March 16, 2018

Lancair Owners and Builders Organization Factual Report in the case of:

NTSB Identification: CEN17LA009. Accident occurred Saturday, October 01, 2016 near Iola, Kansas.

Narrative

On Saturday, October 1, 2016 a Lancair Evolution FAA registration number N38DM lost power in a westerly climb after departure from the Iola, Kansas, Allen County airport (K88). This flight was the second leg of a cross country flight from Raleigh Durham, North Carolina (KRDU) to Ogden, Utah (KOGD). The purpose of the Iola, KS stop was to refuel the aircraft. While passing 11,383 feet MSL at 1629:22 the engine began losing torque approximately 14.5 nautical miles west of the departure airport. At 1629:40 the master caution on the MVP 50 activated noting zero torque, declining oil pressure and ITT. The aircraft was passing 11,956 feet in a climb. The pilot notified ATC and commanded a turn on the autopilot back to the airport, but landed on a gravel road approximately six nautical miles west of the airport.

Aircraft

1. Examination of the subject aircraft was conducted on November 29- 30, 2016 at St. Peters Recovery and Storage, Wright City, Missouri, 63390. The inspection revealed the following:

2. The 2013 Lancair Evolution serial number Evo-0047 was registered as N38DM to Aero Smart Solutions, Inc. The aircraft was a four-passenger experimental amateur-built airplane assembled from a kit manufactured by Lancair International, Inc. of Redmond, Oregon. The airframe was made of carbon fiber composite materials. The aircraft was powered by a Pratt & Whitney PT6 A-42 engine. The Hobbs meter recorded 454.5 hours time in service.

3. The aircraft suffered major contact damage from multiple tree strikes.

4. The fuselage maintained occupiable space from the firewall to the empennage. All four seats remained affixed to their respective floor mounts. The right copilot window shattered near the edge where it is bonded to the fuselage. The left hand pilot carved wooden control stick was broken at its base from the flight control rod. The front seat lap belts and single strap retractable shoulder harnesses remained attached to their respective fittings.

5. The aircraft wings suffered severe contact damage. The left wing was severed nine feet outboard of the inboard rib. The left aileron and flaps were removed by impact. Left aileron flight control tubes were evident on the wing.

6. The right wing was severed just outboard of the fuel cap. The upper and lower composite wing skins between forward and aft spars were absent exposing the fuel bay.

7. The wing fuel tank single point drains were attached to their respective wing components. Neither wing contained any fuel. The two main fuel tanks contain up to 172 gallons of fuel (168 gallons useable).

8. The left and right flaps were detached from the wings. The three-position flap selector knob was found in the takeoff/approach position. The flap electric flap actuator rods were found extended 2 and ¼ inches from the housing. These measurements are consistent with the aircraft data.

9. The main landing gear were found detached from the wing attach fittings. The nose landing gear was not found with the wreckage.

10. The engine mounts were found detached from the firewall with evidence of the engine mount bolts being pulled through the composite firewall.

11. The MT propeller was found in or near the feathered positon with all four blades broken from the hub.

12. The power lever was found near idle, the prop control near feather and the condition lever was found near midrange. The aircraft was not equipped with a manual override (MOR) or standby power lever.

13. The landing gear handle was in the “down” position. The left main landing gear tire had mud around its circumference and mud was spattered on the MLG strut consistent with being down during the off airport landing.

14. The BAT 1 and BAT 2 switches were found “on”. The GEN switch was “on”. The ALT switch was “off”. The DOOR SEAL switch was “on”, the IGNITOR switch was “off”, the PARTICLE SEPARATOR switch was “off”, the FUEL PUMP switch was “off”. The spring loaded START switch was “off”. The PITOT HEAT and BLEED AIR switches were “off”. The DUMP switch was “off”. The AIRFRAME DEICE, PROP INLET HEAT and ICE LIGHT switches were “off”. Many circuit breakers in the center pedestal were found popped.

15. The empennage was severed between the air conditioning intake on the left side and the air conditioning exhaust on the right side just forward of the vertical stabilizer and horizontal stabilizer with severe contact marks on the right side of the empennage. The horizontal stabilizer was found in one piece with the left elevator attached. The rudder was detached from the vertical stabilizer.

16. The aircraft was equipped with a 30 gallon auxiliary fuel tank located in the baggage compartment stowage well. The fuel tank was not compromised. The fuel tank was borescoped and contained no fuel. The auxiliary fuel tank was plumbed with an aluminum line to the right hand wing fuel tank. The auxiliary tank feed line had an electric transfer pump and manual fuel shut off valve located under the rear seat passenger floorboard. The fuel shut off valve was installed to facilitate maintenance and was found in the open position. The auxiliary fuel tank was not equipped with a drain to check fuel quality.

17. The Electronics International, Inc. EDC-33T sn 144951 was removed from behind the instrument panel to facilitate download of the MVP 50 at the NTSB lab.

18. Data from the Garmin G900X SD card and the MVP 50 were recovered from the units and a separate NTSB lab report was authored. This data was used by this author in a flight test of the aircraft glide performance discussed later in this report.

19. The firewall mounted electric fuel boost pump was not located with the wreckage.

20. The firewall mounted Parker 1J18-4 sn 2BH11 fuel filter/ gascolator was found separate from the airframe. It contained a small amount of liquid. The filter was opened and disassembled revealing the four filtration wafers. Each wafer had a whitish in color contaminant adhering to the wafer. The liquids were drained into glass jars and stored by this author pending further disposition.

21. The fuel control was removed from the engine and its fuel filter was opened revealing more liquid contaminants. The liquids were drained into glass jars and stored by this author pending further disposition.

22. On June 17, 2017, inspectors from the St. Louis FSDO met at my office and performed a test for water using a Kolor Kut water finding paste test on the subject samples from the fuel control and fuel filter. All samples tested positive for water contamination.

Pilot

1. The accident pilot possessed a private pilot certificate, (single engine land) and an instrument airplane rating. He also possessed a third class medical dated July 2013.

