Transponders
Buyer's Guide

BY PAUL NOVACEK

COMPARISON CHART on pages 76 & 77

The venerable transponder originally was developed in the 1940s for the wartime need of identifying friendly aircraft from adversaries. Then called an IFF (identify friend or foe), the transponder has evolved into a vital part of our air traffic control system. Without transponders, ground controllers wouldn't know where anyone was, and the chaos soon would result in aluminum rain.

Air traffic control (ATC) facilities use both primary and secondary radar systems. The primary system uses the big dish antenna seen rotating atop a tower. A high frequency and very strong signal is sent into the surrounding sky, only to return when bounced off objects. Then, this reflected echo is analyzed so an object's direction and distance can be displayed on a big round indicator screen. But this primary radar technique has many limitations because it not only detects aircraft, it also detects trucks, trees and mountains.

Step in the secondary surveillance radar system, otherwise known as the air traffic control radar beacon system or ATCRBS. This system uses a smaller directional antenna mounted atop the big rotating dish. This secondary radar antenna sends out a series of pulses asking all aircraft to send a message back. This is where the transponder earns its keep.

The ACSS RCZ-852 Mode S diversity transponder is optimized for regional, corporate aircraft and helicopters.

The aircraft transponder listens for these pulses on a frequency of 1030 MHz. The transponder circuits determine what kind of information the ground station wants, then transmits back a series of pulses on 1090 MHz. Those series of pulses contain information, and depending on what type of information is requested, the transponder sends either the squawk code (Mode A), the pressure altitude (Mode C) or the coded aircraft identification (Mode S).

A word about Mode S capability: The collision avoidance system TCAS II (ACAS II in Europe) allows nearby aircraft to communicate with each other and arrive at a conflict resolution, taking each out of the other's path. The decision is made electronically for one aircraft to climb while the other is commanded to dive. All this autonomous communication between opposing aircraft is done over the Mode S transponder data link. Therefore, all TCAS II aircraft must have Mode S transponders.

Mode S offers more, however. A substantial upgrade in technology over the standard ATCRBS, the Mode select beacon system (Mode S) was designed to do three things: provide plane-to-plane TCAS II communication; allow two-way electronic connections for ATC communications; and provide traffic information service (TIS) from FAA ATC radar systems.

TIS gives pilots access to information on up to seven nearby aircraft, including each airplane's relative location, direction of flight and relative altitude. This data-linked traffic information then is presented in real-time on a panel moving-map display.

Avionics designed for large and air transport aircraft gener-

ally combine the entire avionics suite into a completely integrated system. Although the transponder typically is a separate remotely mounted unit, its integration into the entire system prevents any meaningful price comparisons. Therefore, this Buyer's Guide focuses on transponders designed for retrofit or original equipment in general aviation, corporate aircraft and helicopters.

The accompanying chart offers a brief description and starting price for each unit.

Aviation Communications & Surveillance Systems

A joint venture company of L-3 Communications and Thales, ACSS is located in Phoenix, Ariz. The company designs, manufactures and supports a full line of avionics for regional airlines, business aviation, general aviation and military customers, as well as all aircraft operating in the former Soviet Union. Thales Avionics is the exclusive sales and support agent of ACSS products to commercial air transport customers operating Airbus and Boeing aircraft.

The ACSS RCZ-852 is a full-featured Mode S diversity transponder currently flying on more than 2,500 regional and business aircraft. Its small, lightweight package is optimized for regional and corporate aircraft as well as helicopters, and is easily compatible with all currently available TCAS I and TCAS II systems. Extensive BIT (built-in test) ensures approximately 90 percent of the circuitry is tested during system operation.

Intended for the air transport market, the bigger XS-950 also is a full-featured Mode S transponder poised for future growth. More than 4,000 XS-950 transponders have been delivered to more than 100 operators worldwide since the product debuted in 1996.

The XS-950 Mode S transponder is easily upgradeable for tomorrow's technology requirements. Major functionality upgrades, such as ICAO Level V data link or pending United States transponder security modifications (also known as the hijack mode), are easily accomplished with software-only changes. Both the RCZ-852 and XS-950 have all the required functionality for ACAS II mandate compliance, European-enhanced Mode S, and ADS-B.

For more information, contact ACSS at 623-445-7070 or visit www.acssonboard.com.

