60 deg. Stall Spd.	12 mph	24 mph	22 mph	22 mph
Glide Descent	-1,200* @ 29 **	-600 @ 31	-1,000 @ 32	-800 @ 35
400' Glide Distance	842 ft.	1,860 ft.	1,152 ft.	1,575 ft.
App. Speed	17 mph	30 mph	35 mph	37 mph
Landing Speed	10 mph	26 mph	28 mph	30 mph
* Feet per minute				
** Miles per hour				
*** Descent rate was very different. 700 fpm clean, 1,100 fpm flaps only.				

A first look at the chart is fairly puzzling. Equipped only with the droop leading edges, the NexSTAR has a lower rate of climb than it does with flaps only, but glides nearly 40% further. Huh? I think if we add the subjective pilot data to these results, things will begin to make a little more sense. We hope.

### Flaps Up



Photo 3



Photo 4

Just six small wood screws hold the slotted flaps/speed brakes in place. Removal was easy. The drooped leading edges were left in place. The takeoff run was noticeably longer than we originally experienced with the NexSTAR sporting all its airframe devices. However, the grass might have been a bit longer this time as well, but not by much if at all. After noting that the takeoff speed was a little higher than we normally experience, we noticed that the rate of climb away from the ground was definitely better.

The climb out speeds looked about the same, (they were only 5 mph apart), but the airplane was definitely going UP much faster than usual. The aircraft also seemed to answer the throttle more quickly as it accelerated faster when more engine power was applied. At full power, the top speed looked a little faster as well. (It was, by about 9 mph.)

The first real difference was in the [stall](#). First, please understand that the NexSTAR does not, and will not, really stall. There is never a pitch-up, followed by the usual rapidly falling nose angle, common in most sport airplanes. Instead, the NexSTAR stalls with the nose held about level, no drop, while descending at a medium rate. With droop edges and flaps, the NexSTAR can fly so slowly, less than 6 mph, that the ailerons are fairly worthless. Only the rudder will control direction and lift a "down" wing. The "full-house" NexSTAR had minor [adverse yaw](#) at very slow airspeeds, but not much.

The stall with the flaps removed was almost no different except the stall airspeed was much higher at 17 mph. This remains very slow for this type trainer. The ailerons worked a little better and the amount of adverse yaw remained constant. The descent rate was only about 4-600 ft. per minute. The wings remained level and there was almost no wind to upset them.

Our theory that the drooped leading edges were designed to keep the ailerons working and the wings level at slow airspeeds, while adding to the wing's total lift, had some holes. While the wings did stay level, the stall airspeed increased (proving the droop edges did not provide much lift) while the ailerons did not have much effectiveness even at 17 mph.

But the drooped leading edges seemed to help the airplane's glide by greatly lowering the descent rate. If forced to hazard a guess as to just what this device does, I would propose the following. The drooped leading edges help keep the wings level at very slow airspeeds. They also provide extra lift once airspeeds are in the medium range and at lower [angles of attack](#) than found at the stall. We also found out later that the drooped leading edges do help the ailerons. While not increasing aileron effectiveness, they do noticeably reduce adverse yaw at very slow airspeeds.



Photo 5 Photo 5A

Flying without the flaps/speed brakes was much like flying the "full house" airplane. Airspeed bled off quickly but the powerful .46 AXi always got it back when asked. The aircraft just about refused to fly inverted, always trying to roll level (the autopilot was disconnected for **all** test flights). The airplane did accelerate a little more when the nose was allowed to dip, but nothing exciting. In fact, the dive speed was about the same.



Photo 6

The NexSTAR remained a very tractable trainer, mild mannered, well behaved and with little aerobatic freedom. Airspeeds remained constant and predictable. The landing speeds were higher, nearly double the “full-house” version, but remained in the same realm as most trainers tested. I think the landings could have been performed even more slowly but the sink rate increased when airspeeds got below 25 mph.

#### Flaps/Speed Brakes Only



Photo 7



Photo 8

The flaps were screwed back in place and a few pulls on the clear tape had the ingeniously constructed plastic/wood reinforced, drooped leading edges sitting on the field bench. These 12.25 in. long devices weigh just 2.5 oz. so weight savings did not have a real effect on performance.

