



OLD AUTOPILOTS

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Many general aviation aircraft are equipped with autopilot systems that are now 25, 30 or even 40 years old. Some of these older autopilots are surprisingly sophisticated, featuring advanced capabilities despite the fact that they were designed and built in the 1970s or 1980s. Unfortunately, autopilots don't usually age gracefully; we frequently encounter older systems that don't work properly and others that don't work at all. A serviceable autopilot should be expected to have similar attributes to those of a good co-pilot, in that it must be reliable and it must be capable of executing specific procedures to a prescribed standard. The more capabilities an older autopilot has, the higher the likelihood that at least some of the modes no longer function as they should. When an autopilot is found incapable of performing per the pilot operating handbook (POH) and/or flight manual supplement (FMS) the system must be considered unserviceable and potentially dangerous.

PROBLEM #1: NEGLECTED AUTOPILOT MAINTENANCE

Autopilot systems are often neglected when it comes to maintenance. Some of the probable reasons for this neglect are:

- Lack of awareness: Some aircraft operators are not proactive with autopilot maintenance. They tend to seek help only after an obvious hard failure, and they may not have noticed a gradual deterioration in system performance.
- Lack of knowledge: We regularly encounter pilots who have little or no knowledge of how their autopilot system is supposed to operate. If they don't understand it, they are unlikely to report issues.
- Lack of resources: Most installed autopilots have an applicable FMS and a specific autopilot operating

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handbook. One or both of these essential documents are frequently not available to the flight crew, which contributes to their lack of knowledge.

- Lack of capability: Many aircraft mechanics don't have the training, technical information or test equipment necessary to properly diagnose an autopilot problem.
- Lack of awareness: Aircraft owner/operators may not know where to take their aircraft for competent autopilot work.

We routinely encounter aircraft, which have been operating for many years, with little or no maintenance performed on their autopilot systems. By the time system repairs are actually requested, multiple problems are often discovered.

PROBLEM #2: INCORRECT AUTOPILOT MAINTENANCE

When autopilot maintenance is done incorrectly, the resulting situation can be much worse than a case of neglect. The following are just some examples of incorrect autopilot maintenance that we've encountered over the years:

- Wrong part number autopilot servo installed in aircraft
- Wrong part number circuit cards installed in autopilot computer
- Wrong tilt angle attitude reference gyro installed
- Wrong torque setting on autopilot servo clutch
- Incorrectly routed bridal cable
- Incorrect bridal cable tension (and/or incorrect primary cable tension)
- Wrong part number autopilot control panel installed
- Incorrectly adjusted pitch and/or bank limits
- Control motion transducer rigged 180 degrees out of phase
- Hydraulic pressure and return lines reversed at helicopter pitch servo
- Newly upgraded avionics system(s) incorrectly interfaced to autopilot

Each of the above maintenance errors was serious and potentially dangerous. We really wonder how they could have occurred; it seems likely that the work was done by unqualified maintenance personnel without access to the applicable maintenance publications. We have found the wrong part number (PN) servo installed on multiple occasions, and suspect that the installers ignored the servo PN and selected the replacement part based on the model number only. For example, the Honeywell (Bendix/King) model KS-270A pitch servo is available in a wide variety of configurations to match the unique performance characteristics of each particular aircraft it is installed in. The configuration (rotation speed, direction, etc.) is defined by the last two digits of the part number (065-0059-xx) which means that a KS270A pitch servo PN 065-0059-03 cannot be used in place of a KS270A servo PN 065-0059-01. In addition to servos, there are numerous other autopilot system parts that must specifically match the approved data for each particular installation. System configuration is critical for any autopilot system, but we do see a much higher incidence of wrong configurations in older aircraft. An incorrectly configured autopilot system will typically perform poorly, and may actually drive the aircraft to an unusual attitude, which could possibly lead to a loss of control.

PROBLEM #3: OLD AUTOPILOT MAINTENANCE CHALLENGES

Finding Capability: When an aircraft owner wants to repair an old autopilot system, they may discover that their favourite avionics facility is unable to help them. Not all avionics shops have the specialized capability to test, troubleshoot and repair autopilot systems; and those that do usually specialize in just a few system types. It is costly to add autopilot system repair capability and very difficult to justify for an older legacy system. At a minimum, an avionics facility

requires: (1) Current system service manuals; (2) Specialized test equipment/breakout panels with interface cables; (3) A suitably trained and experienced technician; and (4) Access to repair/replacement parts. For some older autopilots, the aircraft owner may find that there is no one with the required capability in their area of the country.

Factory Technical Support: It used to be that you could call up most of the system manufacturers and receive competent technical support, including helpful advice from knowledgeable product support specialists. It's a simple truth that now, due to the age of these systems, many of the factory experts have long since retired.


Parts Availability: The availability of repair parts varies considerably depending on the particular system. Where parts are no longer available from the manufacturer, they can sometimes be found on the surplus market, but the procurement process can be time consuming and costly.

Defining the Problem: The first challenge of any autopilot maintenance is to obtain a very clear and concise report of the discrepancy from the pilot or flight crew. It seems to be difficult for some pilots to understand the importance of this step. A note stating "autopilot not working" is completely inadequate; and, if additional information is not provided, this could lead to hours of inefficient troubleshooting. It's not uncommon to find that a reported autopilot defect is often completely external to the unit itself. Rather, it is often a symptom of a mechanical control problem, a trim problem, an HSI problem, or a GPS/NAV system problem. A test flight is highly recommended if the reported autopilot problem can't be reproduced on the ground.

Repair Cost: It can be time consuming (and expensive) to troubleshoot and repair an old autopilot, especially if it has been neglected for some years. Because of the interactive nature of autopilot systems, each discrepancy must be dealt with before carrying on with the overall system troubleshooting. A complex autopilot system that has been neglected for some time could have half a dozen or more discrepancies which can seriously complicate the troubleshooting process. This is not the kind of troubleshooting process that can be cost estimated in advance. It is possible that the cost to address all system discrepancies could approach that of a new system. However, some legacy autopilot systems have good capabilities, are still maintainable and may be worth repairing.

Replace it with a New System: For most aircraft, there are only a limited number of new autopilot choices. In some cases, the new systems don't provide any additional capability and may actually have less capability than the legacy system that is being replaced. The main advantages to installing a new autopilot are improved reliability, maintainability and safety.

THE FINAL WORD

Some of the older autopilot systems were well designed in the first place (Bendix/King KFC200, for example) and can often be repaired at a reasonable cost; however, some other systems are no longer considered economically maintainable. Owners should be aware that repairing an old autopilot system can get expensive, and the cost is usually unpredictable. 

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