MicroPilot®

World Leader in Miniature UAV Autopilots

Outsourcing UAV Autopilots: How UAV manufacturers stay competitive with MicroPilot

White Paper by Sarah Vallely

When companies ask the inevitable question, *Should we look for a vendor or produce this in-house?*, executives had better meticulously run their numbers. Many factors impact this decision, and some are more subtle than others. Unmanned Aerial Vehicle (UAV) manufactures often face this same question, especially when it comes to the vehicle's autopilot.

When manufacturers find themselves contemplating the outside vendor/in-house dilemma, they search for supporting facts, educating themselves on their options. After considering the costs associated with designing an original UAV autopilot plus the additional expenses needed to support its design into the future, many UAV manufacturers decide to work with an autopilot vendor. Thorough research shows typical UAV manufactures can cut costs significantly by working with a quality vendor. This approach offers the advantage of industry discounts and production resources enjoyed by autopilot vendors.

The level of expertise a UAV autopilot vendor acquires over time should also be factored in. For example, MicroPilot's years of experience yields products with powerful features. UAV manufacturers also benefit from MicroPilot's experienced staff. Moreover, these manufacturers need to consider the responsibilities that fall upon their shoulders if they build and maintain an autopilot solution in-house. Choosing MicroPilot alleviates manufactures from many industry responsibilities.

Lastly, MicroPilot gives its customers added bonuses that most often cannot be accomplished in-house. These include customer support, access to industry experts, and a product line covering a wide range of customer requirements.

This white paper covers factors involved in purchasing UAV autopilots from a vendor versus building them in-house. Details on how MicroPilot offers UAV manufacturers the best value are also exemplified.

Minimizing Cost

When UAV manufacturers develop their own autopilot solutions, they incur considerable costs and risks, not to mention time spent. The monetary advantages of purchasing an autopilot from a vendor include the vendor's access to quantity discounts and implementation of efficient production technology.

Industry Economies of Scale

MicroPilot obtains components for its autopilots at a fraction of the cost quoted to other companies. This is because MicroPilot orders in quantity. "MicroPilot continues to grow our economies of scale. This is reflected in better pricing of our products and better value for our customers," says Howard Loewen, MicroPilot President. To date, MicroPilot has never increased UAV autopilot prices, in spite of ongoing improvements. In fact, MicroPilot has decreased prices over the past three years in response to significant devaluation of the U.S. dollar.

Automated Calibration

When UAV manufacturers learn about quality autopilot production, they understand the value of calibration. For example, sensor calibration is necessary because the sensor's output varies from one sensor to another, hindering performance. In addition, sensors are affected by temperature, making temperature calibration essential.

Although, some manufacturers calibrate their equipment by hand, automated calibration is quicker and more accurate. A computer automated process does not *forget steps,* therefore 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 testing overall is a better process than manual testing.

Without a system capable of calibrating multiple devices simultaneously, production is compromised. 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 purchased a $300,000 multi axis rotation table with a built-in temperature chamber for its production line.

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

Automated Processes

When UAV manufacturers delve into developing autopilots in-house, they need to prepare for automated production costs. A highly specialized company such as MicroPilot can invest heavily in its production facility. Specifically, they have resources to acquire necessary equipment and software.

Not only is MicroPilot's autopilot production completely automated, save the final test, many of its other processes outside of production are automated. MicroPilot has spent on an overnight build process, overnight regression test process, and on static code analysis tools so their clients do not have to. MicroPilot has fashioned over a period of several years, a system which allows the company to produce quality products in large quantities. The investment never ceases. Loewen says, "We are devoting more funds to developing new features to guarantee our products will be even more powerful in the future."

When MicroPilot launches an autopilot into the UAV market, it forecasts its sales. Therefore, development costs, including funds for calibration technology and automated production equipment are spread among numerous clients.