The takeoff roll was longer than with the drooped leading edges and happened at a slightly higher airspeed. Again, this indicated that the leading edges did provide some extra lift at medium airspeeds. But the climb-out was better with flaps only and matched the clean airframe's climb-out. Level airspeeds however, were slower. While the final flaps-only maximum dive speed matched the drooped leading edge only dive speed, the **acceleration** to this final, 60 mph, airspeed was much slower with the flaps/speed brakes installed.

Our original thought that the flaps provided little lift seems to agree with the faster flaps-only approach, landing and stall speeds. The glide was also not as good with the flaps attached. In the stall, the nose acted just as the NexSTAR's nose always did, remaining about level. Even the descent rate remained the same. At very slow airspeeds, the speed brakes/flaps had little effect except to slow acceleration from those low speeds.

The NexSTAR's aerobatic performance greatly improved. Inverted flight, while still difficult to maintain, at least proved possible. Vertical climbs improved and stall turns were easier to do. Loops remained the same diameter however, but the airspeed “down the back side” of the loop did not increase as much. When forced into the deep stall oscillations ([Phugoids](#)), the flap-equipped aircraft had to go through fewer oscillations to return to level stalled flight. This may be because the speed brakes reduced the descending airspeed.

There was one big difference in the stall however. While the ailerons were just slightly more effective during the stall than they were in the drooped edge-only NexSTAR (the stall airspeed was 5 mph higher accounting for this), there was a lot more, a whole lot more, adverse yaw. Right aileron would cause the nose to swing about 45 degrees to the left while the wings remained level. Finally, the nose would start to swing right and then the wings would begin the right bank.

It should be noted that Hobbico knew this aircraft was capable of very slow airspeeds and adjusted the ailerons accordingly. Following the assembly directions imparts a good amount of [aileron differential](#) into the NexSTAR. But no amount of differential can completely eliminate adverse yaw at 6 mph. Remove the drooped leading edges that increase the ailerons' differential effects at slow speeds and you have an aircraft with more adverse yaw than a full-size biplane of the 1920's. That is a container load of adverse yaw.



Photo 9 Photo 10

Landings with the flaps/speed brakes installed were faster but not difficult at all. Airspeeds remained constant and were easier to control. The glide path was steeper but the aircraft did not accelerate. The engine-out glide distance went all to heck however; down to 1,152 ft. from 1,860 ft.

All things considered, the flap-only NexSTAR was more fun to fly than the drooped leading edge-only version because it was more aerobatic. Steep approaches with slow touch-down speeds were also fun. But the aircraft required more piloting skill than either the full-house version (which requires very little) or the drooped leading edge airframe. Flying the flap-only version would be a very good intermediate step in a pilot's learning curve.

### The Fun Part



Photo 11

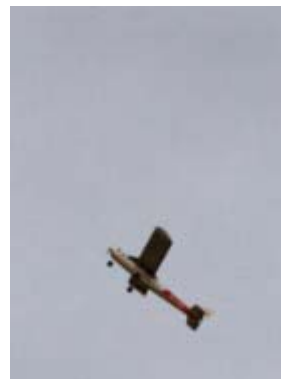


Photo 12

This was the one everyone was waiting for. What would it be like to liberate the NexSTAR from those lift-enhancing drag devices and let it run free in the sky? Please don't misunderstand; these

devices are important advances that allow this trainer to teach new RC pilots how to fly faster with fewer problems. Still, a new pilot learns and advances in the sport. After the thrill of landing with the nose gear relatively straight, the engine still idling and everything still attached to the aircraft wears thin, a new pilot likes to stretch the aircraft's performance envelope.

So what can the NexSTAR do? Freed from the speed brakes and drooped leading edges, the NexSTAR can fly over 67 mph, climb at 2,200 fpm and perform respectable trainer aerobatics. In fact, the NexSTAR is the only flat-bottomed wing, basic trainer tested by Sport Aviator that can reliably fly outside loops. Inverted flight requires about half of the available down elevator but steep inverted turns are still possible.

