SEPTEMBER 2012

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OPTIMAL ENGINE PREHEATING

CORROSION - TWIN CESSNA KILLER - PART II

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IN SEARCH OF OPTIMAL PREHEATING - PART 1

by Ken Sutton, TTCF Member

The kids are back in school, the days are getting shorter, and on my evening walks, I can begin to see to see my breath. It won't be long before the snow will once again be flying here in Chicago, and my attention will turn from summertime thunderstorm avoidance to cold weather operations in my C-310. Throughout the summer I've continued working on perfecting the engine preheating system I wrote about in TTCF last winter.

As you may recall from my previous article, last year I had a discussion with Harold Tucker, Director of Lubricants Technical Services at ConocoPhillips, which led me to pursue a more automated way to control the Reiff preheat system I installed on my C310 several years ago. Prior to this discussion, I had only been preheating my engines when the ambient temperature was below 40˚F. Mr. Tucker suggested that all engine starts below 60˚F should be considered cold starts, and each of those starts was shaving useful life from my engines. He suggested that the closer I could get to normal operating temperature prior to every start, the greater longevity I would enjoy from my engines. There's a host of reasons why this is likely true, and I don't wish to delve into that discussion.

The GSM Auto switch allows me to turn my engine heaters on and off from my cell phone.

Rather, I'd like to focus on how I've gone about trying to achieve the goal Mr. Tucker proposed.

Last winter, I began using the GSM Auto switch (www.gsm-auto.com) which I described in the February magazine. This cell-phone controlled switch, coupled with my iPhone and its ability to create shortcuts for texts, allows me to easily control my engine preheat system. I can turn on and off the preheaters, set them to go on or off at a point in the future, check the status of the heaters (on or off), and even confirm the quality of the cell signal to the switch. This switch has eliminated many trips to the airport, and it has allowed me to preheat the engines at times when I may have opted to simply start them at the ambient hangar temperature of 40-50˚F. Instead, every engine start this past winter and spring has taken place with the engines warmed to a toasty 105-115˚F.

(Above) Engine blankets facilitate uniform engine heating as well as reduce condensation. (Right) Plugs for my exhaust augmenters completed the seal.

A couple of months back, I read an article in Aviation Safety about engine preheating. The debate between using preheaters all the time, versus just hours before flight, consumed this article. However, one point was universally accepted by everyone on both sides of the debate. Namely, if you are going to preheat (as you should), regardless of how you go about preheating, you should consider using a blanket or insulated cowl cover around the cowling to create a uniform heated environment around the engine. The point is that the condensation level that exists between relatively cold and relatively warm air should be moved as far away from the engine compartment as possible. By putting a blanket around the cowling, the condensation level is moved away from the engine. This reduces the possibility of moisture causing damage to the engine components and accessories by more uniformly preheating the entire engine. It all made a lot of sense to me, particularly after I felt around the engine cowling after preheating without a blanket or insulated cowl cover. What I found was that the air inside the cowling was certainly warmer than the hangar, but towards the back of the engine compartment, the temperature was noticeably cooler than the front. With the exhaust augmenter system on my 310G still in place (but left unused), relatively cold air appeared to make its way up the augmenters, mixing with the warm air inside the cowling. I had been using engine cowl plugs when preheating, which was preventing relatively cool air from entering the front of the cowling.

In an effort to move closer to the optimal way to manage my engines, I spoke with the people at Kennon Covers in Sheridan, Wyoming (http://kennoncovers.com/enginecovers.htm). They sent me a pair of clear plastic sheets molded to conform to my engine

(continued on page 12)

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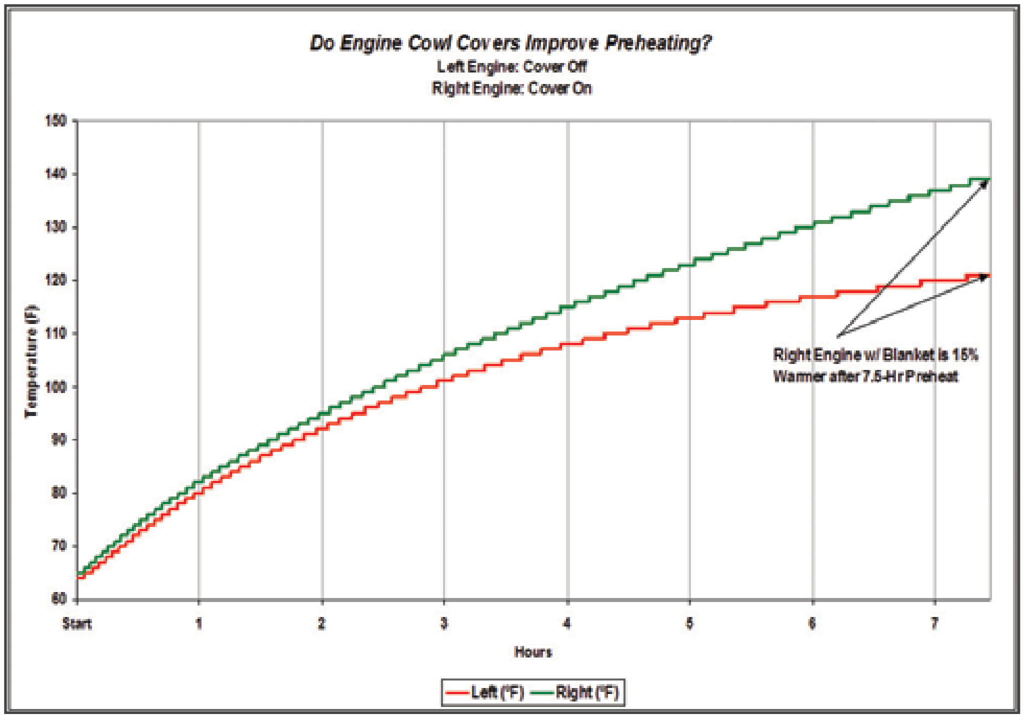
cowlings. It was my job to mark the openings for the oil service doors and the underwing exhaust tips, and then send back the marked up template.
A few weeks later, I was pleasantly surprised to find that the set of covers they built for my C310G fit like a perfectly-sized glove. The Velcro access openings were perfectly placed, and the accommodation for my underwing exhaust couldn't have been better positioned. The craftsmanship of these covers cannot be overstated. As a final touch, Kennon built a pair of plugs for the openings of my augmenters to better insulate the back of the engine compartment.

