The Monthly Flyer

November-December 2020 Vol. 75 No. 11-12

OLDS FORGE FLYERS since 1945

Skyhawk Engine Repair

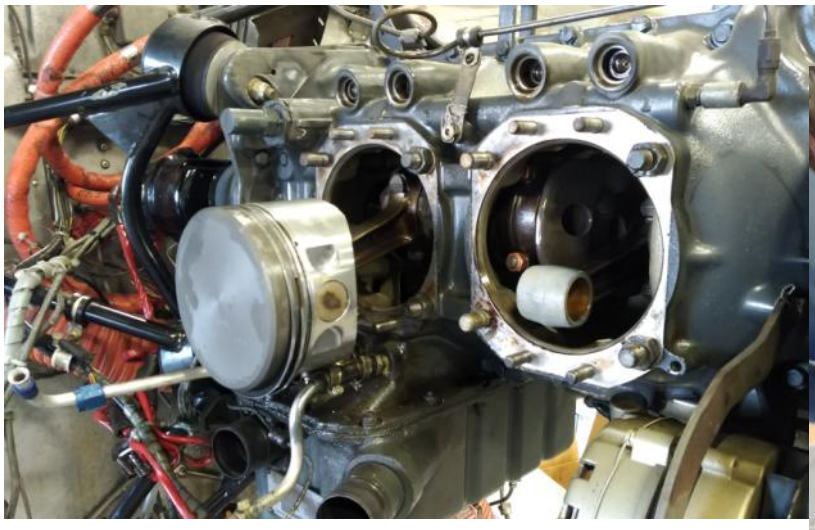
Many people would agree that 2020 has been a pretty bad year from many aspects and it hasn't been good to our Skyhawk engine either. It began this summer with sporadic and unpredictable rough running and violent shaking which we at first thought might be due to improper leaning during taxi. Then we tried performing a recommended procedure on the magnetos. Then it was discovered the carburetor was seriously in need of an overhaul. Finally, a ruptured push rod housing indicated a bent push rod caused by a sticking valve. (See article on page 3)

A thorough inspection revealed stuck valve witness marks on 3 of the 4 pistons. Our mechanic, Les Ojala recommended that we replace all four cylinder-piston-valve assemblies. He assures us that there has been no other damage to the engine. It's quite remarkable what can be seen/ inspected in the engine when all four jugs are removed.

Arrow indicates witness mark

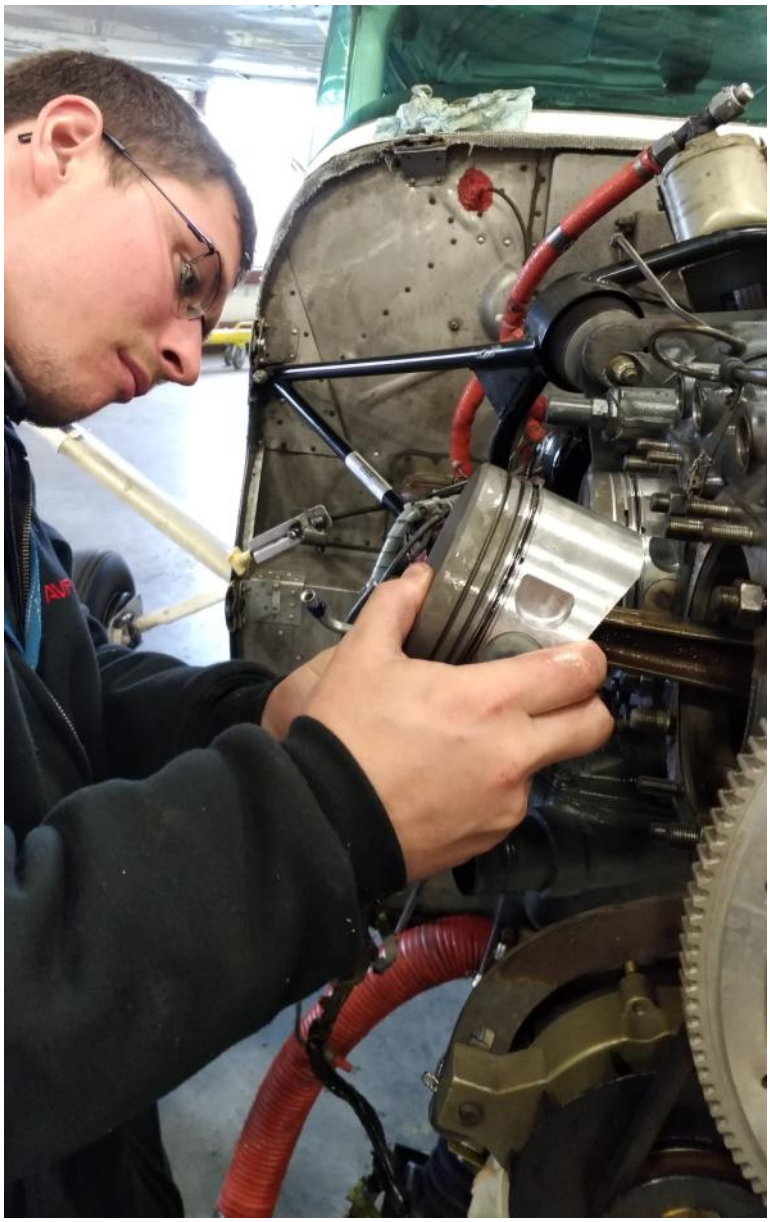
When the work is done, probably by Monday the 21st, we'll have a new "top end" on the engine. We're hoping that, coupled with the previous magneto and carburetor work, we should get a lot more life out of this engine. Of course, we will carefully monitor the engine through frequent oil analysis and compression checks. There will be a "break-in" procedure limiting flight training for the first 25-50 hours on the engine. Look for a "break-in" procedures bulletin soon.