2. The subject pilot posted an account of the accident on lancairtalk.net (a public website) on October 18, 2016. He wrote:

   “here is my official statement to the FAA:

   On October 1st, 2016, my fiancée Beth and I were travelling home from Raleigh, North Carolina (KRDU), to Ogden, Utah (KOGD). We made a fuel stop at Allen County airport in Iola, Kansas (K88). The first leg of the trip was seamless.

   When we landing at K88, I approached the fuel pump as I would have normally, putting my credit card in, getting it authorized and then turning on the pump and filling the tanks. This time was different. Once I authorized my credit card, I hit the button to turn on the pump (opposed to the normal lever). Thinking I had done everything correct, I went to fill up the tanks, but only a trickle of fuel came out. I repeated this process 5 times. Each time holding the button in a little longer because I heard another pump turn on about 100 feet away, but each time I took my finger off the button, the other pump stopped.

I called the airport manager and asked if there was something I was doing incorrectly. He told me he could drive down and check it out if I was willing to wait 20 minutes. I agreed. When he got to the airport, he made some adjustments and finally got the pump playing. I asked him what was wrong with it and he said he had not sold jet fuel in a week and there was air in the lines that he had to bleed out. He also mentioned something about filters and the company that provides the fuels, but I'm not sure on his exact words.

We filled all three tanks of the plane, the right tank first, then the left, then the aux tank. The total fuel taken was around 147 gallons. This gave us about 193 gallons on startup. I taxied up to the runway, did the normal run-up procedures and we took off. Everything was normal on takeoff. I took off on the left tank.

As we climbed out I called ATC to pick up the IFR flight plan I created using ForeFlight app. ATC cleared me to my destination and gave me a climbing attitude. At some point I switched to the right fuel tank. Around 11,000 feet I heard the pitch of the engine drastically change. Immediately following that was an alarm from the engine monitoring instrument (MVP50) which showed me the oil pressure had gone to 0. There were no signs or indications, no burbling or funny things happening with the instruments, the engine had just lost full power. The fuel pressure as indicated by the MVP50 was still strong, although it only measures the electric and mechanical fuel pumps, not the main engine pump. The ITT was also not something I took note of, which means it did not skyrocket into the red because I would have noticed that.

I pushed the nose over, switched fuel tanks from the right to the left. I turned on the igniters and held the start button down. Nothing happened at all. I called ATC and declared an emergency. I did a direct to on the Garmin back to the airport we took off from. The ATC controller also directed me on a vector back to the airport. I feathered the prop and it completely stopped. I also noticed a billow of smoke out of the right exhaust pipe. By the time all this happened we were down to about 6500 feet and 8-9 miles to the airport. When we got to 6 miles from the airport I decided we were not going to make it back to the airport based on our rate of descent and the distance to the airport. I did put the gear down at some point during this time.

I saw an open dirt road and decided we were going to go for that road. We came in a little faster than I expected and the open road became tree lined and we clipped a tree, spun around and slid down the road to a halt.

The cabin was fully in tact with the exception of the co-pilot window which got shattered at some point between the tree and the ground. I opened the door and got out.

Beth had a few injuries which we were not sure of the severity at the time. I scrambled to find my phone and call 911. Some locals showed up and helped us out.

All this being said, a few things were pointed out in this forum I can address for you:

The NTSB is not doing an official investigation until early November. Our best conclusion is that it was fuel contamination, possibly just water. This was the second leg of a trip, the plane operated within norms the first leg. The takeoff was normal. It was a very strange occurrence, with no indications even seconds before it happened. In retrospect (sic), the airport fuel situation was suspect.

First lesson I learned coming out of this is a simulated engine out is not the same as a real engine out, not even close. Maybe if you have military training it's different, but for me, I spent the first few minutes saying "What the F#$% just happened, is this real? Ok...what do I need to do to make this right". I was not scared, I was quite calm and collected, but I was a little nervous and that means things were not flowing like I would expect them to.

I changed tanks, I also attempted a restart. Did I do it 100% right?... I have no idea...this was my first time trying to restart a dead engine in the air.

If you've ever been encumbered by Aviate - Navigate - Communicate...take that feeling to a new level... There's a lot going on and limited time.

I did feather the prop and it completely stopped, it was definitely not the first thing I did.

Being that I was nervous I could not recall whether 1 notch of flaps was better for glide or not, I played with the flaps...I probably created more drag than necessary. [author's note: the MVP 50 downloaded data showed the pilot extended the flaps to the takeoff position of 16 degrees at 1632:33 at 4800 feet GPS indicated altitude]

I decided we were not going to make the airport, given our descent rate and the distance. I had a choice between fields and roads. I chose a road that had an empty section. My #1 concern was not to hurt anyone outside the plane. My #2 concern was to put us on the ground safely and not flip us. The empty section of road was smaller than I anticipated and we ended up clipping a tree with the wing.

I am saddened that we lost the plane, but after second guessing myself for over a week, I decided I could have done everything by the book and we could have both perished. The outcome was good. I don't believe this was in any way an issue with the plane, nor do I believe I could have prevented the engine out.

I am very pleased with the strength and resilience of the airplane. Obviously played a major role in saving us. I also have a new found appreciation for BRS parachutes in planes, what if it was night, or over mountains or water?

My best advice coming out of this is that practicing engine outs once a year is not enough. Even twice a year would have been much better. I was almost 1 year from recurrent training which I was signed up for. I fly the plane a lot. I put on 95 hours in the last 90 days. These situations you don't think about because of the bulletproof stats of the engine. I hear also from a lot of cocky pilots that they can handle whatever is thrown at them with engine issues...maybe it's true, but maybe it's not. Do yourself a favor and be more on top emergency situations.
-Jeff"

3. The subject pilot was reported by the CFI to have transitioned from a Cirrus. The Cirrus aircraft does not have a propeller lever nor does it have retractable landing gear. The FAA Aviation Instructors Handbook describes negative transference of learning, "Many aspects of teaching profit by this type of transfer, perhaps explaining why students of apparently equal ability have differing success in certain areas. Negative transfer may hinder the learning of some; positive transfer may help others. This points to a need to know a student's past experience and what has already been learned." Aviation Instructors Handbook p. 2-36.