I certainly feel like I now have a more complete preheat system that allows me to not only control the preheaters, but also allows for a more uniform preheat of my engines. But I began to wonder if there was a way to quantify the value of my efforts.

A company by the name of Lascar Electronics in the UK (http://www.lascarelectronics.com) builds a variety of data loggers, primarily for the HVAC and Refrigeration industry. One of their products is a data logger that looks similar to a tube of lipstick. It has an internal memory that will digitally store a recording of current temperature, relative humidity, and dew point every 10 seconds for nearly two days. (Longer

Lascar data loggers allowed me to record the temperature and humidity deep inside my engines.

recording intervals will provide for even longer recording periods.) I purchased three of these data loggers from Lascar and set out on a journey to better understand what takes place inside my engines.
The first challenge was to figure out how to get these little data loggers inside my engines for sampling the environment, while at the same time being able to retrieve them when I was finished. This ended up being quite easy. I simply taped a piece of rigid wire around the body of the data logger using



Bottom line: Kennon engine cowl covers allowed the Reiff engine heater to warm my right engine temperature 15% higher than the uncovered left engine. The final temperature was within 10% of my normal operating temperature.

high temperature electrical tape. This provided a ridge around the data logger that would prevent it from falling into my engine oil filler neck, while placing the air opening of the data logger down into the top of the crankcase. The high temp tape sealed off the filler neck to as to get an accurate reading inside the engine.

I used safety wire and attached one end to the USB end of the data loggers and the other end to a block. This was to further insure that they would not fall into the engines.

I then began a series of trials to collect data that I thought might be useful in quantifying the value of the steps I've put in place to preserve my engines. The first trial was designed to simply identify the value of the Kennon engine cowl covers. Recall that Harold Tucker told me it was important to get the engine temperatures as close to normal operating temperature as possible prior to engine start. Do the cowl covers help achieve this goal?

With a data logger installed in the filler neck of each engine, I installed the Kennon cover and augmenter plug on the right engine, while leaving them off the left engine. I started the preheaters and let them run for approximately 7.5 hours. At the end of the test, I found that the right engine was 15% warmer than the left engine. The digital oil temperature gauges on my instrument panel confirmed the effectiveness of the covers with the right oil temp reading 141˚F, and the left engine oil temp reading 115˚F. On this cool spring day in Chicago, my oil temps were approximately 155˚F just after takeoff. The right engine that had been preheated with the cowl cover was now within 10% of its normal operating temperature at engine start. The engine without the cowl cover was warm, but still was more than 25% below its normal operating temperature at engine start. Without question, the insulated Kennon cowl covers are getting my engines much closer to the optimum engine starting temperature.

There are other advantages to the cowl covers, and other things I learned that we can do to help manage our preheat cycles as I worked my way through a series of measurement routines with the data loggers. In next month's issue, I'll explore those possibilities and uncover some ideas you may not have previously considered that may help you better manage and preserve your engines.

IN SEARCH OF OPTIMAL PREHEATING - PART 2

by Ken Sutton, TTCF Member

Last month, I discussed my effort to achieve an optimal outcome when preheating the engines on my C-310G. This all began last winter when Harold Tucker, Director, Lubricants Technical Services at ConocoPhillips, told me that I should be preheating my engines any time the ambient temperature is below 60°F, with a goal of getting as close to normal operating temperature as possible. The GSM Auto cellular remote controlled switch was a first step at achieving this goal, as it allowed me to control the preheaters without having to drive to the airport. The next step was to use insulated cowl covers and cowl plugs made by Kennon Covers. And finally, I used data loggers by Lascar Electronics (www.lascarelectronics.com/temperaturedatalogger.php?datalogger=378) to measure the environment inside my engines in a host of different preheat and cool-down routines. This month, I'd like to expand on the results of the testing I did with the data loggers to demonstrate some of the things we might do to better preserve our engines.