MONTHLY BOARD MEETING
Thursday, January 21st , 6 PM (1800)
Via Zoom. Login info will be emailed
All members welcome to attend

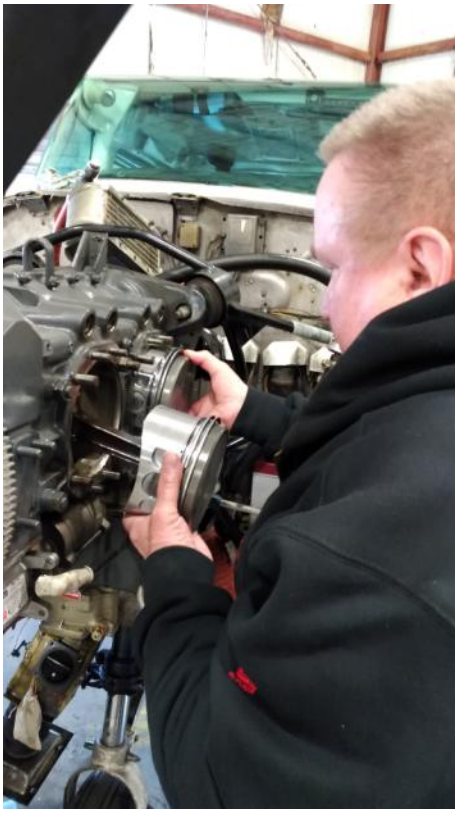


One new piston ready to go

Mechanic Justin English displays a new cylinder



Mechanic Justin English installing a new piston.



Mechanic Les Ojala assists with Rotating the crankshaft

WHY DO VALVES STICK

(Perhaps more than you ever wanted to know)

If you fly behind a Continental or Lycoming, each of your engine's cylinders has two valves: intake and exhaust.

By Mike Bush

The valves open and close by sliding in and out through close-tolerance tubes called valve guides that are press-fit into the cylinder heads. The valves are opened by a valve train consisting of a cam lobe, a lifter (tappet), a pushrod, and a rocker arm. They are closed by a pair of strong concentric valve springs.

A sticking or stuck valve is one that no longer slides smoothly in and out through its valve guide. This can happen when there is a buildup of deposits on the valve stem and/or inside the valve guide.

Of course, you knew all that. What you might not know is what these deposits are made of (it's not carbon), what causes them to form (it's not heat), what happens when they do (it's not pleasant), and how you can prevent this from happening (it's not hard).

Morning sickness and worse

If the valve guide isn't excessively worn, there's not much clearance between the guide and the valve stem. The clearance is intentionally tight so that the valve can't wobble and remains perfectly concentric with the valve seat when the valve closes. The stem-to-guide clearance is at a minimum when the cylinder is cold and loosens up a little as the cylinder heats up. That's why when a valve starts to get sticky, it is first noticeable right after the engine is started cold.