Becker Avionics

The German manufacturer Becker Flugfunkwert GmbH was founded in 1956, and it brought the world's first transistorized single-block airborne receiver into the market. As technology developed, the company produced a comprehensive, high-quality range of communications and navigation products, which are used all over the world in military and civil aircraft.

The Becker ATC-3401 is a complete Mode A/C transponder housed in a single, compact Dzus-mounted unit certified for unrestricted service to 62,700 feet. It displays the squawk code in its left window and its operating mode or flight level altitude in its right window. A stored VFR code, such as 1200, can be recalled quickly with the VFR push button. To facilitate dual transponder installations, provisions are included for automatic transfer of one transponder to the standby mode when the other transponder is selected for normal. This prevents both transponders transmitting at the same time.

The ATC-4401 series of Mode A/C transponders come in four flavors. The Dash-1 series is intended for mounting in standard 2¼-inch instrument holes with either 160-watt or 250-watt transmitters. The Dash-2 series offers remote-mounted boxes used for installations when panel depth is limited. A 2½-inch deep CU-5401 control unit is installed in a 2¼-inch instrument hole. The control unit offers a clear, high-contrast, double-line LCD display readable under all lighting conditions, even bright sunlight. When an altitude encoder is connected, the reported altitude is displayed below the transponder code to verify correct operation of the entire system.

To accommodate Mode S requirements, the Becker BXP-

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Becker Avionics ATC-3401 Mode A/C transponder.

TRANSPONDER COMPARISON

MANUFACTURER	MODEL	DESCRIPTION	PRICE
ACSS	RCZ-852	Remote mount, Mode S	$48,250
	XS-950	Remote mount, Mode S, air transport	$45,737
Becker	ATC 3401	Dzus mount, Mode A/C, 250W, flight level display, VFR button	$4,995
	ATC 4401-1-175	2-inch round mount, Mode A/C, 160W, flight level display, VFR button	$2,155
	ATC 4401-1-250	2-inch round mount, Mode A/C, 250W, Flight Level display, VFR button	$2,370
	ATC 4401-2-175	Remote mount, Mode A/C, 160W	$2,275
	ATC 4401-2-250	Remote mount, Mode A/C, 250W	$2,495
	ATC 5401-1R	Remote mount	$3,595
	BXP 6401-1	2-inch round mount, Mode S, 250W, flight level display, VFR button	$4,990
	BXP 6401-2	2-inch round mount, Mode S, 150W, flight level display, VFR button	$2,685
	BXP 6402-1R	Remote mount, Mode S, 250W	$3,525
	BXP 6402-2R	Remote mount, Mode S, 150W	$2,595
Collins	TDR-94D	Remote mount, Mode S, antenna diversity, corporate and air transport	$28,000
Garmin	GTX-330	Panel mount, Mode S, 250W, TIS, VFR button, p-alt display, flight timers, voice altitude alert	$4,995
	GTX-330D	Panel mount, Mode S, antenna diversity, 250W, TIS, VFR button, p-alt display, flight timers, voice altitude alert	$9,995
	GTX-327	Panel mount, Mode A/C, 200W, VFR button, p-alt display, flight timers	$2,305
	GTX-320A	Panel mount, Mode A/C, 200W	$1,990
	GTX-32	Remote mount for GNS-480, Mode A/C, 200W	$2,495
	GTX-33	Remote mount for GNS-480, Mode S, 250W, TIS, voice altitude alert	$4,195
	GTX-33D	Remote mount for GNS-480, Mode S, antenna diversity, 250W, TIS, voice altitude alert	$8,395

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6401 and 6402 series comes in four flavors as well. The 6401 series is intended for mounting in standard 2¼-inch instrument holes with either 150-watt or 250-watt transmitters. The 6402 series offers remote-mounted boxes used for installations when panel depth is limited. A 2½-inch deep CU-6401 control unit is installed in a 2¼-inch instrument hole.

For more information, contact Becker Avionics at 877-562-3253 or visit www.beckerusa.com.

