EVERYTHING YOU NEED TO KNOW ABOUT PIPER "LEGACY" AUTOPILOTS

BY BOB HART – WWW.AVIONIXHELP.COM

If you've been following my articles, you know that I believe an autopilot (even a basic wing-leveler) belongs in any aircraft that intends to spend time in the clouds in IFR flight. The less time a pilot has spent in IFR conditions (e.g. a low time pilot with a fresh IFR ticket), the more an autopilot is needed.

After World War II and the Korean Conflict came to an end, the U.S. economy moved in a very positive –UP! The General Aviation industry, primed by the economy and pilots with wartime flying experience, grew quickly with Cessna, Piper, and Beechcraft taking the lead in small aircraft sales. Increased sales spawned innovation, not only in aircraft design, but also in avionics. By the late '50s, several companies, including ARC (for Cessna), Tactair, Lear, Sperry, Brittain, and Mitchell were also developing autopilots.

Don Mitchell designed his first autopilot and installed it in a Beechcraft in the early '50s. By 1961, Mitchell/Edo Aire had six models of autopilot available, ranging from the basic *Co-pilot*, a single-axis wing-leveler with heading lock to the *Commander*, a fully automatic, two-axis system with features way beyond its day. This became the foundation for Piper Autopilots and later, in 1983, Mitchell/Edo Aire became **Century Flight Systems** who continue to make autopilots for Piper Aircraft.

Early Piper Autopilots were made by Mitchell and labeled as Piper Autopilots until Century Flight Systems was established and, at that point, autopilots found in Piper aircraft were labeled Century models. Piper first offered a factory installed autopilot in 1958, though it was an option even on the relatively basic Tripacer. The Aztec was the workhorse of the Piper fleet at the time, and autopilots were a popular option even then. Now, let's look at some autopilot basics and then we'll take a look at the legacy autopilots that were available from the Piper factory starting with the earliest versions.

First, autopilots are available in single-axis (roll) or two-axis (roll and pitch).

NOTE: Some autpilots offer a third-axis or yaw damper option (or separate yaw damper) which is designed to compensate for excessive adverse yaw caused by aircraft design (as in the case of the V-tail Bonanza) or excessive turbulence. These are most often found in twins and charter aircraft to dampen yaw and make the flight more comfortable for passengers.

Autopilots are also available as either **rate-based** (where the turn coordinator is the primary sensing device) *or* **attitude/position-based** (where the artificial horizon serves as the sensor for roll and pitch. There are pros and cons to both types. Turn coordinators are electric and are considerably more reliable than a vacuum-based artificial horizon. Plus, a vacuum pump failure is more likely to occur vs. a total electrical failure. In short, an all-electric, rate-based autopilot has less pathways to an inflight failure. Today, all STEC autopilots are rate-based. On the other hand, attitude/position-based autopilots are reported as "smoother" and better able to handle turbulence.

Single axis (roll only) autopilots keep the wings level and most can track an omni, GPS or localizer. Some, when interfaced to a directional gyro with autopilot interface (heading "bug") or HSI can track a heading. This is a real nice feature if you spend a lot of time in controlled airspace where vectoring is frequent. Roll-only autopilots have no way to sense or control altitude.

Conversely, two-axis autopilots provide full roll control (as above), can maintain a heading (with DG/HSI option) *and* can hold an altitude. In fact, better two-axis autopilots can add additional altitude features like altitude pre-select and vertical speed control. Some even have glideslope tracking capability and, frequently, automatic trim—or at the least an "out of trim" warning. It should be fairly obvious that the more sophisticated the aircraft, the more sophisticated the autopilot.

Here's a look at the legacy autopilots that were available from Piper starting with the early days.

AutoFlite

Based on Mitchell's basic model, the Piper AutoFlite was a simple, remote-mounted wing leveler. It consisted of a remote-mounted rate gyro, a servo, and a panel-mounted switch. Turn it on, and

the wings would (or should) remain level. An optional tracker was available which allowed the unit to track a VOR bearing. It worked, but reliability was an issue.

As more capable autopilots were developed using vacuum gyros, the all-electric AutoFlite was sometimes installed as a backup to the system in the event of a failure of the primary autopilot. The original AutoFlite is not a viable unit today, and it's rare to find one installed—much less one that's installed AND still functioning.