A sticky valve causes the corresponding cylinder not to make power (or at least enough power) and manifests itself as a rough-running engine. If you have an engine monitor, you might also notice that the offending cylinder is not producing normal exhaust gas temperature.

As the engine warms up and heat from the other cylinders is absorbed by the non-firing cylinder, the valve-to-guide clearance loosens up a little, the valve gets less sticky, the roughness diminishes and ultimately disappears, and the offending cylinder starts making normal EGT. Many pilots incorrectly attribute this to an oil-fouled spark plug, but that's almost never what causes the roughness—the engine would run smoothly even if all the bottom plugs were oil-fouled. Roughness when the engine is cold that goes away when the engine warms up is almost always due to valve sticking.

This phenomenon is known as "morning sickness" (for obvious reasons) and it's a warning—one that should not be ignored or taken lightly. If you don't act promptly to resolve the sticky valve, the stickiness can worsen to the point that serious engine damage occurs. If this occurs in flight, the result could be a power-loss emergency or even an off-airport landing.

A valve that gets too sticky can get stuck hard, in either the open or closed position. This can get quite ugly.

If the valve sticks closed, then when the valve train tries to open it, something's gotta give. What usually gives is the pushrod, which is the weakest link in the valve train. The pushrod typically bends and puts the valve action permanently out of business.

If the valve sticks open, then the face of the valve can be struck by the rising piston, snapping the valve face right off the stem. This always shuts the cylinder down permanently. Occasionally, it shatters the piston and causes a catastrophic engine failure.

We seem to be seeing this problem more often than we used to. And while valve sticking traditionally was a problem that mostly afflicted Lycoming engines, we're now starting to see it occur in big-bore Continentals.

Why valves stick

If you Google “why do aircraft engine valves stick,” you’ll find that a great deal has been written about this subject. Most of it attributes valve sticking to buildup of carbon deposits on the valve stem and inside the valve guide that results from engine oil contacting the hot valve stem and carbonizing.

If that were true, then valve sticking could be mitigated by operating the engine in such a manner that valve temperatures were cooler. But in fact, engines that are run cooler exhibit more valve sticking, not less. Lycoming engines have valves that run cooler than Continentals because their sodium-filled stems dissipate heat better, yet Lycomings experience far more valve sticking problems than Continentals.

The conventional wisdom about what causes valve sticking is wrong. While it’s true that valve sticking is caused by buildup of deposits, those deposits are not carbonized oil and the solution is not to run the valves cooler.

My friend Ed Kollin is the smartest guy I know when it comes to the chemistry of internal combustion engines. Kollin is a petrochemical wizard who used to run Exxon’s engine lab, went on to formulate CamGuard, and is a Cessna owner. Kollin performed a laboratory chemical analysis of the ugly, nasty, crusty buildup on a Lycoming exhaust valve and found that the deposits consist primarily of lead, carbon, bromine, and oxygen. These lead oxybromide deposits originate from the tetraethyl lead (TEL) octane booster that is blended into 100LL avgas.

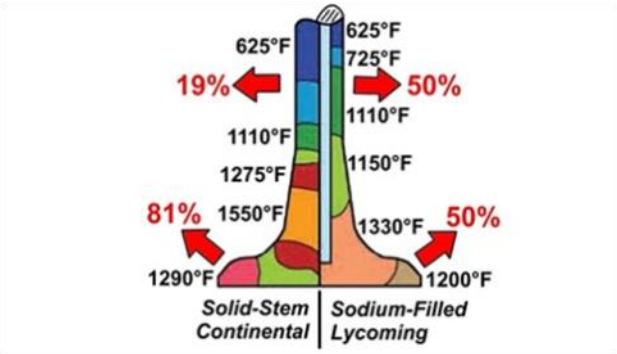
About two grams of TEL are blended into each gallon of 100LL. As the air-fuel mixture is compressed in the cylinder, the TEL is rapidly converted to lead oxide, which is actually the active octane booster that inhibits detonation. However, lead oxide has the nasty habit of coating and lead-fouling spark plugs. Therefore, ethylene dibromide is added to 100LL to “scavenge” the lead oxide by converting it to lead bromide, a molecule that remains in a gaseous state above 1,100 degrees Fahrenheit and passes harmlessly out the exhaust with the rest of the exhaust gases.