4. A telephonic interview was conducted with the accident pilot's certificated flight instructor (CFI), Mr. J.C. Peterson with Elite Pilot Services, of Redmond Oregon. Mr. Peterson holds a CFI and A&P certificate. Mr. Peterson stated that he gave the accident pilot his initial transition training.

5. Mr. Peterson stated the aircraft was built at RDD in Redmond, Oregon. RDD did the Phase I flight testing. Mr. Peterson stated that during training with Mr. Siegel the aircraft had two engine rollbacks where the engine was unresponsive with power lever application. In those two cases, Mr. Peterson made a power off landing to the airport. The aircraft then went to Flightcraft in Portland for engine repairs that took quite a while.

6. Mr. Peterson stated that after the engine was repaired by Flightcraft, Mr. Siegel came back to Redmond to complete his training. He finished that training in three days on April 14, 2015 as documented by a training certificate. The training included checklist procedures for the subject aircraft including engine out procedures.

7. Mr. Peterson noted that during training, Mr. Siegel did not sump the fuel before every flight. Mr. Peterson said that he told students that the engine can tolerate some water. Pratt & Whitney Service Bulletin 1244R21 Turboprop Engine Fuels and Additives - Requirements And Approved Listing states, “Fuel shall consist solely of hydrocarbon compounds except as otherwise specified herein. It shall be free from water, sediment, and suspended matter, and shall be suitable for use in aircraft turbine engines.”

8. Mr. Peterson instructed the accident pilot on engine out procedures both occurring in the pattern, close to an airport and 5-10 miles from an airport. Mr. Peterson demonstrated and the accident pilot practiced feathering and unfeathering the propeller. Engine out demonstrations were performed with the power set to zero thrust to simulate a feathered propeller. The effects of flaps and gear were also demonstrated and practiced to show how they affected glide performance.

9. Mr. Peterson stated that the procedure for loss of power inflight was:
    - Power lever- idle
    - Propeller – feather
    - Navigation – select “nearest” on G900X and turn to that heading
    - Attain best glide speed of 110 KIAS—pitch to maintain altitude while airspeed decreases to 110 KIAS
    - Use autopilot as necessary to reduce pilot workload. (autopilot will maintain airspeed selected and GPSS steering will fly direct to GPS waypoint)
    - If arriving over airport or chosen landing site, spiral down and enter high key and low key for energy management engine out landing.

10. Pilot notes found in the cockpit show a diagram of a spiral engine out landing over an airfield with a 3000 foot AGL high key altitude and 1600 foot AGL low key altitude depicted.

11. Mr. Peterson stated that Mr. Siegel completed a refresher training course in October 18, 2015 at the annual Evolution/ EPS training weekend in Charleston, SC. Mr. Siegel was scheduled to attend the October 2016 training event when the accident occurred.

12. Mr. Peterson indicated the procedure for fuel management was to start the aircraft on the left fuel tank and assure good fuel flow from the left tank then switch to the right fuel tank before takeoff. Takeoff and climb were to be performed on the right tank then when 15 gallons has been used from the right tank, the procedure was to turn on the auxiliary tank transfer pump and pump fuel from the auxiliary tank to the right tank. Fuel transferred will slowly outpace fuel burned but will not overflow the right tank by the

time all fuel in the auxiliary tank is transferred. The auxiliary tank transfer rocker switch was found “off”.

13. The fuel selector is a three position fuel selector and is located on the forward face of shear web between the pilot and copilot seats. The positions are left, right and off. The off position can only be selected by pulling a spring loaded pin then moving the valve to off. The fuel selector valve was found in the left fuel tank position.

Checklists

1. The Evolution Pilot’s Operating Handbook (POH) was found in the baggage compartment. No quick reference checklists were found in the cabin.

2. The FAA Risk Management Handbook (FAA-H-8083-2) addresses the importance of checklist usage to general aviation (GA) pilots by stating,

> Checklists are essential flight deck internal resources. They are used to verify that aircraft instruments and systems are checked, set, and operating properly. They also ensure the proper procedures are performed if there is a system malfunction or inflight emergency. Students reluctant to use checklists can be reminded that pilots at all levels of experience refer to checklists, and that the more advanced the aircraft is, the more crucial checklists become. In addition, the pilot’s operating handbook (POH) is required to be carried on board the aircraft and is essential for accurate flight planning and resolving inflight equipment malfunctions. However, the ability to manage workload is the most valuable resource a pilot has. (FAA-H-8083-2 Risk Management Handbook; 2009; pg. 6-7)

3. The FAA published research titled, *Human Performance Considerations in the Use and Design of Aircraft Checklists*, January 1995. The report was intended to assist operators in designing, developing, and using aircraft checklists, as well as “increase awareness of the impact of human performance as it relates to the use of checklists.” (pg. 1) The literature addressed an NTSB Safety Study of 37 major accidents of U.S. air carriers between 1978 and 1990. The NTSB study found that, in 60% of the accidents analyzed, procedural errors such as “uninitiated or inadequately performed checklists” were classified as causal to the accidents. Further review by the NTSB revealed “that during the period 1983 to 1993, approximately 279 aircraft accidents occurred where the checklist was not used or followed during CFR Part 91, 121, and 135 operations.” (pg. 3). In addition to the NTSB analysis, the literature discussed a review of “approximately 300 randomly selected ASRS ‘checklist’ related reports”. The areas in which checklist errors were identified were as follows: “[c]rew failed to use the checklist. Crew overlooked item(s) on the checklist. Crew failed to verify settings visually. Checklist flow was interrupted by outside sources.” (pg. 8). Of these errors, the first three were also noted as causal or contributing factors in several of the major

accidents analyzed by the NTSB study. In all of the incidents referenced in the ASRS analysis, each pilot was "impacted by one or more human factor(s) and failed to recognize deterioration in personal performance." (pg. 12).

