

The Advantages of Commercial UAV Autopilots over Open Source Alternatives

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Small and large scale businesses are switching to open source software solutions (OSS) to create anything from application platforms to databases. Although OSS enthusiasts reap benefits in a variety of industries, devices that run on OSS can cause complications when installed in unmanned aerial vehicles (UAVs). Some of the key challenges UAV manufacturers face when incorporating OSS into their products are inadequate customer support, orphaned products, and less reliable systems.

OSS companies approach business differently than commercial companies. Their support is limited or nonexistent and they often lack funding for high-dollar yet necessary equipment. Moreover, OSS projects, although well intentioned, are often abandoned because developers are no longer available to support the products they design. UAV customers require high-reliability autopilots to safely carry out sensitive flight missions and transport valuable payloads. Therefore, customers and vendors alike seek out consistent and reliable products. Aviation OSS-based solutions often do not fit this bill.

MicroPilot, world leader in miniature autopilots for UAVs, gives its customers the best of both open source and commercial worlds. While some UAV autopilot vendors sell autopilots in a black box, MicroPilot autopilots provide *open architecture*. With this format, customers know exactly what is going on inside their autopilots. Consequently, UAV manufacturers can make intelligent decisions about how they design their airframes. In addition, its customers are not dependent on a UAV autopilot vendor to set up their unmanned vehicle. Nor do they need to pay for a vendor technician to come onsite each time a modification needs to be made.

Moreover, MicroPilot's customers do not have to reveal proprietary information. In fact, MicroPilot does not need to ever see their customers' vehicles. Lastly, open architecture gives MicroPilot's customers the ability to differentiate their

products. MicroPilot autopilots offer a wealth of features, which their customers innovatively combine to extend value to their end users.

On the subject of proprietary information, the two most common open source licenses are GNU General Public License (GPL) and GNU Lesser General Public License (LGPL), both of which state that any modifications made to the source code become public domain. The two most popular opens source autopilots both are licensed under (GPL); therefore, any attempt to modify the operation of these autopilots, in order to differentiate its functionality, for example, will be made available to the customer's competitors. On the other hand, when customers use an open architecture autopilot, such as those made by MicroPilot, customizations remain the customer's property.

Commercial UAV Autopilot Vendors Provide Comprehensive Technical Support and Service

Quality service is what concerns buyers the most when deciding whether to purchase a commercial or OSS product. Sixty-five percent of enterprise software customers polled said they prefer commercial software over OSS because of inadequate OSS service.¹ Although, OSS companies claim to have sufficient products, their ability to service their customers after installation is typically unsatisfactory or nonexistent.

For example, most OSS product vendors that offer technical support do not have an issue tracking system. Without this technology, much time is wasted updating staff each time a buyer contacts the vendor. Furthermore, OSS companies often cut costs by feeding tech support calls to their production development staff. This can leave customers helpless since technical questions are resolved more effectively by specialists. And unfortunately for the customer, OSS companies often save money by employing a small support staff.

When OSS support is nonexistent, UAV manufactures must rely on Internet forums for tech support. In this case, all details pertaining to a buyer's technical

¹ Matt Asay, *Why choose proprietary software over open source? Survey says!* October 2007; news.cnet.com.

issues are out in the open for anyone to read. As a result, customers and vendors both risk exposing critical details and privileged secrets to their competition when they use public forums for technical support. Although, this approach works for universities and people designing UAVs for recreational purposes, it is less than optimal for commercial UAV manufacturers.

Additionally, many OSS autopilot vendors do not provide training material such as user manuals and prototype manuals (used to create custom end-user manuals). In contrast,

MicroPilot offers full training programs, both offsite and at the MicroPilot Test Facility.

MicroPilot is also fully committed to its customers before, during and after a sale. Qualified technical staff can be reached by telephone or email during regular business hours. Furthermore, MicroPilot relies on issue tracking to better serve their customers. It also employs a separate and well-trained technical support staff who supports customers without divulging critical information.

With a wealth of customer support staff, MicroPilot is equipped to fill customer requests for onsite technicians. “At MicroPilot, we make it a point to confirm customer satisfaction and ensure procedures are in place to preserve our customers’ anonymity,” says Howard Loewen, MicroPilot President.

Commercial Autopilot Vendors are Generally More Established than Open Source Alternatives

Much time is needed to configure an autopilot for a UAV airframe. This includes rewiring harnesses, qualifying settings, flight testing, adjusting manuals, and configuring the autopilot to work with other flight systems. Due to the nature of the open source movement, UAV autopilots not bought up by a commercial company are often abandoned. The developers who originally conceived the design either move on to new projects or are hired by another company.

OSS companies are also often new ventures. If a manufacturer’s autopilot vendor disappears or is no longer available to support their product, buyers might be forced to switch their autopilot technology, or at the very least, required to take over maintaining their autopilots. On the other hand, MicroPilot has been supplying UAV autopilots for 15 years to 600 clients in 60 countries.

Moreover, no OSS UAV autopilot vendor is certified by the International Organization for Standardization (ISO). The ISO audits and registers companies, especially manufacturers. ISO 9001 certification establishes that companies maintain robust business processes, keep proper records and undergo audits.

MicroPilot uses a fine toothed comb to ensure all aspects of their company abide by the highest standards. In fact, MicroPilot is ISO 9001:2008 certified. MicroPilot is the only UAV autopilot vendor awarded with this ISO 9001 certification in the design and production of UAV autopilots and related accessories. This certification also guarantees quality checks. MicroPilot diligently identifies defects and takes corrective action where necessary.