AutoFlite II

The AutoFlite II was an upgrade to the original model with a panel-mounted turn-coordinator (rate gyro), which also served as the controller and a servo. Omni tracking was built-in. It was an all-electric, rate-based wing-leveler with tracking, but had no ability to maintain a heading. This unit went through a few modifications over the years and later became known as the Century I, which is still being marketed by Century today.

AutoControl I

This was the earliest version of a Piper attitude/position-based autopilot. Back then, Mitchell was also making gyros, and the AutoControl I was a single-axis autopilot that used a 4-inch attitude gyro as the roll sensor. Nav tracking was not available. This system is not viable today.

Altimatic II

Prior to 1965, Piper had introduced their first attempt at a two-axis, attitude-based autopilot in the Altimatic II. It had some unique features like dial-up altitude and autotrim (back then, the need to re-trim was sensed by cable tension). Today, an Altimatic II is not a viable system and maintenance is a poor investment. One issue with early autopilots was the use/limitations of germanium transistors. However, silicon-based transistors became available in the mid-'60s and brought with them a significant improvement in autopilot reliability.

AutoControl III/IIIB

Introduced around 1965, the Piper Autocontrol III is a attitude-based, single-axis autopilot with full roll control including nav, localizer and (today) GPS tracking. It also introduced heading hold with the addition of an autopilot directional gyro or HIS, and an optional radio coupler was

available that allowed the pilot to chose between multiple nav sources or heading hold. The AutoControl III was a step up in capability and reliability; and, asside from most units being very "tired," it's still considered a viable autopilot today. Around 1973, Piper introduced the AutoControl IIIB with a redesigned controller and improved design and electronics, thus moving reliability up yet another notch.

One weakness in these systems is servo failure, which can sometimes lead to an electrical failure. Nonetheless, these autopilots are worth maintaining. Frankly, most need a complete rebuild, but you should be able to completely overhaul an AutoControl III or IIIB for 1/3 to 1/2 the cost of a new, comparable STEC autopilot—and some go so far as to suggest that the AutoControl III/IIIB, as an attitude-based autopilot, can actually fly the aircraft *better*! A completely overhauled and aligned AutoControl III/IIIB should provide you with a reliable and safe autopilot for many years.

Altimatic III/IIIB/IIIC

Around the same time the new AutoControl III was being introduced, Piper introduced the Altimatic III. This was a full-featured two-axis autopilot with all the capability of the AutoControls in roll-axis, but with the addition of altitude hold and autotrim was standard. Plus, an optional radio coupler allowed access to multiple nav sources. Glideslope coupling and altitude pre-select were also optional.

Note that the early versions had issues with altitude pre-select, and the altitude bellows were prone to failure. As a result, Piper introduced the IIIB around 1971 and the IIIB-1 a few years later, and each offered some improvements. The IIIB-1 added a better altitude control sensor and pitch wheel oeration.

Reliability improved with each model. The Altimatic IIIC was the final stage in the growth of the Piper two-axis autopilots and actually came from the Century III (described below) with a different controller and faceplate. At this point, you have a relatively modern, full-featured two-axis autopilot with autotrim, altitude hold, and glideslope coupling. The IIIC is very capable and reliable as long as it remains healthy. Again, all of these units are worth supporting, but many have been in the field for up to 50 years. I'm inclined to suggest that the IIIB through the IIIC are

your better bet and, as I mentioned before, you should be able to completely overhaul and align one of these autopilots for 1/3 to 1/2 the cost of a new comparable model.

AltimaticV/X

Piper also offered two high-end autopilots designed specifically for their heavy metal aircraft. The Altimatic V was actually a Bendix FCS810 autopilot with Piper markings. The Altimatic X (10) was actually a Century IV with a different faceplate. Both are complex, high-end, full-featured autopilots with Flight Directors designed for the needs of pilots flying Navajos and other heavy twins. We only mention them here to note that if you're seeking service on one of these units, you *really* need a shop that knows them!

In 1983, as mentioned, Edo Aire/Mitchell became Century Flight Systems and for me things got a little confusing. It's important, when you talk about these autopilots, that you know whether they are Century or Edo Aire/Mitchell. Here's an example: a Piper Autocontrol IIIB is a single-axis roll only autopilot by Edo Aire, while a Century III is a two-axis, full-featured autopilot with altitude hold and all the bells and whistles.