4. The FAA research also discussed the need for checklists. The literature stated the following in regards to the importance of checklists:

> Checklists have been the foundation of pilot standardization and cockpit safety for years. Such procedures, when applied in a disciplined and standard manner, are intended to support human performance by providing a firm foundation for the task, one which the pilot and crew can depend on during a "low" in performance. The checklist is an aid to the memory and helps to ensure that critical items necessary for the safe operation of aircraft are not overlooked or forgotten.
>
> However, checklists are of no value if the pilot is not committed to its use. Without discipline and dedication to using the checklist at the appropriate times, the odds are on the side of error. Crewmembers who fail to take the checklist seriously become complacent and the only thing they can rely on is memory and the fact that not all errors resulting from poor checklist discipline result in accidents.
>
> Pilots who develop strong cockpit discipline, foster team work, and make a concerted effort to comply with tried and tested operational procedures are seldom surprised by an occurrence that was not anticipated. From a human factors point of view, the checklist is an important interface between the human and the aircraft. In addition to assisting the crew to configure and operate the aircraft properly, the checklist provides a method and a sequence for verifying the overall system operation. **It is an important aid in helping the crew to remain focused to the task at hand by eliminating guesswork that often accompanies periods when crew attention is divided especially during periods of stress or fatigue.** The checklist is an important and necessary backup for the pilot and crew.
>
> A positive attitude must be promoted toward the use of checklists and each crewmember should consider its importance. The procedures that are used on the flight deck today are the result of experience, research, and unfortunately, the findings of causal or contributing factors gathered from previous accidents or incidents. Many of the procedures used today were developed and implemented to avoid recurrence of undesirable events. (*Human Performance Considerations in the Use and Design of Aircraft Checklists*; January 1995; pg. 12-14)

5. Specifically the literature notes that checklists provide "a method and a sequence for verifying the overall system operation" (Human Performance Considerations in the Use and Design of Aircraft Checklists; January 1995; pg. 14). Checklists assist pilots in ensuring that the aircraft and its systems are configured correctly for each phase of flight, as well as verifying all systems are working properly.

6. The literature further provides the definition for an emergency, stating that, "[w]hen emergency is used to describe a procedure or checklist, it refers to a non- routine operation in which certain procedures or actions must be taken to protect the crew and the passengers, or the aircraft, from a serious hazard or a potential hazard." (Human Performance Considerations in the Use and Design of Aircraft Checklists; January 1995; pg. 5).

7. The FAA research also discussed the relationship between checklists and distractions/interruptions. According to the study, "[t]he general reference group identified sixty-one occurrences of failure to monitor and cross check flight deck activity, misuse or failure to use checklists, and missed or overlooked items on the checklist following distraction or interruption." (Human Performance Considerations in the Use and Design of Aircraft Checklists; January 1995; pg.11).

8. Ross discussed checklist usage in "Human Factors Issues of the Aircraft Checklist" and found in the Journal of Aviation/Aerospace Education and Research (JAAER) (Winter 2004), emphasizes how important checklists are, especially as aircraft become more complex and advanced, making it "impossible to operate…without checklists." (pg. 9). Specifically, as cited within the article, "Sumwalt (1991) reminds us that there are good checklist techniques and bad checklist techniques." (pg.9). Additionally, when analyzing accidents involving checklist misuse, it is evident that "when the checklist is not used in the proper manner…there can be serious consequences." (pg. 9). It is important to note that the "takeoff, approach, and landing phases…make up 27 percent of an average flight, but account for 76.3 percent of accidents (Degani and Wiener, 1990)." (pg. 9). The JAAER article categorizes checklist misuse into four categories: a crewmember's failure to perform the checklist, a crewmember omitting an item on the checklist, a crewmember's mistake in thinking a checklist item was performed when it was in fact not, and interruption during checklist performance that causes the crew to not complete the checklist (pg. 9). The article concluded, suggesting that in order to minimize checklist deviations, pilots should "regularly and methodologically use a standard checklist routine" and stated that many of the accidents could have been avoided if "more emphasis had been placed on checklist use during initial and recurrent training." (pg. 13).

9. The <u>Pilot's Handbook of Aeronautical Knowledge</u> (FAA-H-8083-25) discusses flight manuals and other documents pertinent to the safe operation of an aircraft. The handbook outlines various sections of an aircraft flight manual, including the normal procedures section. Within the normal procedures section a pilot would find a listing of several checklists. The checklists detailed in the normal procedures section include "preflight inspection, before starting procedures, starting engine, before taxiing, taxiing, before

takeoff, takeoff, climb, cruise," etc. (pg. 7-3). The normal procedures section of the flight manual also provides an amplified procedures area which provides more detail in regards to the various procedures. Specifically, in regards to the use of checklists, the handbook states, "[t]o avoid missing important steps, always use the appropriate checklists whenever they are available. Consistent adherence to approved checklists is a sign of a disciplined and competent pilot." (pg. 7-3).