Shortly after I purchased my C-310G back in 2003, I brought a good friend and highly experienced aviation enthusiast to the hangar to show off my new acquisition. As we moved through the maze of airplanes in the hangar towards the 310, we walked by a P51 Mustang with an odd looking tube extending down from the engine cowling, terminating inside what looked like a miniature 55-gallon drum sitting on the floor. He told me that it was an engine dehydrator, used to reduce moisture inside the engine. At the time, I thought it curious, but I was far more focused on showing off my "new" 310 than I was interested in considering some strange new contraption.

In 2006, the Aviation Consumer magazine ran an article about engine dehydrators that reminded me of what I had seen attached to that P51 a few years earlier. I was now more eager to learn about dehydrators as I found the use of my 310 to be rather irregular over the years. My mechanic, along with just about everyone else I spoke to about airplanes over the years, assured me that the best way to preserve the life of my engines would be to fly at least once, if not twice a week. As much as I would love to tell you that I strictly adhered to this very sound and universal advice, I'm very sad to report that such an outcome has proven impossible over the years I've owned my 310. I fly my airplane as often as I possibly can, with the goal of adding at least 100 hours a year on the Hobbs meter. Some years I've easily achieved this goal, but a few years I came woefully short. Regardless of the time on the Hobbs meter, one thing is certainly true: I am not able to fly my airplane once or twice a week, 52-weeks out of the year. Weather is a huge factor here in Chicago, particularly in the winter. Personal scheduling is the other limiting factor. Given these constraints, am I destined for premature engine overhauls, or are there things I can do to help preserve my engines?

The Aviation Consumer article described a few different engine dehydrators of different designs. They set out to try and quantify the value dehydrators may have on preserving engines that sit for extended periods without flying. Their testing was limited to designs that used chemical drying agents to dry the air and then pumped this dry air into the engine through the engine breather. Their test results were really interesting, and the principle seemed intuitively sound. What was rather unattractive to me was the fact that I would have to bake the drying agent in the oven for a few hours to reactivate it, whenever it became saturated. Fortunately, one of the companies building engine dehydrators at the time offered another model that was essentially a dehumidifier. Without the use of a drying agent, these dehumidifiers could run continuously without the need for ongoing maintenance. Always intrigued by new technology, I decided to give it a try. For about $800 (back in 2006), I purchased a pair of Aircraft Components, Inc. (www.flyingsafer.com) Black Max Engine Dehydrators and began using them on my 310's engines.

In the years since, I have often wondered about the true value of these engine dehydrators. Aviation Consumer

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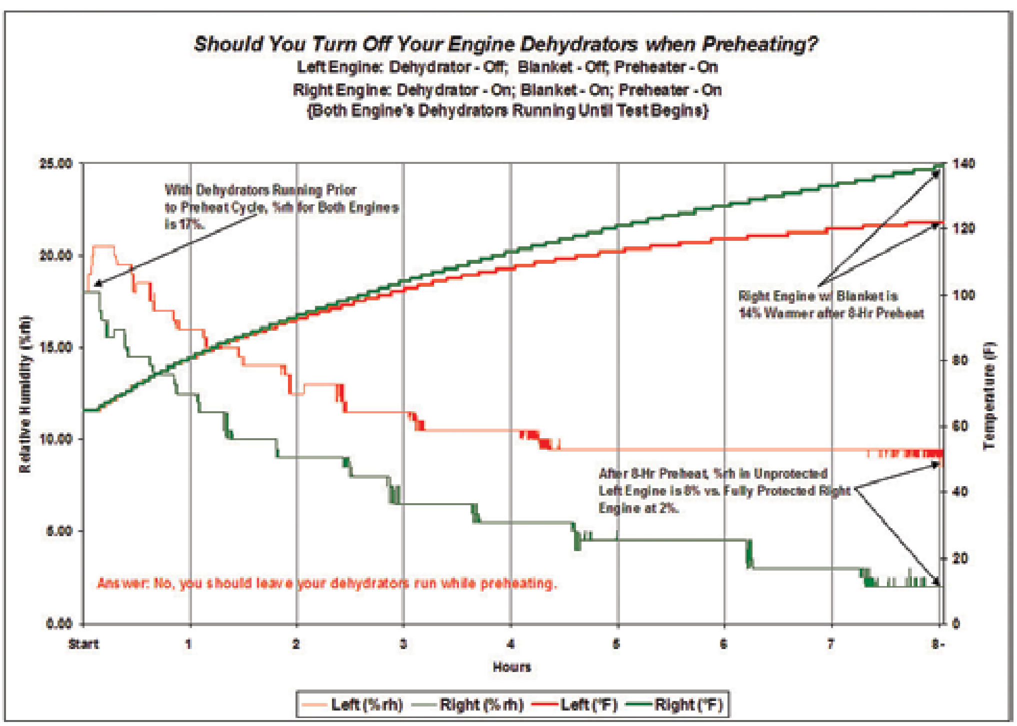

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had done an admirable job trying to quantify the value of dehydrators using a drying agent dehydrator Aircraft Components calls their Engine Saver. However, I had never seen any real world tests performed using the Black Max dehydrator design. The Engine Saver uses a drying agent that must be replaced periodically, but works well in very cold hangars and is a lower cost alternative; while the Black Max design is essentially a maintenance free dehumidifier design well suited to warmer climates or heated hangars. Part of the reason I recently decided to purchase the Lascar data loggers was not only to quantify the value of using insulated cowl covers during preheating, but also to measure relative humidity inside my engines, since it is humidity that the engine dehydrators are working to control.