The full-house NexSTAR has a strange slow-roll performance. The aircraft rotates slowly for the first half of the roll. But then performs the second half of the slow roll so quickly that a quick eye blink will actually cause the pilot to miss seeing it. But when flying clean, this performance aberration disappears. The NexSTAR can perform very nice slow [barrel rolls](#). Consecutive fast rolls stay on line with little altitude loss. Loops are bigger and stall turns higher.



Photo 13



Photo 14

Slow fly-bys show off this attractive, different looking trainer. The fuselage is not slab-sided but rounder like a full-size Cessna. Even clean, the NexSTAR can pass in review at less than 30 mph. Then let the powerful .46 AXi pull it up at a 40-degree angle for several hundred feet. The clean NexSTAR stalls just like it does in all its other incarnations. It just descends with no nose drop. BUT, apply aileron and rudder in the same direction during the stall and the clean NexSTAR drops its nose in that direction and begins to rapidly rotate in the spin.

If it spins, maybe it can [snap roll](#). And it does, but slowly with a large barrel component to the roll. The snap roll is gentle enough that the new pilot can learn it without risking the aircraft. Outside snap rolls however, remain outside the NexSTAR's generous aerobatic abilities. The aircraft pitches up and starts to roll but then falls out of the sky after completing less than half the outside snap. Remember this is a trainer, not a contest-quality aerobatic airplane. For a basic trainer, the NexSTAR does quite well in the aerobatic corner of RC flying.



Photo 15 Photo 16

The clean NexSTAR slips very well in a cross wind (photo 15) and landings are uneventful. Landing speeds are highest of all versions, above 35 mph. But the touchdown speed stays around 30 mph. This performance is about the same as most other basic trainers, maybe just slightly faster. The NexSTAR is a little heavier than many other basic trainers but the speed and weight differences are minor.

### The Package

We learned that Hobbico knows what they are doing when they design a model aircraft. The full-house NexSTAR is an excellent trainer, working well in all flight régimes. But removing either airframe device causes its flight performance numbers to leave the realm of the incredible (really, a six mph stall?) and approach those of other basic trainers.

The flap-only version would be great except for the huge amount of adverse yaw at the stall that occurs when the leading edges are removed. Removing the flaps only creates an airplane that flies well but that builds airspeed more quickly if the pilot lets the nose drop in a turn. Aerobatic capability is also severely limited by the leading edges.

So the perfect trainer version proves to be the full-house NexSTAR. That is probably not much of a surprise as Hobbico has been building trainers for a long time. But once a pilot solos, strip the NexSTAR clean and this basic trainer can teach aerobatics with little risk. It is also fun to bolt on just the flaps for a while and try those dive-bomber approach landings.



Photo 17

Even flying clean, the NexSTAR can make some impressive nose-high approaches like the one in photo 17. Gradually transitioning from the full-house configuration to the clean version therefore will not take much time and has little risk involved. Our suggestion is for the new pilot to begin this transition by removing the flaps. Then flying the NexSTAR with drooped leading edges only, until the pilot is comfortable with the aircraft's performance. Finally, transition to the clean configuration and start aerobatic training.

It is not a bad thing to have one aircraft with such multiple personalities with such minor modifications. It is a good concept. Just as this is being written, we have learned that Hobbico is now offering the NexSTAR's unique airframe as an ARF. The pilot adds the radio, engine and auto pilot, if desired. We do not know the price, but since the NexSTAR System is so reasonably priced at \$380, then the ARF version will also probably be a bargain.

### Definitions

Aileron Differential – Adverse yaw, especially on flat-bottom wings, is caused by the difference in airflow density between the bottom and top of the wing. The airflow along the wing's bottom is denser than it is over the top of the wing. Therefore, the aileron moving down into this denser air creates more drag than the "up" aileron moving into the less dense airflow on top of the wing. The greater drag on just one side of the wing, the side with the down aileron, forces the wing, and the attached fuselage, to yaw in that direction. At slow airspeeds this yawing effect is more powerful, and happens faster, than the rolling effect caused by the ailerons. The airplane's nose first swings away from the turn's intended direction and only then begins to turn correctly once the roll begins.