

A Good Comanche 250 Gets Better with VG and LASAR Ignition (Apr 2008)

Jim Webb, ICS #6849

In 2005, I decided to upgrade my Comanche 250 (N8300P) with two additions. First, I wanted to add vortex generators (VG) to the wings and tail, and second, I decided to upgrade my magneto system with a LASAR electronic ignition system. In the ten years I have owned this airplane, I found that I do a lot of mountain and long cross-county flying (for example, I just got back from a trip from Mesa (FFZ) – Minneapolis (STP) – Houston (HOU) and back). I thought that these two additions would be particularly helpful since much of my flying is at, or above, 10,000 feet with a full load. Following is some information about the additions, and also my experiences in flying “Double-O Pop” with the improvements.

Little Flyers (www.littleflyers.com) in Kearny, Ariz. (E67) did the installations. Roger Stern there has been taking care of N8300P for the last eight years, and I would recommend him and his shop to anyone. My bird has about 4,500 hours total time, and yet I feel very comfortable flying it, thanks to his knowledge of Comanches and his careful and detailed maintenance and preventive care. I likewise would recommend the VG and LASAR installations to other Comanche owners for the reasons that follow.

Operational Comments from Little Flyers after Installation

The engine starts are immediate with engine cold, hot, or in-between. Engine explodes into life on starting. The idle is very smooth, and we found it necessary to set the idle speed down. The throttle response is much more prompt. Takeoff and climb power is much smoother. The engine operates with an extra measure of confidence. Cylinder head temp on climb out is somewhat elevated compared to what it used to be, but with the temp limiting option, it never goes above its limiting threshold. Engine operation is delightfully smooth in cruise with oil and cylinder head temps normal. Pulling the ignition circuit breaker returns the engine to its former operational coarseness. Engine ignition operation is completely transparent to the pilot and is no different from normal magneto operation except for an occasional glance at the indicator light. The spark plugs operate cleaner, but have experienced some lead deposits in some of the bottom spark plugs. This did not, however, cause any engine roughness. Adding Alcor TCP to the fuel eliminated the lead deposits in bottom spark plugs. Spark plug electrode erosion appears to be about half of what it used to be with the previous magnetos.

The system has not given any problems in the last two- and-a-half years and some 250 hours of operation. Routine annual timing checks are easy to do, and so far the system has not drifted out of specs. At last year's Greater Southwest Aircraft Maintenance Symposium, I asked the Lycoming engine technical representative if the LASAR system had negatively impacted their engine. He replied, “Absolutely not.”





Operational Comments from the Pilot

I believe that these two changes have already almost paid for themselves in the amount of fuel saved; and the plane definitely flies better. I notice the biggest improvement once I get above 6,000 feet. Overall, I burn at least one gallon of fuel less per hour than before, thanks to the LASAR ignition system; and at high altitude, it is probably two gallons less. Also, I can achieve the same indicated airspeed with a lower manifold pressure setting. At low altitude, I have not gained significant speed – probably only two or three knots. However when I get above 8,000 feet, I notice a definite improvement in airspeed – probably five knots or more. Not only does the ignition run more smoothly and efficiently, but also the VGs help the airplane to fly in a more level position (rather than nose up), and therefore faster. This is even more striking when I am flying at 11,000 feet and above. Another very strong improvement is in the takeoff roll, particularly on hot days as we have here in Arizona, and/or at elevated airports. Even fully loaded, Double-O Pop lifts off of the runway in a much shorter distance with ease. Surprisingly, though, I have not noticed any change in my stall speeds even though the manufacturer predicts that VGs will lower them.

The LASAR system seems to accommodate to various mixture and fuel settings, and even to slightly different fuels. When I fly down into Mexico, I am not convinced that the fuel is always the same. Before I got the LASAR system, I often noticed that the engine was not running as smoothly. I haven't noticed that since I got the LASAR system.

I strongly recommend these two improvements that I have used for over two years with no problems. However, it is also important to have an excellent shop like Little Flyers that knows Comanches.

Installation Specifics

Pre-painted Micro Aero Dynamics Micro VG Kit 5079

The above kit was installed on the wings and tail surfaces (I/A/W MA2192). The Installation Manual that came with it was dated 7-20-04 per STC #SA01299SE. The kit, which cost \$1,450, supplied 68 vortex generators for the wings, 32 for the vertical stabilizer, and 72 VGs for the underside of the stabilator.