Going back to last month's discussion about preheating, I first wondered if I should be turning off the dehydrators when preheating the engine. I ran this question past two separate experts that provided me with opposite conclusions. One expert told me that I should run the dehydrators when preheating because I would continue to introduce dry air into the engine that could only further help to prevent humidity inside the engine. The other expert suggested that introducing cold, albeit dry air into the relatively warm engine would lead to condensation and possibly rust on the internal engine components while preheating. Therefore, his suggestion was to turn off the dehydrators while preheating. It was these two polar-opposite responses from experts that led me to purchase the Lascar data loggers to measure the environment inside my engines, so as to draw my own conclusions from actual data.

For the first test, I attempt to answer the question: **Should you turn off your dehydrators when preheating your engines?** With both dehydrators running for more than 48-hours before I began this test, I removed the engine cowl cover and dehydrator from the left engine, while leaving them in place on the right engine for the test. Then I began the preheating cycle. Over the next eight hours, the engines warmed from approximately 60˚F to more than 140˚F on the right engine, and to approximately 120˚F on the left engine. This is consistent with the data I provided in Part I of this article. The insulated cowl covers are consistently improving the efficiency of the preheat process by approximately 15%. More critically, the insulated cowl covers are getting my engines much closer to normal operating temperature at engine start. But let's now focus on humidity inside the engine during preheating. As the preheaters increase the temperature of the engines, the humidity begins to drop. But the takeaway is the difference between the engine using the dehydrator, and the engine not using the dehydrator. As you can see in the graph on page 10, the dehydrated engine ends an eight hour preheating cycle at less than 2% relative humidity. The engine without the dehydrator ends the cycle at just over 8% relative humidity. Both values are essentially bone dry and either process is to me, very acceptable. However, the question I set out to answer was since I already have dehydrators, should I use them when preheating, or should I turn them off? The data clearly tells me I should continue to run them when preheating. (See graph on page 10.)

But what if you don't have dehydrators? Would they help reduce humidity inside your engine when preheating?

I clearly remember one of my economics professors at the University of Chicago once telling me that every question in economics should be answered with the statement, "It depends." As unfulfilling as that answer often is, unfortunately it is the only conclusion I can draw from the data derived from my third round

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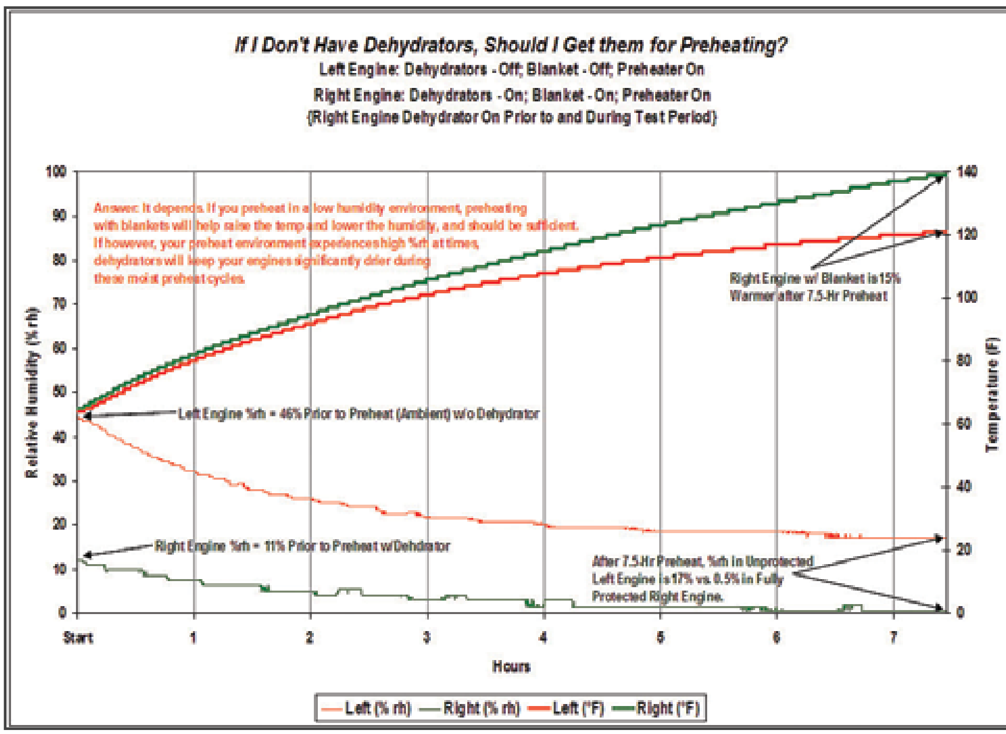

