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IS&S BUILDS REPUTATION FOR DELIVERING INNOVATIVE SOLUTIONS AND SUPPORT

STORY BY DALE SMITH



When you name your new company Innovative Solutions & Support, you've set some extremely high standards for the company to live up to. And that is precisely what Geoffrey Hedrick, IS&S's chairman and chief executive officer, meant to do when he started the company in 1988.

"The company isn't called Innovative Solutions and Support by accident," Hedrick said. "From the beginning, we have been focused on solving problems that require unique and truly innovation solutions. "But having even the most innovative product is about half the solution. The other piece is providing the support customers need to ensure that equipment will continue to provide the solution they are looking for.

"Whether products or support, we don't believe that doing 'me-too' work lends any strength to our competitive posture. We focus on finding ways to solve problems that others had not thought of."

Although it sounds good on paper, Hedrick stresses that even the best innovation can miss the mark. Avionics is a fast-moving target.

"We started IS&S by patenting a new high-resolution CRT with beam indexing for CAD workstations," he

said. “It worked well, but unfortunately, that’s the time when LCDs were just coming into the market. It was clear that there wasn’t a future in CRTs. But I knew the avionics business pretty well. We shifted our focus and entered into a program to develop a replacement servo-pneumatic altimeter for the U.S. Air Force and Navy.

“Our solution featured carbon composite gear plates and composite gears – pretty innovative for the early 1990s. They had to withstand up to 9G operation, a 22G shock, and operate up to 80,000 feet – with less than 100 feet of error. It basically had to do what no altimeter had done before. It did. And we won the contract and delivered several thousand of the altimeters to the Air Force and Navy.”

While IS&Ss new altimeter met, and often exceeded, all of the military’s requirements – including a lower cost – there was one thing that put the unit over the top.

“We were doing a reliability demonstration, and there was a failure in the environmental testing chamber,” Hedrick said. “It filled with liquid nitrogen, and all of the instruments instantly plunged to minus 192 degrees. It froze them solid. When we managed to thaw them to minus 55 degrees, they all started working fine. The military was more impressed with that than anything else we had accomplished.”

Fortunately for IS&S, this was also the time when the Federal Aviation Administration’s reduced vertical separation minimum came along, and the company’s new altimeter met all of the mandate’s requirements.

“We sold that unit to a variety of aircraft OEMs in the commercial and business aviation markets,” Hedrick said. “At the time, we also had over 60% of the world’s aftermarket business. It was a very successful program.”

Quick-change cockpit solution

Of course, altimeters weren’t the only innovative solutions IS&S was working on. Knowing that cockpit cathode-ray tubes were on the way out, Hedrick and his engineering team set out to create a liquid-crystal display upgrade path for legacy EFIS installations.



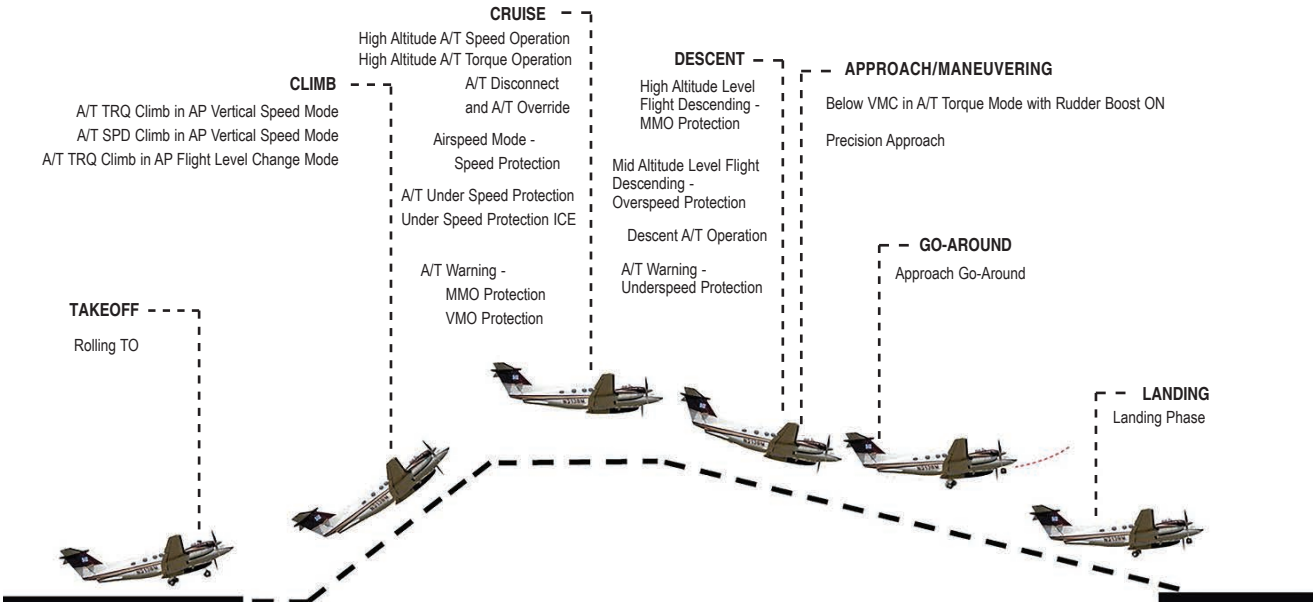
“We bought a Pilatus PC-12 and set out to develop a large-format upgrade for that aircraft,” he explained. “We used a COTS (commercial off-the-shelf) LCD. It was the same display that Apple was using in its computers at the time. We also started a major upgrade program with American Airlines to replace the CRT