10. The Pilot's Handbook of Aeronautical Knowledge (PHAK) (FAA-H-8083-25) also states:

> Checklists describing the recommended procedures and airspeeds for coping with various types of emergencies or critical situations are located in the Emergency Procedures section. Some of the emergencies covered include: engine failure, fires, and systems failures. The procedures for in-flight engine restarting and ditching may also be included.
>
> Manufacturers may first show an emergencies checklists in an abbreviated form with the order of items reflecting the sequence of action. Amplified checklists that provide additional information on the procedures follow the abbreviated checklist. To be prepared for emergency situations, memorize the immediate action items and after completion, refer to the appropriate checklist. (FAA-H-8083-25 Pilot's Handbook of Aeronautical Knowledge; 2003; pg. 7-3)

11. The FAA Airman Certification Standards and the Practical Test Standards emphasize proper checklist usage throughout the administration of pilot practice tests

Fuel Sumping and Fuel Quality Testing

1. The FAA Airplane Flying Handbook states, "Using the proper, approved grade of fuel is critical for safe, reliable engine operation. Without the proper fuel quantity, grade, and quality, the engine(s) will likely cease to operate. Therefore, it is imperative that the pilot visually verify that the airplane has the correct quantity for the intended flight plus adequate and legal reserves, as well as inspect that the fuel is of the proper grade and that the quality of the fuel is acceptable. The pilot should always ensure that the fuel caps have been securely replaced following each fueling… Checking for water and other sediment contamination is a key preflight item. Water tends to accumulate in fuel tanks from condensation, particularly in partially filled tanks. Because water is heavier than fuel, it tends to collect in the low points of the fuel system. Water can also be introduced into the fuel system from deteriorated gas cap seals exposed to rain or from the supplier's storage tanks and delivery vehicles. Sufficient fuel should be drained from the fuel strainer quick drain and from each fuel tank sump to check for fuel grade/color, water, dirt, and odor. If water is present, it is usually in bubble or bead-like droplets, different in color (usually clear, sometimes muddy yellow to brown with specks of

dirt), in the bottom of the sample jar. In extreme water contamination cases, consider the possibility that the entire fuel sample, particularly if a small sample was taken, is water. If water is found in the first fuel sample, continue sampling until no water and contamination appears. Significant and/or consistent water, sediment or contaminations are grounds for further investigation by qualified maintenance personnel. Each fuel tank sump should be drained during preflight and after refueling. The order of sumping the fuel system is often very important. Check the AFM/POH for specific procedures and order to be followed." Airplane Flying Handbook p.2-6 to2-7.

2. The Lancair Evolution POH addresses the importance of sumping fuel and checking fuel quality on preflight and after refueling. Fuel sumping is called for in the preflight inspection checklist as well as in other areas of the POH, shown below.

SAFE OPERATING AIRSPEEDS

NOTE

All airspeeds in this section are indicated airspeeds in Knots (KIAS) and assume zero instrument or installation error. You should make sure your system has been correctly calibrated and account for those errors as necessary.

Max Demonstrated X-WIND component	20
Rotate Speed (V_R) with flaps 24 deg.	65-80
Best Angle of Climb (V_X)	85
Best Rate of Climb (V_Y)	105
Cruise Climb	140-160
Stall Speed clean (V_S)	76
Stall Speed Landing config. (V_{SO})	61
Landing Gear Operating Speed (V_{LO})	150
Landing Gear Extended Speed (V_{LE})	165
Approach Flaps Extended	160
Full Flaps	140

PRE-FLIGHT INSPECTION

COCKPIT CHECK

Aircraft Status Log............................CHECKED
Required Forms/Certificates ....ON BOARD/CHECKED
All Electrical Switches ....OFF/NORMAL
Circuit Breakers ....CHECK IN
Gear Handle ....DOWN
Battery Master Switch.......................ON
Aircraft Battery ....CHECK 24 VOLTS MIN
Fuel Gauge ....CHECK QUANTITY, BALANCE & RESET
Fuel Selector ....FULLEST TANK
Oxygen Quantity ....CHECK
Trim Servos.......................................CHECK
Flaps ....DOWN
Pitot Heat Cover................................REMOVE/STOWED
Pitot Heat ....ON (10 SEC)

Pitot Tube ....VERIFY WARM AND CHECK CONDITION
Exterior Lights ....ON & CHECK
Pitot Heat ....OFF
Battery Switch....................................OFF
Propeller Heat ....ON FOR 30 SECONDS, CHECK BLADES FOR HEAT

LEFT FUSELAGE

Main Entry Door ....CLOSE AND CHECK EXTERNALLY
Step ....SECURE
Rear Window ....CHECK CONDITION
Upper and Lower Antennas ....CHECK CONDITION
Static Port...CLEAR
A/C Vent ....SCREEN CLEAR
Horizontal Stabilizer/Elevator ....UPPER/LOWER SURFACES, ATTACH POINTS, FREE
Elevator Trim Tab ....SECURE, ATTACH POINTS, FREE
Rudder..CONDITION, ATTACH POINTS, FREE

RIGHT FUSELAGE

Horizontal Stabilizer/Elevator ....UPPER/LOWER SURFACES, ATTACH POINTS, FREE
Baggage Door ....CLOSED & LOCKED
Static Port...CLEAR
Windows ....CHECK CONDITION

RIGHT WING

Right Main Gear Door ....CONDITION, ATTACH POINTS
Right Main Gear Mount.....................CHECK ATTACH POINTS, HYDRAULIC & BRAKE LINES/PADS, EXTENSION (4" MINIMUM)
Right Main Tire..................................CONDITION, INFLATION
Right Flap...ATTACH POINTS, MOVEMENT
Aileron Push Rod ....CHECK CONNECTION (INSIDE WING)
Right Aileron ....ATTACH POINTS, FREE
Nav / Strobe Lights ....CONDITION, SECURE

Fuel Tank Vent ....CLEAR
Right Fuel Tank Cap.........................VISUALLY CHECK
.... FUEL & SECURE
Leading Edge/Stall Strips ....CONDITION, SECURE
Underwing Panels ....SECURE
Fuel Sump Drain ....SAMPLE
Wing Root Fairing ....SECURE

NOSE

Cowling...SECURE
Propeller Hub/Blades.........................CONDITION, SECURE, LEAKAGE, FREE
Propeller Spinner ....SECURE
Exhaust Stacks ....CONDITION, COVERS REMOVED
Engine Intakes...................................CLEAR
Nose Gear Strut.................................CONDITION, EXTENSION (4" MINIMUM)
Nose Gear Tire..................................CONDITION, INFLATION
Landing Light....................................CONDITION
Oil Level ....CHECK
Oil Cap & Door.................................SECURE
Windshield ....CHECK CONDITION