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of engine data logging. This test began more than 48-hours after the engines had last run. I left the dehydrator off on the left engine; while I ran the dehydrator continuously on the right engine since it was last run. I left the insulated cowl cover off the left engine, but installed it on the right engine. I then began a preheat cycle that would last a little more than 7-hours. Again, the difference in ending temperature was about 15% between the engine with, versus the engine without the insulated cowl cover. The relative humidity inside the engine without the dehydrator began at an ambient 46% at the beginning of the test. The engine that had been using the dehydrator for a couple of days was at 11% relative humidity at the beginning of the test. At the end of the preheat cycle, the engine without the dehydrator was at 17% relative humidity, and the engine with the dehydrator was at 0.5% relative humidity. Again, both numbers indicate it was very dry inside the engines at the end of the preheat cycle. However, it's not difficult to interpolate that if instead of the non-dehydrated engine beginning the preheat cycle at 46%, it had been something like 90%, at the end of the preheat cycle the relative humidity inside the engine could remain dangerously elevated, subjecting internal parts to the potential for rust and corrosion. So to get back to the question at hand, should you get a dehydrator to reduce the potential for moisture inside your engine when preheating, the only accurate answer is: "It depends." If you keep your airplane in an environment that is consistently dry, preheating will reduce the moisture inside the engine and your risk of rust or corrosion during the preheat cycle is quite low. If however, you are like me and you keep your airplane in a dry, temperature controlled hanger, but still have times when the relative humidity in the hangar climbs to more than 70%, an engine dehydrator might be something you would wish to consider. (See the graph on page 12).

Living in Chicago, we experience some of the most extreme temperature swings in the country. For example, a few weeks ago, we had 18-days in a row where the temperature never exceeded 50˚F. Nighttime lows were in the low 30's. The temperature in my hangar was holding at about 47˚F with a relative humidity of 32%. But then all at once, we had a day where the temperature soared to 88˚F under oppressive humidity. The cold hangar floor began to condense water out of the sudden damp warm air, and a very thin layer of water covered the hangar floor. This is not at all unusual for my hangar, nor is it unusual for all the hangars in the Chicago area several times a year. The only thing I can do is wait for the temperature of the cold floor to rise and the moisture to evaporate. Along the way, the relative humidity inside the hangar soars to more than 90%. It doesn't do this for more than a dozen days out of the year, but it does describe the worst case scenario for my airplane in my hangar.

In part, this is why I decided to get engine dehydrators for my 310 back in 2006. If I was flying my airplane every day, or every few days, I would assume that the internal engine parts are mostly covered with residual oil and are therefore protected from these periods of high humidity in my hanger. But since this isn't the case, I'm relying on the dehydrators to protect my engines from condensation and the resulting rust and corrosion that occurs from condensation. With the data loggers at the ready, I set out to perform the fourth test to answer the question, **"Will engine dehydrators reduce moisture in my engines between trips?"**

In this test, I installed the data loggers within minutes of engine shutdown after a flight that exceeded one hour. I used a dehydrator on the right engine, and did not connect a dehydrator on the left engine. Unsurprisingly, what I found was that after shutdown of my air cooled engines, the temperature begins to rise. As it does, relative humidity begins to fall in both engines. Within about 20-minutes of engine shutdown, the temperature in both engines reverses and begins to fall. As it does, the relative humidity in the engine that has the dehydrator continues to fall. However, the relative humidity in the engine that doesn't have the dehydrator begins to rapidly rise. After approximately 18-hours since engine shutdown, the engine temperature stabilizes as the engine reaches ambient temperature. However, (see the graph below) the relative humidity in the engine without the dehydrator remains elevated at 81% after 24-hours, while the engine with the dehydrator recorded a relative humidity of just 11%.

As private pilots, we are all taught that at a temperature-dew point spread of 3˚F, fog will begin to form. In the

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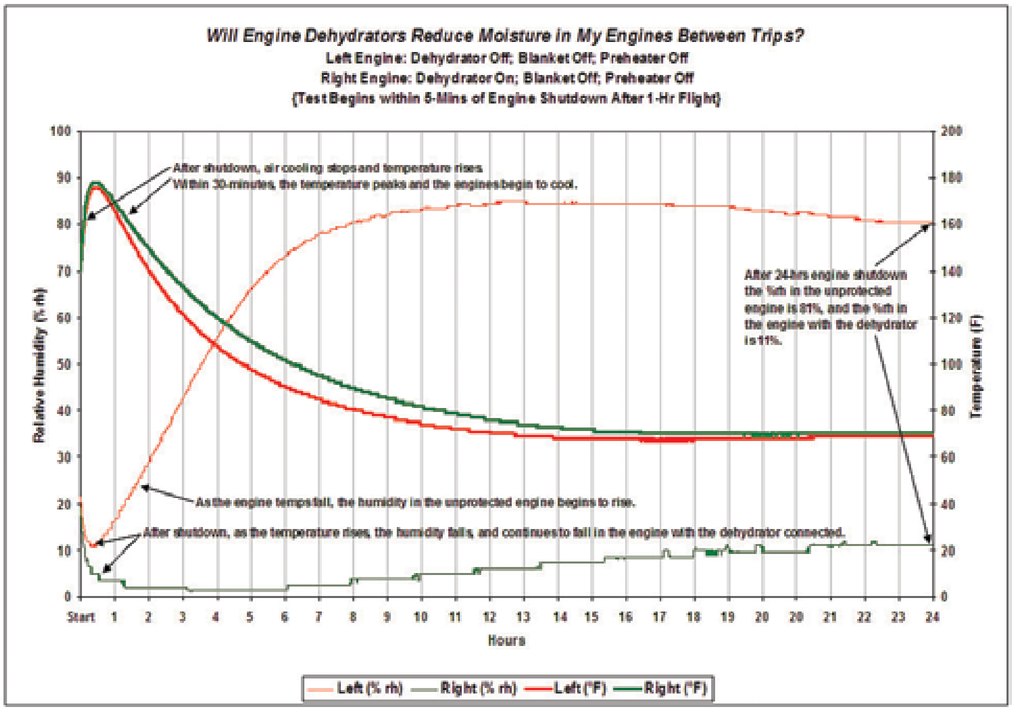