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OPPOSITE PAGE, TOP: IS&S’s Cockpit/IP Flat Panel Display System for Boeing 757/767 offers a cost-effective upgrade path from obsolete CRTs to new 10-inch flat panel displays.

OPPOSITE PAGE, BOTTOM: IS&S ThurstSense Autothrottle is the first-ever, full-regime autothrottle system for Pro Line 21, and Collins Fusion-equipped King Air B-200 and B-300 series aircraft.

ABOVE: The IS&S NextGen upgrade for the Pilatus PC-12 features two 10-inch LCDs for the PFD, 15-inch MFD, and the optional ThurstSense integrated autothrottle system.



IS&S's patented ThurstSense full-regime autothrottle allows the pilot to automatically control the power setting of the engines throughout all phases of the flight, which greatly reduces pilot workload.

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displays in the Boeing 757/767 fleet with new LCD panels. It was a large program.

"While they are very nice displays, the magic to our solutions weren't only the 10-inch replacements, but the compelling thing was that we made the upgrade installations as easy as possible for the operators. Streamlining installations saves time. When you're talking an airliner or air cargo aircraft, you're losing tens of thousands of dollars every day that airplane sits on the ground."

Hedrick said that the true innovation in the cockpit upgrade started when they totally reengineered the installation process to reduce line-replaceable units and wire count in the airplane.

"We had one installation done – remove 22 original LRUs –- and replace it all with our new LCD displays in under 24 hours," he said. "At the time, the competitor's 10G system took at least four weeks to complete. At $50,000 to $75,000 per day, that's a lot of lost revenue for their plus 10G system.

"We're still doing a lot of freighter conversions today. We've upgraded American Airlines' fleet, as well as 757s for FedEx. We've also developed panel and engine display upgrades for Lockheed C-130s, and we have engine instrument upgrades for aircraft ranging from PC-12s up to 747s."

He added that IS&S won a military contract to upgrade 584 Air Force KC-135 aerial tankers with new systems, which included new air data computers, altimeters and airspeed indicators. If you're getting the idea that IS&S has put a full-on effort to develop solutions for the retrofit market, you are correct.

"We've focused on retrofits for a very good reason," Hedrick said. "When the aviation industry hits a down cycle, they stop buying new airplanes. But they spend money on upgrading their current fleets. Then when they have an upturn, they want new airplanes, but the OEMs can't deliver them fast enough. So again, they upgrade their current aircraft. The retrofit market wins at both ends of the spectrum."

Panel innovations for business and general aviation

It's no surprise that IS&S hasn't limited its panel upgrade innovations and expertise to just big-box military and commercial applications. The company also offers an array of panel upgrades for PC-12s, Citation series, and King Airs.

"We had an earlier solution for Citations, and while it was very nice, it required massive rewiring of the aircraft," Hedrick said. "That was very expensive, and in many cases, it cost more than the airplane was worth. It was never the success we or Cessna had hoped it would be."

The company ultimately used what it had learned from its successful upgrades for the commercial and military markets and created a second-generation Citation upgrade that is more aligned with the company's "a

simple solution is a better solution" philosophy.