As Kollin explains it, the chemical reaction between lead oxide and ethylene dibromide to form lead bromide gas is a bit complicated, goes through a number of intermediate steps, and takes a significant amount of time. The time this chemical reaction takes to play out is a function of temperature—the hotter the combustion temperature, the faster the lead oxide is scavenged into lead bromide gas. There actually are eight distinct steps during which intermediate forms of lead oxybromide are formed that ultimately become lead bromide gas. It’s these intermediate oxybromides that cause the valve sticking problem.

Condensation temperatures

All these compounds have a condensation temperature below which they change from a gas to a solid and start forming deposits as the combustion gases cool down toward the end of the combustion event. The condensation temperature of lead oxide is quite high—1,630 degrees F—which is why it so readily condenses on spark plug electrodes and shorts them out unless properly scavenged. The intermediate lead oxybromides have lower lower condensation temperatures—initially 1,470 degrees F decreasing to 1,300 degrees F after eight steps—and the end product, lead bromide, remains gaseous at temperatures above 1,100 degrees F.

As these various lead compounds exit the cylinder, they will condense and form hard metallic deposits on any surface they encounter that is cooler than their condensation temperature. The coolest surface they will encounter is the portion of the exhaust valve stem that slides out of the cool exhaust valve guide and into the exhaust path when the exhaust valve opens.



If you look at the accompanying exhaust valve temperature map and focus on the temperatures of the lower portion of the valve stem, the problem will be apparent. Typical Continental valve stem temperatures are just barely high enough to inhibit condensation of lead oxybromides, which is why Continentals aren’t that prone to valve sticking (unless they’re run too cool).

Typical Lycoming valve stem temperatures are substantially cooler because Lycoming’s sodium-filled valves are much more efficient at shedding heat to the guide and cylinder head. That’s good for valve longevity but bad for valve sticking because the cooler valve stem temperatures are below the condensation temperature of lead oxybromides and therefore promote deposit formation.

How to prevent sticking

The key to preventing valve sticking is to keep combustion temperatures high. This accomplishes two things: First, it speeds up the scavenging reaction that converts nasty lead oxide to less nasty lead oxybromides to nice gaseous lead bromide. If most of the lead oxide can be converted to lead bromide before the exhaust valve opens, deposit condensation is minimal

Second, higher combustion temperatures result in higher valve stem temperatures, and that will minimize condensation of any lead oxybromides that remain in the exhaust gas as it flows past the exhaust valve on its way out the exhaust port.

The best proxy we have in the cockpit for exhaust valve temperature is cylinder head temperature. (Note that it isn’t EGT.) Most of us know that it’s important not to let CHT get too high for optimal engine longevity. I’ve long recommended keeping CHT no higher than 400 degrees F for Continentals and 420 degrees F for Lycomings, with CHTs about 20 degrees F lower than those maximum temperatures being just about ideal. We keep our CHTs below

those maximums mainly by using the mixture control properly and operating either enough lean of peak or enough rich of peak to prevent excessive CHTs.

But some pilots seem to think that if a little CHT reduction is good, then a lot of CHT reduction must be better. That's not the case, and now you know why. Excessively cool CHTs mean low combustion temperatures that slow the lead scavenging process, and cool exhaust valve stems that promote lead oxybromide deposits.

To minimize valve sticking (especially in Lycomings), it's important to try to keep CHTs in "the sweet spot" between 350 degrees F and 400 degrees F as much as possible. It's also important to lean aggressively during taxi and other low-power ground operations to keep combustion temperatures as high as possible.

Guess the Flight Deck answer: T-38

Mike Busch

Mike Busch is arguably the best-known A&P/IA in general aviation. He writes the monthly "Savvy Maintenance" column in AOPA PILOT and hosts free monthly EAA-sponsored maintenance webinars. Mike is a mathematician by training, having received his Bachelor of Arts degree in mathematics from Dartmouth College. After Dartmouth, he did graduate work in mathematics at Princeton University and in business administration at Columbia University. While at Dartmouth, Mike did pioneering work in computer software development, and ultimately retired from a long, successful career as a software entrepreneur. Mike then co-founded AVweb in 1995 and served as its editor-in-chief and investigative journalist until its sale to Belvoir Publications in 2002. Through his work as a type club tech rep for Cessna Pilots Association, American Bonanza Society, and Cirrus Owners and Pilots Association, and as CEO of Savvy Aviation, Inc., Mike has helped thousands of aircraft owners resolve thorny maintenance problems that have stumped their local A&Ps. Founded in 2008, Mike's company Savvy Aviation, Inc. provides a broad palette of maintenance-related services to thousands of owners of piston GA airplanes. Those services include maintenance management and consulting, engine monitor data analysis, a nationwide prebuy management program, and 24/7 breakdown assistance that's essentially "AAA for GA."