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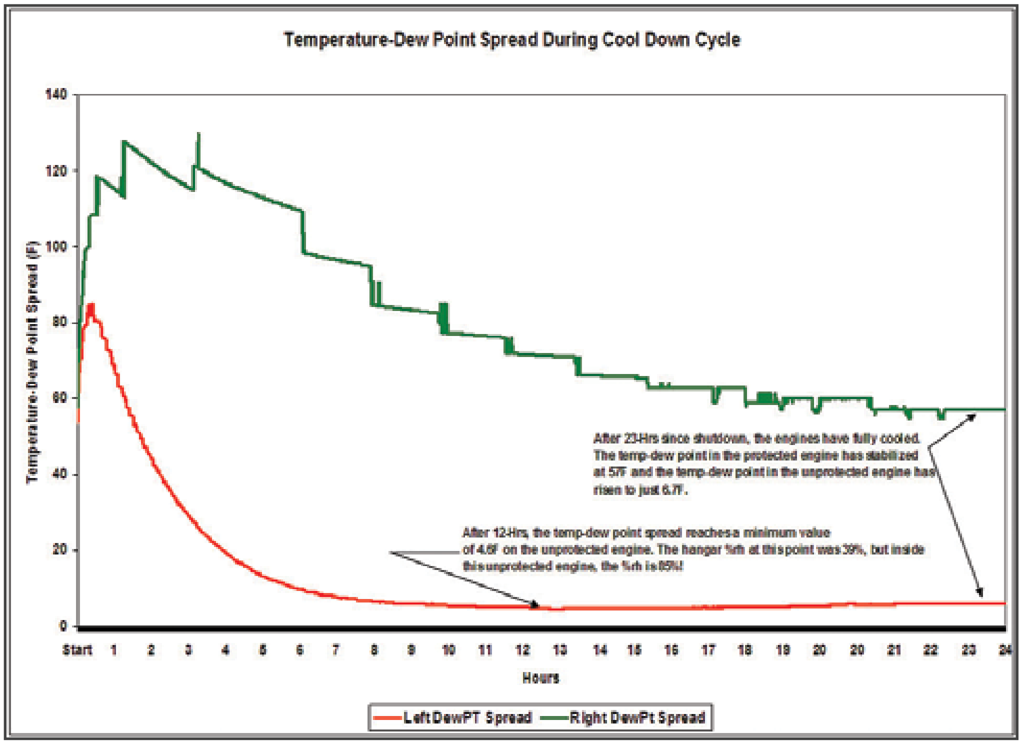
next graph (right), I've plotted the temperature-dew point spread during the engine cool-down cycle. At engine shutdown, the temperature-dew point spread for both engines is a very safe and comfortable 55˚F. But as the engines cool, temperature-dew point spread in the engine without the dehydrator begins to plunge; and 12-hours after shutdown reaches a very damp and nearly saturated level of just 4.6˚F. At the same 12-hour mark, the engine with the dehydrator records a temperature-dew point spread of 74˚F. A full 24-hours after engine shutdown, the temperature-dew point spread in the engine without the dehydrator is just 6.7˚F, while the temperature-dew point spread in the engine with the dehydrator remains at a very dry 57˚F.



While this data was compelling for me, suggesting the effort of using the engine dehydrators all these years has been a worthy investment, I was still not fully convinced of their value. It is clear to me that the engine dehydrators are not only helping to keep my engines dry during preheat cycles, but they are significantly reducing moisture inside my engines after engine shutdown and between flights.

However, I continued to wonder how much value they add over time. Certainly a case can be made that after engine shutdown, and for some period in the future, internal engine parts are coated in oil, therefore making the concern over internal relative humidity irrelevant. While I find this argument to be compelling, I know it is not consistent. There have been a few times since I've owned my airplane that it has sat for up to a month without flying, and without dehydrators (prior to 2006). The oil analyses after these periods confirmed that long periods of inactivity led to rust on the internal engine components. This, I find to be an argument without dispute.