LEFT WING

Wing Root Fairing ....SECURE
Fuel Sump Drain ....SAMPLE
Underwing Panels ....SECURE
Leading Edge/Stall Strips ....CONDITION, SECURE
Left Fuel Tank Cap ....VISUALLY CHECK FUEL AND SECURE
Pitot Tube..CONDITION, SECURE, WARM
Fuel Tank Vent ....CLEAR
Nav/Strobe Lights ....CONDITION, SECURE
Left Aileron.......................................ATTACH POINTS, FREE
Aileron Trim Tab ....SECURE, ATTACH POINT
Aileron Push Rod ....CHECK CONNECTION (INSIDE WING)
Left Flap..ATTACH POINTS, MOVEMENT
Left Main Tire...................................CONDITION, INFLATION

cannot be neglected. The repaired contour of any repair should be similar to the original contour to remain as close as possible to the same airfoil as before thus maintaining the same "lift" on each blade. In addition the repair must result in the nick being fully removed and the blade surface polished. Give your propeller care, respect its overhaul periods, and it will pull you through many hours of flight. If in doubt, have it inspected by a certified propeller repair facility.

FUEL SYSTEM

The fuel system feeds fuel to the engine through a fuel screen pickup, fuel selector, gascolator/fuel filter, electric boost pump, and finally a fuel control unit. The fuel tanks should be sumped at regular intervals.

CAUTION

After flight when parking and securing the aircraft ensure the fuel selector is either in the left or right tank position. If the selector is "in between" the fuel in the higher wing will drain to the lower wing causing a dangerous imbalance condition. Also, fuel may dump through the vent system onto the ramp until the higher wing is completely empty.

HYDRAULIC SYSTEM

A self-contained hydraulic system is used to operate the landing gear. The pump is electrically powered. When the "gear up" position is selected the pump is activated and 2000 psi is provided to the up side of the landing gear actuators raising the gear. This pressure is maintained although the electric pump is disabled by a limit pressure switch and the pressure holds the gear in its retracted position. Upon selecting the "down" position, 2000 psi is provided to the down side of the actuators and lowers the landing gear until it is down and locked.

As with any hydraulic system proper servicing is required. Use only MIL-L-5606 "red" hydraulic fluid.

The airframe will withstand the storage quite well under almost any circumstances since it is of high temperature materials however the upholstery, instruments and avionics will suffer from excessive heat and exposure to the sun so a cover is recommended. Elastomers such as tires also need to be protected from exposure to ultraviolet to limit their deterioration.

Fuel tanks should be filled or drained completely, the control surfaces locked, the aircraft electrically grounded, a pitot cover installed, the static port (or ports if installed on both sides) covered, the engine and cabin cooling air intake (NACA inlet) covered or plugged and the battery removed.

PREPARATION FOR SERVICE

Following storage, the aircraft preparations for flight should include the following:

- Remove all taped openings, plugs and control locks.
- Clean and thoroughly inspect the aircraft checking the gear, tires, controls pitot and static ports.
- Install a serviced battery.
- The fuel tanks should be checked for water accumulation and purged as required.
- Following a short but thorough engine ground check the aircraft should be flown for 30 minutes maximum and given a very thorough post flight inspection.

FUEL SERVICING

The fuel should be clean and water free. The firewall gascolator drain should be checked on preflight inspections for evidence of water, and the filter checked for solid foreign material. It is good practice to leave the tanks full to minimize the amount of combustible fuel/air vapor present in the tanks. This also helps minimize the amount of water vapor in the fuel system.

FUEL TANK CAPACITY

All fuel is carried in the wing's integral tanks. Fuel tank caps are located on the upper wing surface near the wing tips.

Fuel Capacity = 168 U. S. Gallons.

WARNING

When fueling, ensure that the aircraft is grounded at the nose gear tow bar bracket to eliminate static electrical discharges.

APPROVED FUELS

Refer to the latest revision of Pratt & Whitney Service Bulletin No. 1244 for approved fuels and additives.

Use of Fuel anti-icing additives (Prist) is approved.

OIL SYSTEM SERVICING

APPROVED OILS

Refer to the latest revision of Pratt & Whitney Service Bulletin No. 1001 for approved oils.

OIL LEVEL CHECK

To avoid overfilling the tank and consuming excess oil, an oil level check is recommended within 30 minutes after engine shutdown. The ideal interval is 15 to 30 minutes. If more than 30 minutes has passed, and the dipstick indicates that oil is needed, start the engine and run at ground-idle for five minutes, and recheck the oil level as follows:

1. Unlock the filler cap and dipstick from the filler neck on the accessory gear box and remove the filler cap.
2. Wipe the dipstick with a clean lint free cloth.

CAUTION

When the filler cap and dipstick/gauge assembly is installed and locked, no movement is allowed.