From the Maintenance Crew

By Chet Dawson

Skyhawk Procedures

With the new top end overhaul of the Skyhawk engine, there are specific engine break-in operational procedures that must be followed for the first 25-50 hours in order to ensure proper seating of the rings. Please consult and coordinate your flights with Chet for specific instructions about engine operation. Touch and go training will be prohibited for the first 25 hours. Here's Chet's contact info:

Mobile: 517-449-2182
Home: 517-339-3727
Email: chet777@comcast.net

Cooperation will help ensure long engine life.

OIL FILLER TUBE AND DIPSTICK

We recently had another incident, ***AGAIN,*** where the oil dipstick was tightened so tightly that it could not be loosened by hand; pliers were required. And then, instead of unscrewing the cap, the filler tube rotated requiring a mechanic and unnecessary expense to the club. The dipstick is sealed with an "O" ring. It only needs to be screwed in snuggly, not reefed down. Excessive tightening will damage the "O" ring.

Cold Weather Engine Operation

We are now getting some cold weather which needs to be taken into consideration when flying the planes. Both planes are equipped with Tannis engine heaters. If the plane is outside and the temperature is below freezing, 32F or 0 C, the Tannis heater should be plugged in to keep the engine at proper temperature. The engines should not be started if they have been left outside for any period of time when the temperatures are below freezing and the Tannis heater has not been plugged in. Doing so could cause serious wear or worse to the engines.

If you have any questions, please give me a call at 517 449-2182 or 517 339-3727.
Chet Dawson, Maintenance

Pilot's Tip of the Week

Tracking With GPS

"Even with GPS, I struggle to find a heading that keeps me on course throughout the flight. I have friends who stay perfectly centered from takeoff to touchdown. I'm too embarrassed to ask them how they do it, so I'm asking you." — Cal S.

Jeff Van West replies:

"The two elements to staying on course are knowing what heading will cancel the wind drift and then holding that heading with level wings. Presuming you're doing a good job holding a specific heading, let's look at finding the right heading to fly.

When you plan your flight (or program your GPS) you'll get the course you want to fly. Let's say that's 270 degrees. That can also be called your desired track over the ground. If there was no wind, you'd fly a heading of 270 and your actual track over the ground would be 270. Your actual track would match your desired track and you'd stay on course.

Ah, but today there's a strong wind from the north that will blow you off course. In the pre-GPS days, we would estimate the wind correction heading before takeoff. Maybe we would launch and fly 280. We would see if we passed north or south of checkpoints and make adjustments. We could even compare two objects (towns, lakes, whatever) and watch how they shifted relative to each other for more real-time adjustments. Of course, the correction would change as we went because the wind is never exactly the same throughout the flight.

With GPS, we can simply turn to a heading of 270 and then reference the screen. The easiest method is with a moving map that's track-up. Our desired track is the magenta line. Our actual track due to the wind is always the top center of the map. So turn left or right as needed to keep the magenta line pointed straight up. Note the heading that accomplishes that task and keep flying that heading. Periodically check the map to make sure you're still on the magenta line *and* that it's pointed straight up.

If you need more precision, such as under IFR, or you like a north-up map, you can do this with raw numbers. Most GPS units abbreviate the desired track as DTK, which is 270 in our example. They can also show your current track, usually abbreviated TRK. Let's say that with the north wind, your track is 260. Even though you might be centered on course right now, your current heading will have you drift south of course at a 10-degree angle.

Fix the issue by turning 10 degrees right. Check your track. If it's 270, the new heading will keep you on course. If your track is now 272, 10 degrees was too much. Turn back to the left two degrees. Keep doing this until track and desired track match. Continue making corrections as you fly and you'll stay perfectly on course to your destination.