Expert Focus

Certain products warrant expert focus, especially technical solutions. *Expert focus* allows vendors to provide reliable products with powerful feature sets, maintain continuous improvement, and employ large staffs who collaborate to tackle one specific goal. MicroPilot achieves this level of expertise and hits all these targets. They have gained knowledge and experience that cannot be bought.

Proven Products with Powerful Features

MicroPilot's technological experience allows this autopilot vendor to launch competitive products. In fact, MicroPilot has sold several thousand autopilots to more than 600 clients in 60 countries. Typically, UAV Manufacturers face challenges along the way when they develop autopilots in-house, due to overwhelming learning curves.

UAV autopilots weighing 28 grams, with 24 servos and in-flight programming, boasting full autonomous launch and recovery are not designed by engineering teams overnight. MicroPilot's extensive background benefits its customers by providing successful implementation of fully integrated sensors and GPS, and up to 32-channel 24-bit ADC with twelve input ranges. Hours of testing allow MicroPilot to pull off failure handlers, payload control, and user defined telemetry. Additional features MicroPilot has mastered and installed in its UAV autopilots are:

- Remote Serial Port Support
- Waypoint list (incorporates powerful scripting commands)
- In-flight waypoint move, insert, delete and modify
- Fully Open Architecture
- Data log with viewer
- Power on Self Test
- User programmable holding patterns
- Multi UAV support
- Advanced video Features
- Dead reckoning
- Support for multiple GCS to single MP2x28^{g} communications
- Change Synchronization among multiple GCS's
- Software in loop simulator with integrated training mode
- trueHWIL, the highest fidelity simulator in the industry

Validation and Integration Tools

There is more to a UAV autopilot than meets the eye. In addition to its feature list, MicroPilot invested in developing a series of autopilot validation and integration tools to help UAV manufactures bring new products to market. For example, a gains setting program simplifies the gain tuning process. Software/quasi-hardware in the loop simulators help speed learning curves and integration processes. MicroPilot offers a trueHWIL – the highest fidelity simulator available in the industry. In addition, a vibration analyzer is available that captures vibration data and allows UAV manufacturers to easily analyze vibrations. As well as, a datalog viewer used to capture and analyze datalogs from the autopilot.

Extensive Staff

The size and depth of its staff is one more reason MicroPilot has become the leading UAV autopilot vendor in the world. Typically in-house autopilots are developed by one or two engineers and a few production specialists. All too often, only members of the development team are privy to internal operating details. This raises issues concerning backup for those on vacation and general staff turnover. On the other hand, MicroPilot employs a team of developers who are all intimately familiar with day-to-day development.

Continuous Improvement

Because MicroPilot's staff is 100% dedicated to designing and producing UAV autopilots, they maintain the focus and resources to focus on constantly improving their products' design. Smaller autopilot manufactures and larger UAV manufacturers who employ a team to design their own solutions are often unable to dedicate a high level of focus. MicroPilot is expanding its staff of experts, including hiring more developers. In addition, they work with an engineering service to design and lay out the unique circuit boards used in their autopilots.

"We are always working on our next generation autopilot – one every couple years. We fund ongoing projects to significantly increase the functionality of our autopilots," says Loewen. MicroPilot's recent accessory advances include trueHWIL, making it possible to extend beyond standard autopilot functionality.

In a high-paced market place, taking advantage of MicroPilot's staff and continued technological improvements translates into one pot-of-gold advantage - UAV manufacturers get their products to market before their competitors.

MicroPilot executives know time is of the essence and serve their customers with this in mind.

Sharing the Load

Producing a 28-gram UAV autopilot with the features MicroPilot provides does not come without a hefty set of responsibilities. MicroPilot takes on these responsibilities so its clients can focus on what they do best. Choosing a vender such as MicroPilot, rids UAV manufactures of risks associated with producing autopilot technology. These include redesigning circuit boards when parts are discontinued and keeping up to date with industry standards and certifications.

Keeping Pace

The electronics industry grows and changes at lightning speed. What was cutting edge last year is old news this year. Although, exciting for the average consumer who anticipates each advance, innovations can create obstacles for manufacturers. For example, discontinued electrical components can throw a wrench in UAV autopilot production. Typically, electrical components stay in production for only a few years.