Here's what we saw from Century after the change:

Century Flight Systems

Once the handle on these autopilots changed from Edo Aire/Mitchell to Century Flight Systems, model names changed as well. The Piper AutoFlite II became the **Century 1**. This is the only dedicated* single-axis, rate-based autopilot still available from Century and it maintains the same capability—it offers roll axis only with tracking, but no heading hold. The lack of heading hold makes this a less desirable option, unless you never find yourself being vectored in controlled airspace. But let's face it, heading hold is a big plus when the FAA is telling you what to do!

* The modern Century 2000 can be ordered as single-axis.

The Piper AutoControl III and IIIB became the **Century II and IIB**. These are single-axis autopilots with tracking and heading control either through a DG or HSI. These are very common in Piper legacy aircraft like the Cherokee line. I had a IIB in my Cherokee Six. It was simple and very reliable!

The Piper Altimatic III, IIIB, and IIIC became the **Century III**. These are two-axis, full-featured autopilots with most of the bells and whistles, including altitude hold and glideslope coupling. These are common in Piper performance singles and light twins.

The Piper Altimatic X (10) became the **Century IV** and filled the role of a full-featured autopilot with Flight Director for the heavier Piper twins.

Century Flight Systems went on to produce the Century 21, 31, 41, and later, the Century 2000 and Trident models. You can sometimes find these retrofitted in later Piper models.

This should give you a decent overview of the Piper and Century Autopilot models and their capability. So, let's talk about other things you need to know about your autopilot!

No matter what autopilot you have, whether Edo Aire or Century, it's important that you know everyting about it—and know it well. This may seem obvious, but it's not. Your aircraft has a flight manual that should include everything you need to know about your autopilot. However, many shops that work on autopilots shockingly report that many aircraft owners have actually *never* read the Flight Manual Supplement for their autopilot!

When things go wrong with your autopilot or your electric trim system, you need to know what to do—you need to know its components; you need to know its features; and, perhaps most importantly, you need to know how to disengage it!

When things are not going well, immediately disengaging the autopilot should be an oavious response—especially in IFR conditions. Generally speaking, there are three ways to do this:

1. **Most autopilots have (or should have) a disconnect switch on the yoke**. Things can go sour quickly and this is the quickest way to sotp your autopilot from causing it. Be sure to test this switch regularly to make sure it works.
2. **The on/off switch on the autopilot's controller.**
3. **Pulling the circuit breaker should render the autopilot null.** I recommend markig or otherwise identifying the autopilot's circuit breaker so that you can find it quickly. Also make sure that your circuit breaker *can* be pulled—some of the early ones can't.

Initially, you will try to "fight" with the autopilot and, fortunately, most autopilots must be able to be overpowered in order to get certified. But mechanical systems can fail, so you'll want to minimize the time you fight with the autopilot and they quickest way is to disengage it.

All airplanes have trim systems. Two-axis autopilots with altitude features (hold or whatever) typically have an electric trim system. Many have autotrim which automatically trims the aircraft to minimize extra forces on the elevator or trim tab from "out of trim" conditions. Electric trim systems (without autotrim) have a feature called trim prompting. A sensor in either the trim servo or cable system detects excess pressure and "prompts" the pilot (with a annunciator light) to re-trim. Even manual electric trim systems can fail, but a failure in an autotrim system creates real problems and often leads to accidents.

The following is an example of just the type of scenario that you must avoid. Again, the message here is to **always disengage first!**

The autopilot suddenly goes into a nose down situation. The autopilot and autotrim are engaged and the pilot reacts by applying backpressure. Unless the pilot immediately disconnects the autopilot, autotrim does its job by further applying down trim. As you can imagine, things can get ugly fast, especially at low altitude.

And, don't just use your autopilot in IFR conditions. Use it frequently and respond if you see any anomalies in the autopilot or trim system by communicating these to your aircraft and autopilot mechanic. This is not the place to try to save money.

We talked about rate-based vs. attitude/position-based autopilots. Rate-based systems use the turn coordinator, which is electric in all modern aircraft and is considerably more reliable than the gyros used on attitude/position-based units. A total electrical failure, even in a single engine aircraft is not very common, and you get many more hours of service from a turn coordinator than you do from attitude gyros—either vacuum (as most are) or electric.

When you first turn on your master switch, the spooling up sound that you hear (before engine start) is your turn coordinator. Frankly, when they're on the way out, they'll "scream" at you. You'll want to get that taken care of, especially if you spend time in IFR and depend on your rate based autopilot.