There are other GPS data fields such as track angle error (TKE) and cross-track error (XTK) that can come in really handy, especially under IFR. Some digital HSIs show a track indicator right on the compass rose. Some apps show a suggested heading that takes into account forecast winds. However, those are just a starting point, not a final heading.

Also, remember the GPS is supplemental if you can look outside. That's where your eyes should be most of the time if you're not in the clouds.

And if you can look outside, consider traveling in something other than a straight line from A to B. It can be a lot more fun."

November 2020 Board Meeting Minutes.
Meeting conducted by ZOOM video conference.

Olds Forge Flyers - Meeting Minutes

Date:	11/19/2020	Time:	6:00	Location:	Zoom Conf Call

Attendance:

Board Member	Attended	Member / Guest In Attendance	Member
Brian Zeeb - President	X	John Yurkon	X
Dick Best - Vice President	X	Frank Eastman	X
Steve Harsh - Treasurer	X	Osama Alian	X
Steve Colby - Secretary	X		
Larry Borton	X		
Mark Coucke	X		
Dave Oxendale (2 yr)	X		
Jeff Markham (2 yr)			
Cooper Lawrence (Inactive)			
Chet Dawson	X		

AGENDA AND DISCUSSION:

1	**Call to Order (President or Executive Member)**
	Meeting called to order by Brian Z. at 6:00 pm.
2	**Additions to Agenda: (Board)**
	None at this time.
3	**Approval of Minutes of Previous Meeting: (Colby)**
	October minutes submitted via e-mail by Steve C. for Board review. Motion to approve the minutes by Steve H., 2nd by Dick B. Motion approved without opposition.
4	**Review and Approval of Treasurers Report: (Harsh)**
	On track to breakeven for the end of the year at this point! Steve H. updated his analysis for the purchase of an aircraft. Dick B. inquired about AOPA assistance, Steve H. says they do only financing. Ten year analysis....using a Sling TSi for example, 4 seater...$185,000....sell the Archer.....would require a dues increase to $125/month or an hourly rental rate of $220/hour. Motion to table this discussion made by Larry B., 2nd by Dick B., motion approved without opposition. Motion to approve the Treasurers Report by Steve C., 2nd by Dave O., motion approved without opposition.
5	**Maintenance Report: (Dawson)**
	Skyhawk carburetor was rebuilt, several significant issues were found. It is back up and running with no complaints and some positive feedback. Archer oil pressure light still an issue. Les has installed a new oil pressure switch, waiting for feedback. Keep an eye on the AI on the Archer, it is taking some time to spin up. GPS's updated, next is for December 5th. Archer needs an oil change in twelve hours, will do this next week and install the cooler baffles. Motion to approve the Maintenance Report by Larry B., 2nd by Mark C., motion approved without opposition.
6	**Committee Reports**
6a	Membership Committee - Bill Z. returned as an active member.
6b	Archer Instrument Committee - Steve C. presented an update on the current status. Request for three quotes, two have been received, third expected shortly. Proposals have centered on either Garmin G5's or GI275's. Installs with the GNC355 (not too much concern about giving up radio navigation). Desires are for bigger display of G5's and not the GI275's. Osama A. expressed desire for Garmin GTN650Xi, much quicker than the 430, easier to put in flight plans and make changes. More user friendly. Costs more.
7	**Old Business:**
7a	Club Website -No updates at this time.

November 2020 Board Meeting Minutes.
Meeting conducted by ZOOM video conference.

8	**New Business:**
8a	Aviation Hall of Fame Association - No interest from the Board for pursuing this opportunity.
8b	Member Request - per flight changes in the Lynx NGT 9000 ADS-B - Osama A. was asking if it was possible to change the ADS-B to a given call sign. What does the Lynx manual specify for enabling the issue and how does it reset/or does it reset? If it does not reset on an ignition cycle, that might present a challenge for the next person if the previous person did not change it back. We would require instructions in the aircraft depicting how to change it back if necessary. Osama A. will peruse the Lynx manual to learn more about the process regarding this.
9	**Discussion Of Flying Experiences**
	Next meeting is December 17th
10	**Adjournment:**
	Brian Z. called for a motion to adjourn. Steve C. made the motion to adjourn, 2nd by Mark C., motion approved without opposition. Meeting concluded at 7:05 pm. Thanks to Steve H. for the use of his Zoom account.