3. Install the cap/dipstick and lock.

RECOMMENDED SERVICING

Interval – Preflight

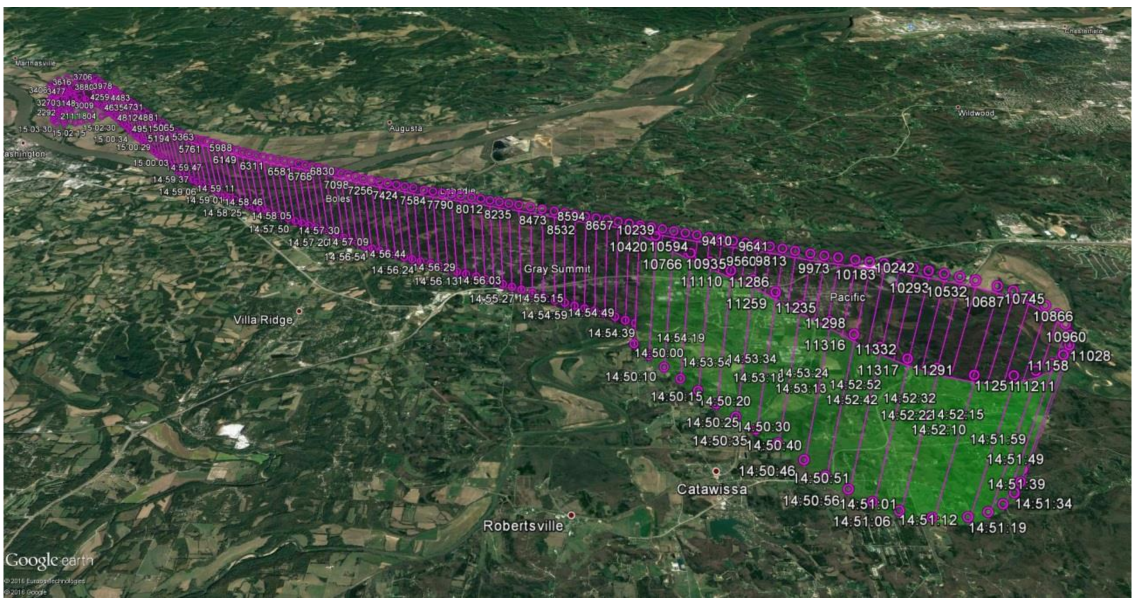
- [ ] Check & service engine oil
- [ ] Drain water trap
- [ ] Verify fuel quantity

Interval – First 25 Hours

- [ ] Service oil. Inspect for rub and wear inside cowling
- [ ] Inspect fuel lines for security
- [ ] Check bleed air lines for security
- [ ] Check battery fluid
- [ ] Check brake lines
- [ ] Check all gear doors (nose and main gears)
- [ ] Check control surface hinges and control rods and connections – if hinges show signs of corrosion or excessive wear replace the hinge.
- [ ] Jack the aircraft and retract gear/check gear door fit

Flight Tests

1. An exemplar Lancair Evolution was flown by this author to replicate the glide portion of the accident flight. The test demonstrated that if the aircraft was flown at best glide airspeed of 110 KIAS and with landing gear and flaps UP with the propeller feathered per the POH that the aircraft would arrive over the airport at approximately 3500’ AGL achieving a glide ratio of approximately 18:1. The flight test also demonstrated that if the propeller was not feathered, and the aircraft was flown with the landing gear and flaps UP at best glide speed of 110 KIAS with a glide ratio of 13.5:1, the airport was also within glide range.



2. Data recovered from the accident aircraft and statements made by the pilot indicate he extended flaps to improve his glide. The Pilot’s Handbook of Aeronautical Knowledge states, “Flaps are the most common high-lift devices used on aircraft. These surfaces, which are attached to the trailing edge of the wing, increase both lift and induced drag for any given AOA.” P. 6-8. Data indicates flaps were extended at 16:32:33 to approximately 16 degrees, or takeoff position at about 4802 feet MSL. The propeller did not begin to feather until approximately 1630:29 or 10070 feet MSL and feathering was not complete until 1633:10 or 3703 feet MSL. The aircraft did not achieve 110 KIAS, best glide speed, until 1632:35 and 4751 feet MSL. From 1629:48 until 1633:18 the rate of descent exceeded 1000 feet per minute and was at times in excess of 4000 feet per minute. During that three and a half minute period the aircraft

descended from 11899 feet MSL to 3561 feet MSL—over 8000 feet, at almost 2300 feet per minute.

3. The Evolution POH emergency procedures checklist specifies configuration and best glide speed for an engine out situation. The POH reflects the information conveyed by the CFI during the pilot's transition training.

ENGINE FIRE/MECHANICAL FAILURE AIRBORNE

Pitch to Glide Attitude ....110 KIAS
Propeller Control Lever ....FEATHER
Fuel Condition Lever ....CUTOFF
Power Control Lever...........................LOW IDLE
Fuel Selector Valve.............................OFF

NOTE

If smoke is present in the cabin, shut off all equipment operated by engine bleed air.

Perform Forced Landing Procedure

AIRSTART PROCEDURES

WARNING

Do not attempt to restart a failed engine caused by a known mechanical failure (Ng – 0%) or engine fire if Ng is above 50%.

ENGINE FLAMEOUT IF Ng IS ABOVE 50% (HOT AIR START)

Check Fuel Quantity ....SWITCH TO FULLEST TANK
Power Control Lever...........................IDLE
Ignition..ON
Fuel Condition Lever ....CHECK ON
Ng / ITT ....MONITOR

WHEN ENGINE RELIGHTS (ABOVE 51% Ng AND 400°C ITT)

Ignition..OFF
Power Control Lever...........................AS REQUIRED
Land at Nearest Suitable Airfield & Investigate

WARNING

During airstarts above 14,000' or with Ng<10%, starting temperatures tend to be higher and caution is required, if Ng is below 50%.

AIRSTART IF Ng is < 10% (COLD START)

Airspeed ....110 KIAS (90 KIAS MINIMUM, 260 KIAS MAXIMUM)
Power control Lever..........................IDLE
Fuel Condition Lever........................CUTOFF
Gen/Alt/Non-Essential Equipment ....OFF
Battery Switches ....ON
Fuel Selector Valve...........................ON, SWITCH TO FULLEST TANK
Fuel Pump ....ON (CHECK 5 PSI MINIMUM, Ng 12% MINIMUM)
Ignition Switch...................................ON
Fuel Condition Lever........................GROUND IDLE, AFTER 5 SECONDS STABILIZED Ng
ITT ....MONITOR (1090 °C MAXIMUM FOR 2 SECONDS)
Power Control Lever.........................AS REQUIRED
Land at the Nearest Airfield
If Unable to Restart...........................USE AIRSTART WITH STARTER ASSIST PROCEDURE

AIRSTART (WITH STARTER ASSIST, Ng < 10%)