"Our LCD flat panel upgrades for the PC-12, Citation, and King Air are basically the Avio avionics from the Eclipse 500 – 10-inch on the right and left sides with a 15-inch display in the middle for the engines and radar," Hedrick explained. "It's a very nice upgrade. I think we've done about 250 of them so far, and we expect to see a lot more.

"In some systems, we can also integrate our new ThrustSense Autothrottle to have full 4D navigation capabilities. Vertical and lateral navigation, RNP (required navigation performance), LPV (localizer performance with vertical guidance), as well as the required time of arrival. It's quite a valuable and safety-enhancing upgrade for these aircraft."

Innovative solutions for safety

Along with providing cost-effective and capability-enhancing upgrades for a wide array of aircraft, the company has also channeled its considerable resources on developing the aforementioned full-regime autothrottle system for the Pilatus PC-12 and Textron King Air series of turboprop aircraft.

"Right after we purchased the Pilatus, I decided then to develop the autothrottle system, but it was a lot easier said than done," Hedrick said. "For the next several years, we worked on it until we came up with a very simple, retrofittable actuator that is truly fail-safe. We put it on our airplane, and it works perfectly."

According to the company, its patented ThrustSense full-regime Autothrottle provides automatic power management from takeoff to touchdown, including go-arounds. In addition, the system protects the engine against operator-induced speed exceedances, engine over-torque, and over-temp. All of which greatly enhance the safety and operational value of the aircraft.

"We pride ourselves in delivering truly innovative and unique solutions to problems," Hedrick explained. "For example, the Autothrottle features our patented Guard Mode that lets you manage the power manually, but the system will automatically keep the engine where it needs to be for that phase of flight. If you advance the throttle to a point where it will over-temp or over-torque, the system will automatically push the power to a safe zone. ThrustSense also provides electronically controlled detents and a PCL brake.

"It's the same if you're on approach and slow the airplane down too much. It will automatically sense the loss of airspeed and advance the throttles to maintain a safe maneuvering speed. The Autothrottle will also maintain IAS, Mach, or torque and take speed commands from the FMS for integrated VNAV."

"ACCORDING TO THE COMPANY, ITS PATENTED THRUSTSENSE FULL–REGIME AUTOTHROTTLE PROVIDES AUTOMATIC POWER MANAGEMENT FROM TAKEOFF TO TOUCHDOWN, INCLUDING GO–AROUNDS. IN ADDITION, THE SYSTEM PROTECTS THE ENGINE AGAINST OPERATOR–INDUCED SPEED EXCEEDANCES, ENGINE OVER–TORQUE, AND OVER–TEMP. ALL OF WHICH GREATLY ENHANCE THE SAFETY AND OPERATIONAL VALUE OF THE AIRCRAFT."

Hedrick also explained that while he and his team were initially developing the ThrustSense Autothrottle, they also looked into developing a fully autonomous landing system for the big Pilatus single.

"When we started looking at autoland for the PC-12, we realized that the reality of it is that very few fatal accidents are actually due to the incapacitation of the controlling pilot," he said. "It's a much smaller number than the catastrophic loss due to pilots getting too slow. The Autothrottle guards against that."

With the success of the ThrustSense system for the single-engine PC-12, the company turned its attention on using the technology to aid multiengine pilots.

"Our new ThrustSense Autothrottle with LifeGuard has been created to solve the ongoing problem of catastrophic upset that can occur when you lose an engine on a multiengine turboprop," Hedrick explained. "It solves the VMCa problem."

As a refresher: VMCa stands for velocity-minimum control (airspeed). That happens when a multiengine aircraft suffers the failure of one engine. While trying to maintain altitude, the pilot pulls back on the yoke, dropping the airspeed to the point where control of the aircraft is lost.

"We bought a King Air to use for that program," he added. "We found that faced with this situation, pilots can inadvertently pull back on the yoke resulting in a drop in airspeed below VMCa."

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As Hedrick explained, IS&S's patented LifeGuard technology provides critical VMCa upset protection by automatically maintaining the maximum safe thrust produced by the "good" engine. Doing that minimizes the chance of the pilot trying to climb too aggressively and subsequently lose control.