Olds Forge Flight Instructor Contact Information

Mark Coucke	517-719-9061	mdcoucke@gmail.com
Adlay Kejjan	517-899-0731	adlaykejjan@gmail.com
Pete Kamarainen	517-281-3899	pete@grandairaviation.com
Fred Moore	517-230-7918	fredmoore48842@aol.com
Pam Tobin (Ground Instructor)	517-703-4273	airwomancfi@gmail.com

Can you guess the flight Deck?

October's Numbers

Monthly Hours Flown Report:

	Skyhawk $ 90 / hr.		Archer $ 105 / hr.	
	2020	2019	2020	2019
Year-to-date Total	71.5	162.8	62.2	104.2
November	16.2	8.5	6.9	4.1
TOTAL	**87.7**	171.3	**69.1**	108.3

COMBINED HOURS THROUGH November
2020: 156.8 2019: 279.6

The upward trend of hourly usage we had going last year is now gone. Let's hope it returns as the Covid 19 concerns ease. The planes thrive on use. After a several month hiatus, all members should consider flying at least an hour with an instructor. For variety do a short cross country and land at one of the many nearby airports. Schedule your club annual review or FAA Flight Review and have an instructor familiarize you with the ADS-B compliant transponders and the new G5 units in the Hawk. Sign up with **socialflight.com** for your customized weekly email listing of timely and interesting destinations. The kids will love the full motion simulators at the "Air Zoo" in Kalamazoo (KAZO). Check their web site. You can taxi right in to the museum's parking area. It's an extremely good museum that amazingly even has an SR-71. Traverse City (KTVC) has a courtesy car available. Many great restaurants. Grand Traverse Bay is beautiful from the air especially in winter. Or how about a Macinac Island weekend—fly in and skip the ferry. In the U.P., there's the Soo Locks, Pictured Rocks and Marquette. There's lots of great destinations and plenty of sightseeing in the mitten. And you can do it all from the air. You've got a pilot license—USE IT!!!

FLYING IS FUN!

Maintenance Report

Maintenance Issues:

Notify Chet: 517-449-2182 chet777@comcast.net
517-339-3727

Skyhawk: GPS updated. Cylinders, pistons replaced. Use only non-detergent mineral oil.
Annual Due: 2/12/2021 Hours flown since last annual: 72.5

Archer: GPS updated.
Annual Due: 3/12/2021 Hours flown since last annual: 53.4
USE Phillips 20W 50 OIL ALL YEAR!

Please record oil usage accurately, and make sure you have enough oil in the plane for your cross-country flight.
GPS cards in each plane include expiration date.
Thanks, Chet, and Stevo!

MONTHLY BOARD MEETING

Thursday, January 21st, 6 PM (1800)
Via Zoom. Login info will be emailed
All members welcome to attend

Financial Report

OLDS FORGE FLYERS, INC

Profit & Loss Statement

January 1 - November 30, 2020

Archer Hr = 69.3 Skyhawk Hr = 87.4

	Actual	Budget
OPERATING INCOME:		
Aircraft Income	$14,197	$15,143
Initiation Fees	$3,425	$1,900
Membership Dues	$27,785	$26,180
Interest	$0	$0
Other Misc. Income	$19	$0
TOTAL INCOME	$45,426	$43,223
OPERATING EXPENSES:		
Variable Costs:		
Improvements, Archer & Skyhawk	$784	$784
Engine Depletion, Archer	$1,105	$1,105
Engine Depletion, Skyhawk	$1,245	$1,245
Fuel, Archer	$2,123	$2,938
Fuel, Skyhawk	$2,677	$3,011
Misc fuel & Oil	$0	$428
Maintenance, Archer*	$4,568	$4,470
Maintenance, Skyhawk*	$3,505	$3,537
Maintenance, Other	$0	$623
Total Variable Cost	$16,007	$18,142
Fixed Costs:		
Office and Service Fees	$2,427	$2,319
Operations Costs	$20,101	$20,330
Total Fixed Costs	$22,528	$22,648
Misc. Cost	$0	$300
TOTAL EXPENSES	$38,535	$41,090
NET OPERATING INCOME	$6,891	$2,132
Contingency Fund (equity fees)	$3,425	$1,900
NET AFTER CONTIN. FUND	$3,466	$232

* Archer Annual (Budget = $4,,500; Actual = $6,818)
* Skyhawk Annual (Budget = $2,800; Actual = $1,883)