The total installation time was 13.3 hours. Here is a listing of the tasks (and time) involved for each phase of the installation:

1. Removed wax/dirt from VG mounting areas (0.3 hr).
2. Laid out masking tape/threads for locating template edges on the wings (0.6 hr), stabilator bottom side (0.5 hr), and vertical fin (0.4 hr).
3. Marked off span locations for template to center the VGs (1.0 hrs).

4. Installed self-stick templates (1.6 hrs.) and verified tentative VG placement, as per drawings PA24001 sheets 1/2, 2/2, PA24002 sheet 1/1, PA24003 1/1 (0.3 hr).
5. Removed paint glaze on VG mounting areas (1.8 hrs.) and accent paint strip ridges on each side of vertical fin (0.5 hr).
6. Cleaned mounting surface areas with isopropyl alcohol (0.3 hrs).
7. Progressively applied adhesive activator to template hole mounting areas, applied adhesive to VGs, and installed on wings (1.8 hrs.), bottom of stabilator (1.5 hrs), and to the vertical fin (1.1 hrs.). For the stabilator and the vertical fins, the VGs had to be held in place until the adhesive partially set.
8. Removed locating templates and completed touch-up cleaning (0.8 hr).
9. Printed and installed placard on instrument panel (0.2 hr).
10. Completed documentation and submitted 337 form (0.6 hr); negligible weight change.

The Kit instructions were well written, only a few insignificant exceptions were encountered. Templates were easy to use and all the needed items were supplied with the kit.

Comments from Little Flyers

Little Flyers wrote the following when they flight checked the aircraft. "Stalls were preceded by very energetic buffeting, aircraft produced mild porpoise cycles with continued application of aft stabilator control. Landing/touchdown was much more predictable with notable increase of pitch authority during landing flares. VGs take the "thump" out of landing arrivals and one can hold nose of aircraft up longer after landing."

Unison/Slick LASAR Electronic Ignition System with Bush Kit

Little Flyers first removed the existing Bendix S6LN-200 series magnetos; they were obsolete and in need of expensive repairs. Then, they installed the Unison LASAR (Limited Authority Spark Advance Regulator) ignition system with cylinder head temp limiting consisting of left sensor magneto, right non-sensor magneto (impulse coupled), a 12-volt controller (computer), special control wire harness, a special cylinder head temp probe, and a push-to-test indicator light, along with the necessary placards. The total cost was \$3,020 and the total installation time was 17.2 hours.

Realistically, this is about a two-day project to install the system in an equipped shop with an experienced technician. In addition, there are a number of judgment calls and evaluations that had to be made.

1. If system does not have the "bush kit" option and if the electronic feature fails, the engine will not start until it is repaired. With the "bush kit" option, the engine will start and operate on the magneto standby mode. We recommend the "bush kit" option.
2. Unison does not suggest a location for the controller/computer. Therefore, its location and mounting must be well thought out as there are many systems already mounted on the aft side of the firewall, especially the left side.
3. The location of the controller determines the length of the low-voltage harness, and this has to be determined before ordering. The harness is permanently installed to the controller box.
4. Information for the hottest operating cylinder temperature is not always available and has to be determined.
5. System warning indicator light was not supplied in the kit we received, so Little Flyers used the standard military specification "push to test" indicator light. In our opinion, a warning indicator light should be required.
6. Most A&P technicians will find the LASAR ignition system unfamiliar and challenging. Thoroughly understanding the system and instructions is imperative. Also, a special timing indicator is required; it can be rented from www.hangartoolbox.com.

Some details about the installation:

1. Controller/Computer
 - a. Evaluated position of proposed mounting holes to clear flight control cables and brake plumbing on aft side of firewall. Note: This location would be unacceptable if the aircraft were fitted with original aft crossover exhaust system (I have installed a dual exhaust system).
 - b. Little Flyers fabricated a mounting template for the controller/computer so that it would be located on the left middle side of the firewall using one existing screw hole.
 - c. Installed and secured new LC1011-15 12-Volt Controller with CHT limiting.