Commercial UAV Autopilot Manufacturers Generally Invest in Production more than Open Source Companies

Although the open source model may work for nonprofessionals, most UAV manufactures cannot sufficiently fill their needs with OSS autopilots. OSS autopilot manufacturers, for the most part, do not have the capital to invest in production. Such investments include overnight build process tools, calibration, automated assembly, and simulation tools.

Error Checking Tools

Overnight processes ensure errors from the previous day are caught quickly. MicroPilot's overnight build process compiles its entire code base nightly, and its overnight regression test performs hundreds of tests. MicroPilot also employs a static code analysis tool, which looks for specific types of errors. And it uses logic analyzers during testing to observe digital systems.

Automated Calibration

During production, sensor calibration eliminates varying signals and temperature. Although, some manufacturers calibrate their equipment by hand, automated calibration is quicker and more accurate. Because a computer automated process does not *forget steps*, it makes more accurate measurements.

Furthermore, automatically testing the functionality of a dozen or more boards, simultaneously, allows vendors to cope with peaks in demand. Automated

calibration solutions are costly; however, they cannot be excluded. MicroPilot has invested almost a million dollars in automated calibration solutions and relies on calibration technology to further improve the quality and throughput of its production process. In addition, MicroPilot recently added a \$300,000 multi axis rotation table with a built-in temperature chamber to its production line.



Figure 1: Two-Axis Motion Simulation Table System by Ideal Aerosmith

MicroPilot is a commercial company with a business model that ensures significant investment in tools and equipment. The OSS business model is quite different. Although, few upsides exist for buyers, such as lower pricing, the commercial model produces a different end product due to the tools and equipment used to produce their products.

Simulation Tools

Simulation tools are another investment many OSS UAV autopilot manufacturers are not able to make. This is an important factor to consider as simulators are invaluable tools autopilot companies use to develop reliable and safe products. Software in the loop (SIL) simulation tool links autopilot code to a flight simulator. MicroPilot has used an SIL since its inception more than fifteen years ago. With this tool, the entire system is tested on a single computer. SIL and quasi hardware in the loop (qHWIL) simulators provide valuable training tools for MicroPilot's customers.

TrueHWIL simulators take simulation to an even higher level. “Unlike existing qHWIL simulators that use a serial communications port to transmit sensor information to the autopilot, the trueHWIL uses analog-to-digital converters to electrically simulate all sensor signals,” reports Vitaliy Degtyaryov, lead developer of MicroPilot’s trueHWIL. “This tool provides the highest possible simulation fidelity, since the exact same code executes in the simulated autopilot as in the real autopilot.” The trueHWIL gives MicroPilot customers access to a validation tool that is unmatched in the industry.

Insurance Coverage

Essential insurance coverage is one more cost many OSS UAV autopilot manufacturers often forgo. If an autopilot vendor goes out of business because they could not afford to defend themselves against a lawsuit or recover from a fire, the buyer is left with an unsupported autopilot. In this event, UAV manufacturers are often forced to switch autopilot vendors, costing them time and money. MicroPilot holds operational liability, product liability, insurance for loss of business assets/inventory and business interruption insurance.

High-Tech Commercial Products Keep UAV Manufacturers Competitive

MicroPilot’s fifteen years in the UAV autopilot industry and technological advancement allow them to help their clients’ stay competitive. For example, time-to-market is critical. OSS autopilot manufacturers may not be able to roll out products for UAV companies quickly enough. Many issues can hold up OSS UAV autopilot manufacturers. One being, finding replacements for obsolete components. Time is of the essence; therefore, waiting for parts for an uncompleted UAV might leave UAV manufacturers’ customers going elsewhere. Because of MicroPilot’s years of experience, they have the know-how to deal with obsolete components.

OSS UAV autopilots’ circuit boards typically have RAM and flash memory installed directly on the microcontroller chip. Although this simplifies the design of the circuit board, it limits the amount of RAM to a few kilobytes. This limited RAM may be sufficient for flying an aircraft autonomously; however, it is not enough memory to accommodate all the features used in a typical UAV. In contrast,

MicroPilot UAV autopilots contain many megabytes of both RAM and flash. Separate RAM and flash chips are installed outside the microprocessor.

MicroPilot sets the technological benchmark in the UAV autopilot industry. In fact, MicroPilot was presented with the *All Star Award for Excellence in Technological Innovation* by the Manitoba Aerospace Association.

UAV Manufacturers Count on MicroPilot for their Autopilots

UAV manufacturers who experiment with OSS-based autopilots are often stuck with inadequate customer support, orphaned products, and less reliable systems. Choosing a stable commercial company with superior technical support saves UAV manufacturers costs in the long run. MicroPilot, established in its industry as the leading UAV autopilot vendor, hires experienced personnel. Moreover, MicroPilot fills its orders reliably and on time, with the help of automated calibration. Finally, its state-of-the-art development, production, and testing facilities serve numerous satisfied clients worldwide. UAV manufacturers count on MicroPilot.

About MicroPilot

With 600 clients in 60 countries, MicroPilot is the world leader in miniature autopilots for UAVs and MAVs. MicroPilot offers a family of autopilots weighing 28 grams that can fly fixed-wing, transitional and helicopter UAVs. MicroPilot provides complementary products such as the Xtender SDK, trueHWIL, payloads, and catapults.

MicroPilot's low cost MP2128^{HELI} flies helicopters, VTOL and fixed wing aircrafts. For triple redundancy, MicroPilot produces the MP2128^{HELI3x} for helicopters and MP2028^{3x} for fixed wing. Just released MP-trueHWIL Matlab-based hardware in the loop electrically simulates all sensors, providing the highest fidelity autopilot simulation available.

For more information contact info@micropilot.com, or visit www.micropilot.com.