Collins

For more than 70 years, Rockwell Collins has been developing a full line of communications and aviation electronics for every facet of aviation. Its avionics are installed in the cockpits of nearly every airline and most of

MANUFACTURER	MODEL	DESCRIPTION	PRICE
Honeywell	KT-70	Panel mount, Mode S, 200W, flight level display, VFR button	$5,770
	KT-71	Panel mount, Mode A/C, 200W, flight level display, VFR button	$5,940
	KT-73	Panel mount, Mode S, Data-link TIS, 200W, flight level display, VFR button	$5,440
	KT-76A	Panel mount, Mode A/C	$1,800
	KT-76C	Panel mount, Mode A/C, 200W, p-alt display, VFR button	$2,410
	MST-67A	Remote mount, Mode S, non-diversity	$21,710
Microair	T2000SFL	2-inch round mount, Mode A/C, altitude alert, voltage alert	$2,300 AUD
Narco	AT-165	Slide-in replacement for Narco AT-50/150/155, Mode A/C, 250W, dual display, VFR button, p-alt display, altitude alert, flight timers w/alarm	$2,100
	AT-165/VS	Slide-in replacement for Narco AT-50/150/155, Mode A/C, 250W, single display, VFR button	$1,710
	AT-165/K	Slide-in replacement for King KT-76/78, Mode A/C, 250W, dual display, VFR button, p-alt display, altitude alert, flight timers w/alarm	$2,036
	AT-165/K/VS	Slide-in replacement for King KT-76/78, Mode A/C, 250W, single display, VFR button	$1,787
	AT-165/KA	Slide-in replacement for King KT-76A/78A, Mode A/C, 250W, dual display, VFR button, p-alt display, altitude alert, flight timers w/alarm	$2,036
	AT-165/KA/VS	Slide-in replacement for King KT-76A/78A, Mode A/C, 250W, single display, VFR button	$1,787
	AT-165/C	Slide-in replacement for ARC RT-359A/459A, Mode A/C, 250W, dual display, VFR button, p-alt display, altitude alert, flight timers w/alarm	$2,195
	AT-165/C/VS	Slide-in replacement for ARC RT-359A/459A, Mode A/C, 250W, single display, VFR button	$1,944

All starting prices are subject to change. Please contact an authorized dealer for current pricing.

the military aircraft of the world.

Collins offers a single, but fully capable, transponder for the corporate jet and air transport fleets. The TDR-94D Mode S transponder is an all solid-state, crystal-controlled receiver/transmitter, operated from a variety of

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Collins TDR-94D Mode S transponder and CTL-92 control head.

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flight deck devices: the CTL-92 transponder control, radio tuning unit or FMS.

The TDR-94D is designed specifically for TCAS II-equipped business aircraft and regional airliners with limited space. It is housed in a package specially designed for efficient heat transfer and resistance to high-intensity radiated fields. The unit accepts either ARINC-429 or commercial standard data bus control and altitude information to facilitate flexible system design. The TDR-94D provides new Mode S elementary and enhanced surveillance functionality, in addition to an optional ADS-B capability.

For more information, contact Collins at 319-295-1000 or visit www.collinsavionics.com.

Garmin

Since purchasing the UPS-AT avionics products, Garmin has expanded its line of transponders to four panel-mounted and three remote-mounted models. Its basic model, the GTX-320A, features a solid-state transmitter providing 200 watts, which eliminates the need for a cavity tube that can degrade with time. It also fits into existing installations of select Narco and King transponders using optional adapters for simple, cost-effective upgrading.

Adding a digital display and numerous pilot-friendly features, the GTX-327 features a numeric keypad and dedicated VFR button. The GTX-327 also offers timing functions, such as flight time and count-up/count-down timers, as well as current pressure altitude.

Garmin's most capable panel-mount transponders, the GTX-330 and GTX-330D, both are Mode S and TIS data-link capable. Built on the same receiver and transmitter technology as the GTX-327, the units' solid-state design increases efficiency by using less power, creating less heat emissions, and eliminating warm-up time. In addition, the GTX-330 and 330D also feature an altitude monitor with voice alerting. The GTX-330D differs in that it adds antenna diversity for improved visibility to TCAS-equipped aircraft.

Garmin's remote-mount transponders, the GTX-32/33/33D, offer the same features as the panel-mount units but are designed to interface directly with Garmin's GNS-480.

For more information, contact Garmin at 913-397-8200 or visit www.garmin.com.

Garmin GTX-330 Mode S (TIS) transponder with flight timers and voice altitude alerting.

Honeywell KT-73 data-link transponder with Mode S capability provides TIS from FAA ATC radar systems.

Honeywell

Honeywell offers the Bendix/King line of transponders for general aviation, corporate and helicopter fleets. Many of its units have stood the test of time. As new communications and navigation equipment are replaced with newer models, many of the old King transponders keep their proud place at the base of the radio stack.