2. Controller Manifold Pressure Sensing
 - a. Removed existing manifold pressure plumbing between #6 cylinder and right upper side of firewall fwd side.
 - b. Partially drilled one end of new AN815-4D union, pressed in AN470AD-6 rivet, cut and profiled excess rivet. Drilled fitting with #50 drill (.070-inches) and installed at #6 cylinder line. Note: Restricted manifold pressure fittings are now available from Unison.
 - c. Fabricated new line assembly from 20 inches of 1/4-inch aluminum tubing, formed as needed. Installed and secured with new cushion clamps to firewall channel. Installed new AN824-4D tee inboard end.
 - d. Made a new manifold pressure hose assembly from 22 inches 193-4 low pressure hose and 311-4D fittings. Installed between line tee and restrictor fitting.
 - e. Assembled controller manifold pressure hose from 193-4 low pressure hose and one new 311-4D fitting. Installed hose assembly between tee and controller.
3. Controller CHT Control/sensing
 - a. Determined probability of hottest cylinder temperature. Installed M5340-03 adapter/probe in #4 cylinder well. Connected to low voltage harness with a 4-circuit connector plug.
4. Cockpit Annunciator/indicating
 - a. Located and installed MS25041-2 push-to-test indicator light with dimming feature in center section of pilot's instrument panel.
5. Tachometer Drive Signal
 - a. Spare capped tach signal wire ends and coil, and secured adjacent to ignition switch.
6. Low Voltage Control Harness
 - a. Determined the configuration and length of harness needed and ordered it. Then installed the new custom-made LH-1004-17 low voltage control wire harness and secured it, as well as sealing the harness at firewall grommet with high-temp RTV. Next, completed all of the terminations except for electron tach drive signal wire, which was spare capped.
 - b. Installed red power wire on a dedicated 10-amp circuit breaker main buss. Connected ground to left side of upper firewall channel section. Treated magneto and controller connector plugs with M-5430 lubricant and connected.
7. Ignition Switching
 - a. Removed the existing "P" leads and right terming grounding jumper at ignition switch. Connected LASAR harness connections to ignition switch. Reinstalled ignition switch.
8. LASAR Magnetos
 - a. Installed new Unison LASAR 6776 left sensor magneto with new 62224 adapter gasket, LW-12681 magneto gasket and two new STD1410 mounting nuts. Timed to engine using T-300 SynchroLASAR timing indicator. Note: New drive bushings had been recently installed.
 - b. Installed new Unison LASAR 6755 right non sensor magneto, impulse coupled, with new 62224 adapter gasket, LW-12681 magneto gasket, and two new STD1410 nuts. Timed to engine using T-300 SynchroLASAR timing indicator. Note: New drive bushings had been recently installed.
9. LASAR Placards
 - a. Printed and installed placard in full view of pilot that reads: "Operation of LASAR engine ignition requires a minimum grade of 100 octane Avgas."
 - b. Printed and installed following placards inside of both cowl doors:
 - i. "Pull LASAR ignition circuit breaker before servicing engine."
 - ii. "If battery master and magneto switches are 'ON' or ignition switch wire(s) detached, system will fire with engine rotation in either direction. Additionally this LASAR system has the 'bush kit' option and with magneto switch in 'Right,' 'Both,' or 'Start' position or right switch wire detached activation of the right magneto impulse will trigger an ignition event with propeller rotation in normal direction."
 - iii. "Do not operate system with open high voltage circuit (ignition leads removed)."
 - iv. "Use only M-5430 connector lubricant on LASAR system low voltage wiring harness disconnect plugs."
 - c. At ignition circuit breaker: LASAR
 - d. On indicator light lens: "I", below light: "IGNITION"

Exceptions and Comments

As with most installations, some problems arose that required knowledge, experience, or creativity. Some of the issues and solutions Little Flyers experienced are:

1. #4 cylinder head temp port well threads were too tight to install CHT probe adapter – shortened tap and chased threads.
2. New replacement left magneto was too tight in the mounting adapter – removed burrs from adapter inside diameter and lightly sanded inside bore.
3. The existing Aero-Lite small barrel ignition harness is not recommended for use with LASAR ignition system – installed new Unison all weather ignition harness.
4. The existing standard spark plugs were not compatible with new all weather ignition harness – gapped and installed new spark plugs.
5. Initially, the electronic ignition feature on the system we received was intermittent. Of course, it was over the long July 4th weekend, and no factory support was available. We managed to diagnose the sensor magneto, correct and reinstall it in a four-hour period.