Discontinued components require, at a minimum, engineering time to specify and test a replacement component. At worst, whole circuit boards need to be redesigned to incorporate replacement parts. UAV manufacturers can avoid these headaches and responsibilities if they purchase their autopilots from an outside vendor. MicroPilot has the experience and know-how to deal with obsolete components. Replacing outdated components is often a high hurtle for smaller and less specialized companies to overcome.

Industry Standards and Certifications

Much can be said for specialization. For example, in the medical industry, the sick and injured seek out (or are referred to) specialists. This is because a general practitioner cannot keep up to date with all the latest research and breakthroughs relating to health, no matter how smart they are. This same concept applies to the UAV autopilot industry. MicroPilot is an expert when it comes to UAV autopilots. The people behind the name do their homework, and they do it diligently.

Not only does MicroPilot keep up with the latest autopilot development and production techniques, MicroPilot uses a fine toothed comb to ensure all aspects of their company abide by the highest standards. MicroPilot is ISO 9001:2008 certified by the International Organization for Standardization, which regularly audits MicroPilot to ensure that they maintain robust business processes, keep proper records and implement a system of continuous improvement. MicroPilot also checks its production equipment's calibration, maintains backups, and relies on documented procedures.

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.

"Before UAV manufactures decide to build their autopilots in-house, they should seriously consider what's involved regarding changing production protocols – practices such as phasing out discontinued parts, maintaining production-line calibration, and following industry specific standards laid out by ISO," asserts Loewen.

Added Bonuses

One more advantage to purchasing UAV autopilot solutions from MicroPilot versus producing them in-house is the additional perks offered. These include knowledgeable customer support, custom design, and a full array of products to satisfy customers' requirements.

Customer Support and Experts on Demand

MicroPilot provides a range of technical support for their customers' peak needs. In addition to its customer support staff, MicroPilot uses a comprehensive issue tracking system. MicroPilot also fills requests for onsite technicians. If its customers require custom hardware/software or integration assistance, MicroPilot professionals can fill these needs.

MicroPilot enjoys a productive working relationship with its customers and has demonstrated its commitment to its customers by making many changes to its software as per their customers' request. Full training programs, both offsite and at the MicroPilot Test Facility, are also available.

Scale of Products

MicroPilot is a full-service vendor offering a family of autopilots to accommodate its customers' future needs. This means, UAV manufactures can purchase all the software, hardware and accessories they need from one company. Moreover, because of their products' design, customers only need to learn the technology once. Think iPhone, iMac and iPod. Once users learn one interface, the others come easily. Likewise, MicroPilot equips its customers to use *all* its products after learning how to install and operate only one. Also, MicroPilot offers an upgrade path so UAV manufacturers can grow and adapt at a fraction of the cost.

Come Fly with Us

MicroPilot headquarters are surrounded by 40 acres of farm land. Test flights occur daily, taking advantage of ambient temperatures from -40°C/-40°F in winter to 35°C/95°F in summer. A variety of wind conditions also offer the weather diversity needed to sufficiently test UAVs. MicroPilot's airfield operates under a Transport Canada Special Flight Operations Certificate. What's more, these facilities are available to MicroPilot's key clients.

MicroPilot's competitive edge gives its customers the ROI they need to thrive within their markets. Automated calibration improves reliability and ensures MicroPilot can accommodate their customers' peak demands. MicroPilot's design updates along with its range of autopilot products allow UAV manufacturers to stay competitive. MicroPilot has invested valuable resources and accumulated oceans of knowledge about building the ultimate UAV autopilot - so their clients do not have to.

About MicroPilot

With 600 clients in 60 countries, MicroPilot is 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 as well as complementary products such as the Xtender SDK, our trueHWIL, payloads, and catapults.

MicroPilot's low cost MP2128^{HELI} flies helicopters, VTOL and fixed wing. For triple redundancy, 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.