Conversely, vacuum gyros used in attitude/position-based autopilots are not so quick to inform you of their pending failure. First of all, you've started your engine and it's much harder to hear your vacuum gyros. Secondly, by nature, a vacuum attitude gyro is not only vulnerable to its own

condition, but it's vulnerable to the condition of your vacuum pump and filter; and a failure of either will render *all* of your vacuum instruments inoperable, including your autopilot.
Moreover, attitude gyros are subject to bearing wear as well. Generally, as they slow down they will start to tilt and your attitude-based autopilot will follow. You vacuum gauge will not reflect this so you must pay attention. Modern autopilots will normally disengage, but the older ones may not. We all understand the benefits of wings level in IFR cruise, we also understand the dangers of thinking your level when, in fact, you're not!

This is a good time to mention my "mentor" on this article. Bob Ferguson of Autopilot Central (www.autopilotcentral.com) in Tulsa, Oklahoma. For years, Bob has maintained a solid reputation for his autopilot expertise, especially with Piper and Cessna legacy autopilot systems.
As an Avionics Consultant with APG Eastern Avionics, I've frequently found Bob to be a very good source for autopilot advice, parts support, repairs, and overhaul—especially with legacy autopilot systems.

With the exception of pre-1965 autopilot systems, Bob agrees that most legacy autopilots still have value; but, as I mentioned early on, they're getting "tired." The Piper AutoControl and Altimatic III, IIIB, and IIIC have been in the air for up to 50 years, and some are still fine. Others, however, need frequent repair and probably should be completely overhauled. Bob reinforces my experience that you can typically overhaul one of these systems for 1/3 to 1/2 the cost of a new replacement, and when you're done you'll have a reliable autopilot that, in some cases, may actually fly your Piper *better*. Most pilots, however, just pick away at repairs and solve the "problem of the day." Sadly, this is what gives legacy autopilots a bad name.
On a related note, if your autopilot is tired, there's a good chance your airframe and rigging is too. Autopilot technicians frequently find that the issue with an autopilot is often the result of poor aircraft maintenance. For instance, static systems with old plastic tubing that literally breaks in your hands will absolutely affect the performance of the altitude portion of your two-axis autopilot. The fact is most airplanes have not had their control system rigged or cables tightened in years! You'd be kidding yourself if you think such neglect wouldn't cause frustration in an aircraft with an otherwise normal operating autopilot. Autopilots should be aligned after repairs or parts replacement. This is frequently not done and can result in a "balky" autopilot.

Speaking of frustration, when it's time for autopilot repair or OHC, do your homework and take your aircraft to a shop that is qualified on *your* autopilot, especially if you have an older legacy system. Your local avionics shop that installs STEC systems may simply not have a handle on older Piper autopilots and that's not going to help your autopilot repair budget—or lower your blood pressure. You may have to travel a bit to get your aircraft in the hands of a shop that has the knowledge and experience to help you. Use the tools you have available to you (like forums and the Internet) to get a sense where you need to go to get things right. On that subject, don't just walk into an autopilot repair facility and tell them your autopilot doesn't work. You need to know your autopilot and its functions AND you must be able to identify the specific functions that aren't peforming. Otherwise, you're just wasting money while your tech blindly searches through the system looking for flaws.

As I have frequently mentioned in my articles, the cost of flying your own private aircraft has continued to rise and, at the same time, aircraft values (which went crazy!) are dropping. An autopilot plays a very important role in single pilot IFR flight and, unfortunately, the cost of maintaining your autopilot, especially poorly maintained or tired, old legacy units can be significant. Most pilots take the least expensive route to autopilot maintenance which is to fix "today's problem" as opposed to biting the bulletand going for that complete autopilot overhaul that will end up costing them more in the long run. The challenge of budgeting for an autopilot overhaul is only going to grow as pilots struggle with the pending ADS-B mandate. A wing-leveler in a VFR aircraft is nice, but a complex autopilot in an IFR platform is an important tool and much more than a luxury item. Its role to minimize pilot load in IFR can't be overstated.

To restate the overriding message behind this aritlce, owners must maintain their plane's autopilot if they're using it as an IFR tool. And, that too many pilots are discarding a good autopilot without understanding the financial benefits of a total rebuild vs. new replacement. I can't emphasize it enough—piecemeal repair of legacy autopilot components is the expensive way!

I'm regularly on the Piper Owners Forum ready and waiting to help you with your avionics and autopilot issues.

Until the next time…Happy and Safe "hands free" flying!