The KT-76A is a fleet standard in Mode A/C identification and was among the first transponders to incorporate large scale integrated (LSI) circuitry, reducing both weight and power requirements. Its design efficiency and rugged construction continue to provide reliability and value.

The KT-76C Mode A/C transponder features a sequential pushbutton squawk/code entry and a programmable VFR button. It operates with both 14- and 28-volt electrical systems, and its extensive backlighting and bright gas discharge display make it easy to read in all light levels.

Identical in appearance, the KT-70 is a Mode S transponder, while the KT-71 only replies to Mode A/C interrogations. It matches the existing Silver Crown line of Bendix/King panel avionics with its distinctive red gas discharge displays. Both feature a programmable VFR code button and flight-level altitude readout. A handy feature enables a landing gear switch control over the ground/flight mode, automatically keeping the transponder in standby mode while on the ground.

The KT-73 data-link transponder is Mode S capable and provides TIS from FAA ATC radar systems. TIS can be displayed on the KMD 250, 550 or 850 multi-function displays. The KT-73 is fully field-upgradeable (software only) to include air-to-ground automatic dependent surveillance-broadcast (ADS-B) operation. This transponder function enables aircraft to transmit position, altitude and vector information derived from the onboard GPS system for use by ATC facilities.

Intended for corporate and regional aircraft, the remote-mounted MST-67A offers all the capabilities needed to operate in the evolving world airspace. The MST-67A features a unique flight ID function that converts the transponder's Mode S address (for U.S.-registered aircraft only) into the tail number of the aircraft. For most Part 91 operators, this is also the flight ID, so it's automatically stored in the transponder register, eliminating the need to install and use an additional control head or FMS.

For more information, contact Honeywell at 800-601-3099 or visit www3.bendixking.com.

Microair

Microair Avionics is an Australian company developing, manufacturing and distributing sophisticated avionics for worldwide markets. Its products are designed and manufactured in Bundaberg, Queensland, Australia. Because kit-builders comprise a large part of Microair's customers, it offers wiring harnesses to suit all designs, or will customize harnesses to suit requirements.

One of the smallest and lightest (21 oz.) transponders in the

The Microair T2000 SFL Mode A/C transponder with altitude and voltage alerting mounts in a 2 ¼-inch round hole.

world, the Microair T2000 Mode A/C transponder is extremely power-efficent, producing a nominal 200 watts. The TSO certification of the T2000 transponder has expanded Microair's customer base into the general aviation sector.

The T2000 is available in two versions. The T2000 SFL uses a backlit LCD display, while the T2000 SL uses an LED display. Both fit a standard 2¼-inch round instrument hole. For tight panel applications, a compact control head can be added to the system to remotely mount the T2000. Both models feature a dual-line display with controls for mode, VHF hot key with ability to input the VFR default, encoder altitude, assigned altitude and input voltage. In addition, the altitude display is switchable between feet, meters or flight level.

For more information, contact Microair Avionics at +61-7-41553048 or visit www.microair.com.au.

Narco Avionics

Narco Avionics was a pioneer in the avionics world, bringing revolutionary products to the general aviation scene since 1945. Its latest effort enables an aircraft owner the option of upgrading an old transponder with a digital slide-in replacement.

The all-new AT-165 series has a one-touch code-entry knob, one-touch 1200 VFR button, multiple timers with alarm output, and an altitude display with visual and audible altitude hold warnings. Audible alerts from the AT-165 warn the pilot when flying outside of the desired altitude range.

Narco's new Value Series — denoted by a "VS" after the model number — employs only a single display of mode and squawk code. The elimination of the pressure altitude display, altitude alerter and flight timers reduces the cost.

All AT-165s use the latest digital technology to provide a lightweight (1.7 pounds) system with a high-power, 250-watt (nominal), 100 percent solid-state transmitter. They are fully compatible with modern altitude encoders and are a slide-in replacement for all older Narco AT-50, AT-50A, AT-150 and AT-155 transponders. The "KA" model replaces all King KT-76A or KT-78A transponders, while the "K" model replaces the KT-76 or KT-78. The "C" model replaces the Cessna ARC 300 and 400 series transponders.

For more information, contact Narco Avionics at 800-234-7551 or visit www.narcoavionics.com. ■

The Narco AT-165 is a modern slide-in replacement for older ARC, King and Narco transponders.