What remains in question is how long can my engines sit idle without dehydrators by which the residual oil will protect the internal components, and would dehydrators prolong this period? I seek out the answer to this question in Part III of this article, next month.

IN SEARCH OF OPTIMAL PREHEATING - PART 3

by Ken Sutton, TTCF Member

Last month in Part II of this series, I attempted to quantify the value of engine dehydrators for preserving internal engine components between flights. While I demonstrated that the use of engine dehydrators significantly reduced the relative humidity and dew point in my engines between flights, what about the oil that coats the engine after shutdown? Won't that oil protect my engine parts, making the dehydrators unnecessary? Once we shut down our engines, internal engine components remain coated in oil which provides a barrier to the high humidity conditions that exist after shutdown. But how long will this coating of oil protect our engines before rust will begin to form on the vulnerable camshaft, lifters, starter adapter and other critical components? It's been my observation that the iron component of my oil analysis is directly proportional to the time my airplane has been idle between oil changes. It is a fact that rust begins to form on critical engine components over time. How long can our engines sit between flights (with and without engine dehydrators) before rust and corrosion begin to form?

There have been a myriad of tests performed on engine oils and additives, all designed to demonstrate the value of one product over another. In my testing , I was primarily focused on quantifying the value of engine dehydrators.

The Test

I began my testing by building two humidity chambers. The first chamber was fed exclusively by one of my Aircraft Component Inc.'s Black Max engine dehydrators that I've been using on my C-310's engines for the past five years. The relative humidity in this chamber then becomes a function of the Black Max's dehydrating capability. Over the trial period, the relative humidity in this low humidity chamber was measured at between 18-28 percent.

The second humidity chamber used a high-flow humidifier that produced a measured range of relative humidity from 85-93 percent.

The next step was to simulate a normal flight. After a discussion with my mechanic about the engine components most vulnerable to rust and corrosion, I decided to use actual valve lifters that I had replaced in my engine two years ago. These lifters had been preserved in an airtight bag since they had been removed. They showed wear, but no signs of rust or corrosion. To simulate a normal flight, I procured three small deep fryers. In one fryer I used Phillips XC; in the second fryer I used Phillips XC plus the oil additive CamGuard, properly proportioned to one quart of engine oil; and in the third, I used Exxon Elite. I then turned on the fryers and raised the temperature of the oil to 190˚F. I suspended two lifters in each fryer of oil and "cooked" them for exactly one hour. Simultaneously, I suspended a pair of dry lifters in an oven preheated to exactly 190˚F, and "baked" those lifters for exactly one hour. Once the baking and cooking time was complete, I placed one lifter from each mixture into each humidity chamber.

Low humidity chamber driven by my Black Max dehydrator.

Above: The "fryers" used for "cooking" the lifters. The oil was heated to 190 deg. F. Left: Lifters suspended in the oil for one hour.

Thereafter, I monitored the lifters twice a day, and used the data loggers I used in Part II of this series to monitor conditions inside the chambers to ensure they were providing a consistent environment for the test.

Oven used to "bake" the dry lifters.

According to testing done by the makers of CamGuard, I expected the "dry" lifter in the high humidity chamber to begin rusting after five days. In addition, their test results using a similar methodology to my high humidity chamber suggested that the lifter cooked in oil with their additive would begin to rust in 21 days. I had no idea what to expect with the lifters in the low humidity chamber that was being controlled by the engine dehydrator.

Results

After just four days in the high humidity chamber, the "dry" or "No Oil" lifter began to rust. After five days in the high humidity chamber, the lifter cooked in Phillips XC began to rust. The lifter cooked in Phillips XC plus CamGuard made it to 19-days in the high humidity chamber before rust began to appear, and the lifter cooked in Exxon Elite

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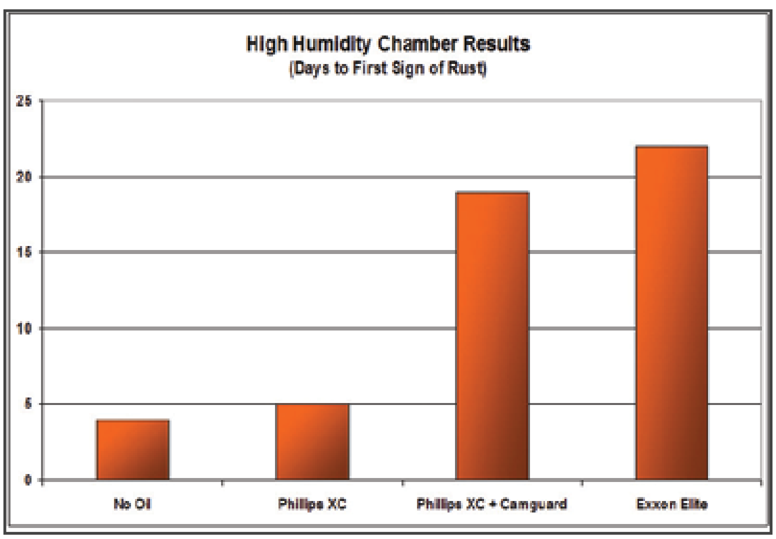
made it 22-days in the high humidity chamber before rust began to appear. After 24-days, I terminated the high humidity chamber test. During these 24-days, I monitored the lifters in the

The high humidity chamber used for testing the lifters.

low humidity chamber (the chamber controlled by the engine dehydrator), and rust never appeared on any of the lifters in the low humidity environment.