"Our real-time analysis of loss of control due to asymmetric thrust and a sudden loss of airspeed of as little as 5 knots per second showed that by maintaining the maximum safe thrust of the operating engine, the pilot can maintain heading with the foot on the rudder on the side of the good engine and the airplane will stay straight," he said. "No matter how slow you go, the airplane will go straight and level to the stall. Of course, our ThrustSense Autothrottle will sense the loss of airspeed and automatically advance power on the good engine to help prevent the stall warning.



IS&S is very active in the legacy air transport and military markets. One of its more popular upgrades replaces legacy mechanical flight and engine instruments with the new-generation Flat Panel Display System on legacy Lockheed C-130 aircraft.

"It keeps the pilot in control and the airplane right side up. Even the best pilots can get into this situation. Our innovative technology provides better control and safer operations.

"Textron has shown great initiative and trust by certifying our ThrustSense Autothrottle with LifeGuard protection as a standard feature on the new-generation King Air 260 and 360. I believe they're the only factory-new turboprop airplanes in the world with VMCa mitigation. We're also offering the system as a retrofit solution to other legacy King Air models through Textron service centers and select MROs. The system integrates with the existing throttle quadrant, so installation and operations are very simple."

Like with the ThrustSense Autothrottle for the PC-12, the twin-engine version provides a host of features, including FADEC-like engine protection, over-torque, and under-torque protection, under- and over-speed protection, and more.

"You can fly the airplane the way you want, and the system will protect you as much as technology can," Hedrick said.

As you would expect, because of the safety-enhancing benefits of the ThrustSense technology, the IS&S team is hard at work developing systems for other popular twin- and four-engine turboprop aircraft.

You can't spell support without the second 'S'

As he mentioned earlier, Hedrick stressed that providing exceptional support to its customers, avionics shops, and MROs is part of the company's DNA.

"That commitment was, and is, a critical part of who we are," he said. "Support is integral to making sure that our products deliver the solutions customers expect. We work very closely with our shops to help make our installations as easy as possible."

While the recent COVID-19 pandemic has brought virtual meeting tools into aviation and avionics, helping customers via virtual technology is nothing new to IS&S. Hedrick shared a story of how, in 2001, IS&S first used a camera taped to a technician's cap so engineers could get a peek of what was happening during an installation. And today, that capability is more valuable than ever.

"We recently helped with a retrofit of a King Air panel in Australia without leaving our facility here," he stated. "We couldn't travel there, so we set up our own Zoom-style virtual network and used video to help them through the entire installation a half a world away. I think they did the whole upgrade in three or four days. It was amazing.

"It just brings home to everyone here the need to fully document every process every step of the way. Sometimes, we can forget the small details.

"I think the reason we've been so successful with our variety of projects and customers around the world is we do what others can't. I'm so proud of our engineers and everyone on our team. I'm constantly impressed with what they are able to do. They are the true innovators." ❑

To learn more about IS&S, visit innovative-ss.com.

PILOTS: FLY YOUR AIRPLANE!

When operating in ThrustSense's manual mode the pilot maintains unhindered control of the aircraft's thrust with the throttles. ThrustSense activates to protect against over-torque, over-temperature, excessive airspeed or under speed stall and then returns to monitoring mode. Electronically adjustable detents covering entire flight envelope can be programmed to emulate NextGen aircraft operation.



ThrustSense®
Autothrottle with LifeGuard™ Protection
Making Safer Flying Simple

Rudder boost or a yaw damper cannot alter or mitigate the VMCa loss of control. Only the patented IS&S ThrustSense® auto-throttle system with LifeGuard™ can protect against catastrophic loss of control all the way to stall, while automatically maintaining maximum safe power.

- Airspeed, Mach and Torque control for smoothest transitions
- Automatic torque adjustment for altitude during climb
- Electronically adjustable throttle brake
- Easy installation, short downtime with no structural modifications

Available on Beechcraft® King Air® 260 and 360 aircraft and for retrofit on all certified 200/300 cockpits through Textron Aviation Service Centers or your preferred Service Center.

Available for retrofit on Pilatus PC-12 Legacy and NG through authorized Service Centers.

Contact Tom Grunbeck, Director of Autothrottle Programs at 484.502.6658 or tgrunbeck@innovative-ss.com

Innovative Solutions & Support
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Scan here tor more information and sales contact

Scan here to view the VMCa protection demonstration video