Fuel Condition Lever........................CUTOFF
Power Control Lever..........................IDLE
Gen/Alt/Non-Essential Electrical Systems ....OFF
Battery Master Switches ....CHECK ON
Fuel Selector Valve...........................ON, SWITCH TO FULLEST TANK
Fuel Pump ....ON (CHECK 5 PSI MINIMUM)
Ignition..ON
Start Switch...ON
Fuel Condition Lever........................ON, AFTER 5 SECONDS STABILIZED Ng > 12%

WHEN ENGINE RELIGHTS (ABOVE 51% Ng AND 400°C ITT)

Starter...OFF
Ignition Switch...................................OFF
Power Control Lever.........................AS REQUIRED
Land at the nearest suitable airfield & Investigate
If unable to restart.............................PERFORM THE FORCED LANDING CHECKLIST

FORCED LANDING

The use of gear UP versus gear DOWN is a function of the type of landing site. If the site is relatively hard and smooth, a gear DOWN landing is recommended. Conversely, if the site is soft or rough, a gear UP landing is recommended. This procedure can be used for practice, and actual engine failure or a precautionary landing.

NOTE

For feathering, a minimum oil pressure of 15 psi should be registered if propeller is windmilling.

Landing Gear ....UP
Flaps..UP
Propeller Control Lever ....FEATHER
Airspeed ....110 KIAS

The above configuration should give maximum glide performance with approximately 500 fpm descent and an 18:1 glide ratio. This should result in approximately 3.5 nm glide distance per 1000' of altitude lost.

Fly Directly to Intended Landing Site
Fuel Pump Switch ....OFF
Ignition Switch...................................OFF
Fuel Condition Lever ....CUTOFF
Power Control Lever...........................IDLE
Fuel Selector Valve.............................OFF
Cabin/Baggage Door Seal Switches ..OFF
Enter Forced Landing Pattern Overhead at high/low key whichever altitude permits, using an initial aim point 1/3 of the way down the runway/intended landing site. Use approximately 2500' AGL for High Key altitude and approximately 1300' AGL for Low Key altitude with the propeller feathered. If unable to feather the propeller, use 3500 AGL for High Key and 1700 AGL for Low Key.

Flaps ....24° AT LOW KEY
Gear..DOWN, WHEN LANDING SITE APPEARS ASSURED
Flaps ....FULL, WHEN THERE IS NO DOUBT ABOUT LANDING SITE
Battery Switches ....OFF
Flare & Land ....BE AWARE OF HIGHER DESCENT RATES AND THE NEED TO FLARE EARLIER

PROPELLER OVERSPEED

Power Control Lever ....IDLE
Oil Pressure ....CHECK
Propeller Control Lever ....REDUCE RPM
Airspeed ....REDUCE
Power Control Lever ....AS REQUIRED TO MAINTAIN RPM
If overspeed was significant or vibration is experienced, Land at the Nearest Suitable Airfield

PRESSURIZATION SYSTEM MALFUNCTION

Differential Pressure Exceeds 6.5 psi:
- Cabin Pressure Dump Switch ....DUMP
- Oxygen Masks ....DON & ACTIVATE
- Emergency Descent ....EXECUTE

Sudden Loss of Pressure:
- Cabin Pressure Gauge ....CHECK CABIN ALT/PRESS DIFFERENTIAL
- Cabin Pressure Dump ....CHECK OFF
- Bleed Air...ON
- Cabin Entry/Baggage Door Seal Switches ....CHECK ON
- Cabin Pressure Control ....CHECK SETTINGS
- Emergency Descent ....EXECUTE, IF CABIN ALTITUDE CONTINUES TO RISE
- Oxygen Masks ....DON & ACTIVATE

MAXIMUM GLIDE CONFIGURATION

Gear...UP
Flaps...UP
Propeller...FEATHER
Airspeed ....110 KIAS

The above configuration should give maximum glide performance with approximately 500 fpm descent and an 18:1 glide ratio.

Glide distance is approximately 3.5 nm per 1000 feet of altitude loss, however this may vary significantly. It is suggested that it be established for your individual aircraft.

Both of these problems are aggravated by smoking and alcohol which also upset the blood's ability to carry oxygen to the brain. Avoid them for your safety and that of your passengers. The presence of carbon monoxide in the cockpit can result in similar symptoms.

ENGINE FAILURES

An all-too-sad fact is that engines can fail at any time. One of the most likely, and worst times, is on takeoff. This is when the most is being asked of the engine and there is the least amount of time to react. On takeoff, if runway exists, attempt to stop and even accept an overrun into the weeds. After lift off, the number one rule is to maintain flying speed. Climbing at V_x (greatest altitude for the distance traveled) after rotation provides the most altitude in the least amount of time and reduces your exposure to that low-altitude glide to a landing. Do not attempt to turn around unless you have 800 feet AGL, just land on the remaining runway or within ±30° of the takeoff heading, maintaining control through initial impact and until the aircraft comes to rest. Should you ever have this unfortunate occurrence, you'll be happy you used all the runway available rather than making the takeoff from the intersection to avoid the long taxi to the "far end" of the field.

Again on the positive side, engine failures without warning are extremely rare. Being mechanical devices there is almost always some warning of a failure. For example, oil consumption increases, vibration increases due to a stuck valve, reduced power shows itself by an increased takeoff time and distance, metal chips are caught in the oil filter, etc. Paying attention to your engine is most important. As suggested earlier, engine instruments are now available which can provide the information which, when faithfully tracked, will warn of failure of this mechanical marvel.

Water in the fuel system is another cause of engine failure. In cold weather it can freeze in the filter, tank or lines, and limit or totally restrict fuel flow to the engine. Preflight checks can completely control this potential engine problem.

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4. The leading cause of all Lancair accidents and incidents involve intentional and/ or unintentional failure to follow procedures. https://www.lancairowners.com/files/wp-content/uploads/2016-LOBO-White-Paper.pdf

/s/ William J. "Jeff" Edwards, PhD., President, Lancair Owners and Builders Organization