I documented the following results:

After 24-days in the high humidity chamber, the lifter baked in the oven with no oil coating had heavy rust and pitting on all surfaces. The other lifter



baked with no oil but alternatively placed in the low humidity chamber had no sign of rust. *(See picture #1 to the right.)*

After 24-days in the high humidity chamber, the lifter cooked in Phillips XC engine oil had significant rust and pitting on most of its surfaces. The top quarter of the lifter was much worse than the bottom as clearly, the oil drains off the lifter from top to bottom over time. The other lifter cooked in Phillips XC, but alternatively placed in the low humidity chamber had no sign of rust. *(See picture #2 at right.)*

After 24-days in the high humidity chamber, the lifter cooked in Phillips XC engine oil plus CamGuard anti-corrosion additive had rust on the top third of the surface and some minor signs of rust on the lower body. The other lifter cooked in Phillips XC + CamGuard, but alternatively placed in the low humidity chamber, had no sign of rust. *(See picture #3 at right.)*

After 24-days in the high humidity chamber, the lifter cooked in Exxon Elite engine oil had small patches of rust to the top third of the lifter body, only. The other lifter cooked in Exxon Elite, but alternatively placed in the low humidity chamber showed no sign of rust. *(See picture #4 on page 13.)*

After 24-days, none of the lifters in the low humidity chamber showed any sign of rust or corrosion. In fact, I let these lifters remain in the low humidity chamber controlled by the engine dehydrator, and after 31-days, I terminated the test with absolutely no sign of rust or corrosion! It appears that it would take a very long time, if ever, for rust to get started in this low humidity environment created by the engine dehydrator.

From these tests, I've concluded that it is certainly important to use an engine oil with an anti-corrosion additive like Exxon Elite or Aeroshell 100 Plus- or add an anti-corrosion additive like CamGuard. However, the bigger takeaway was the fact that using the engine dehydrator protected the lifters from rust and corrosion well beyond the point where lifters exposed to a high humidity environment, like inside our engines after shutdown, began rusting. Do the dehydrators work to completely eliminate rust and corrosion from inside our engines? Most likely there are cavities and chambers that the dehydrator cannot reach to push a steady flow of exceptionally dry air. Yet, by using dehydrators, I move closer to the optimum environment for protecting my engines from premature wear. Of course, another option would be to simply fly my airplane at least once every four to five days. However, if you're like me, no matter how much you might wish it so, this is simply not a

Picture #1: No oil treatment.

Picture #2: Lifters cooked in Phillips XC.

Picture #3: Lifters cooked in Phillips XC plus CamGuard.

Picture #4: Lifters cooked in Exxon Elite.

viable option.

Summary:

So what have I learned from all of my efforts that will help me better manage the engine health of my C-310? Going forward I plan to:

- Preheat the engines before every flight in an attempt to get their temperature as close as possible to normal operating temperature. The GSM Auto cellular switch goes a long way to providing convenient and timely control to the engine preheating process.
- Use engine dehydrators when preheating to reduce the relative humidity and lower the dew point inside the engines.
- Use insulated engine cowl covers to increase effectiveness of preheating, and to more uniformly preheat all the engine components.
- Within 30-minutes of engine shutdown, begin using engine dehydrators to rapidly reduce the relative humidity inside the engines. Continue to run the dehydrators on the engines until the next time the engines are ready to be started. This will maintain a very low relative humidity environment inside the engines, protecting them from rust and corrosion even after the oil coating on those components has dripped back into the sump.
- Use an engine oil that contains an anti-corrosion additive, or use an anti-corrosion additive in the engine oil.

I hope the data I generated with these tests will help other Twin Cessna pilots and owners get longer life out of their engines.

FROM THE EDITOR

(continued from page 5)

I've read all the speculation about why this is the case - cost, time constraints, risk, alternative activities, etc. All I can say is that I've experienced a lot that life can offer and nothing, outside of family and friends, has delivered the rewards that aviation has. I recently had a flight that included icing, deviations for thunderstorms, turbulence and an ILS to near minimums. The feeling of satisfaction I had when I landed bordered on elation. What a thrill it was. Not to mention the flight had allowed me to viist a place I never could have otherwise and in a timeframe not possible by any other means. If only more people knew. Meanwhile, I'll just enjoy the quiet skies, spacious FBO ramps and marvel at my good fortune.

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IN THIS ISSUE

414 Canadian Fishing Adventure: I first met Doug Thompson at this year's Defiance seminar. He has probably the nicest tip-tanked 414 I've ever seen. He describes it in this article but you really have to lay eyes on it to appreciate it. This story is about how he used his airplane to fly himself and his friends across the Canadian Rockies to a remote fishing lodge in British Columbia. I always enjoy stories about people using

(continued on page 27)