TELONICS QUARTERLY™

VOLUME 6 / NUMBER 4 / SPRING 1994

ST-10 PTT Configurations and Options

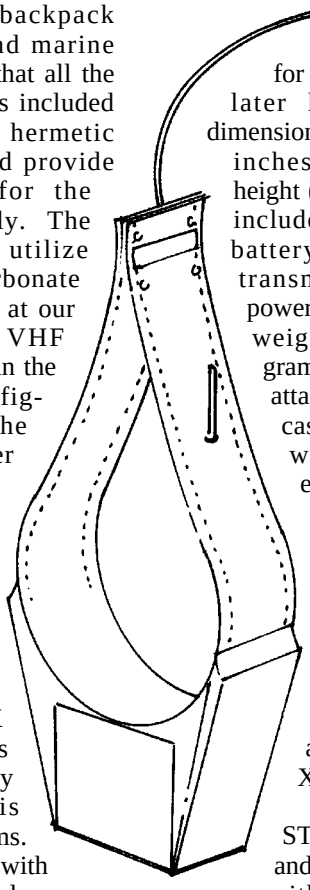
An update.

An article in the Fall 1993 Telonics Quarterly entitled "So you want small PTTs?" introduced a micro-miniaturized PTT, the ST-10. This current article provides additional information about the ST-10, including examples of collar-mounted configurations for terrestrial mammals and backpack configurations for birds and marine animals. It should be noted that all the collar-mounted configurations included in this article are sealed in hermetic canisters which enclose and provide complete waterproofing for the electronics and power supply. The backpack configurations utilize lightweight molded polycarbonate housings, designed and built at our laboratory. Conventional VHF beacons can also be included in the same housings in some configurations. In those cases, the VHF unit has its own power supply and antenna.

The first example of a collar-mounted configuration was designed for arctic fox and then modified for wolverines. The housing dimensions are 1.9 inches length, 1.6 inches width, and 1.3 inches height (4.8 X 4.1 X 3.3 cm). This housing contains the ST-10 PTT and battery pack. Without a collar this package weighs 150-160 grams. The completed arctic fox unit with collar weighed approximately 180 grams while the wolverine unit, with its larger collar and external protective casting, weighed 240 grams.

Another configuration has been fitted to kangaroo. The housing measures 2.0 inches length, 1.6 inches width, and 1.9 inches height (5.1 X 4.1 X 4.8 cm). This housing contains the ST-10 electronics, battery pack, and a VHF transmitter with power supply. The approximate weight of the package is 240 grams without a collar and about 400 grams with collar, special TA-7 helical VHF antenna and CAST-5 option which adds additional physical protection.

The next example has been used for three different species to date. The first was Perry caribou. *(Note: Perry caribou is a small subspecies which had not previously been instrumented with an ARGOS PTT. The ST-3 has been used extensively on other caribou.)* The same basic design, with modifications to the collar, antennas, VHF specifications, and addition of the CAST-4 full external casting option was then used for white-lipped peccaries and later hyenas. The housing dimensions are 2.7 inches length, 1.9 inches width, and 2.2 inches height (6.9 X 4.8 X 5.6 cm). This includes the ST-10 electronics, battery pack, and a VHF transmitter with independent power supply. The approximate weight of the package is 390 grams. With the addition of the attachment collar and external casting options, total weight was about 800 grams for each of the three species mentioned.

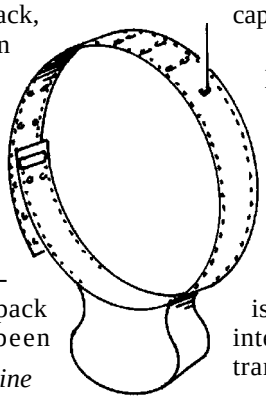


Perry Caribou

The last collar-mounted example is currently in production for wolves and additional work on Perry caribou. Housing dimensions are 3.1 inches length, 2.7 inches width, and 1.9 inches height (7.9 X 6.9 X 4.8 cm).

This housing contains the ST-10, battery pack, and a VHF beacon with its separate power supply. Estimated weight is 550 grams without a collar and 1000 grams with collar and external casting.

In addition to the collar-mounted ST-10 configurations, three sizes of backpack configurations have been developed.



Wolverine

These are suitable for deployment on some birds and in marine applications. Our CAST-7 full internal casting option eliminates all air-pockets from around the electronics and throughout the packaging. The option allows exposure to depths of 500-1000 meters or more. Other than the Telonics ST-6 and ST-10 PTTs, we don't know of any other PTT being manufactured with this capability of full casting. Full casting is available in several packages and is recommended for many marine applications. The CAST-7 option can eliminate the need for extremely expensive development of high pressure housings to protect the electronics and power supplies.

The smallest ST-10 configuration was designed as a backpack for geese in Alaska. It measures 3.1 inches length, 1.3 inches width, 0.7 inches height (8 X 3.3 X 1.8 cm), and weighs 48 grams. The stacked board version of the ST-10 electronics is used in this configuration.

The next size backpack configuration measures 3.6 inches length, 1.9 inches width, 0.8 inches height (9.2 X 4.8 X 2.0 cm). It weighs 75 grams in the standard version, or 125 grams with the CAST-7 full internal casting for deep diving applications. The package includes the ST-10 electronics and battery pack.

A third backpack configuration was designed for a project involving swans. It measures 4.1 inches length, 1.9 inches width, 0.9 inches height (10.4 X 4.7 X 1.8 cm), and weighs about 100 grams. This package includes the ST-10 electronics, battery pack, and also has room for inclusion of a small VHF transmitter and its independent power supply. To our knowledge this is the first package designed for birds containing both PTT and VHF transmitter capabilities in the same package.

Operational life with any particular configuration will depend on the duty cycle and repetition periods selected. Examples of life for each of the configurations mentioned in this article is provided below. These estimates assume use of a 65 second repetition period. Life is presented for both a relatively intensive duty cycle of 8 hours of transmission per day, and a much

less intensive cycle of 8 hours of transmissions per week. In all cases cell capacities have been derated from their nominal values, but further derating may be required with the smaller configurations in below 0°C.

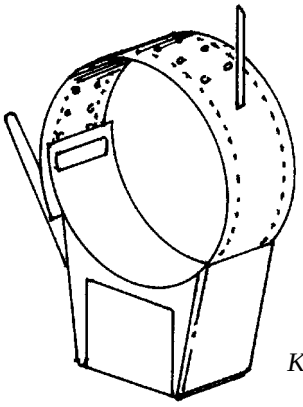
DUTY CYCLE

Configuration	Operational Life	
	8 hrs/day	8 hrs/week
Geese/48 gram backpack	28 days	138 days
Fox-Wolverine/ 75 gram backpack	63 days	310 days
Swan/100 gram backpack	98 days	483 days
Kangaroo	126 days	620 days
Caribou-Peccary-Hyena	210 days	1035 days
Wolf-Caribou	420 days	2070 days

Since the Fall 1993 article introducing the ST-10, we have also developed additional software to allow for collection and transmission of some salt-water-switch and activity data. For units equipped with the salt-water-switch option, it is now possible to include a counter of the number of seconds the PTT spends on the surface. With the activity sensing option, the number of seconds in which activity was detected over a user-specified time interval is available.

We will continue to provide updates as the applications of, and options for, the ST-10 increase. All of the packages and options mentioned in this article resulted from researchers' requests for their particular projects. If you have an application and can't find the technology, contact us for more information or with your project requirements. The technology is evolving quickly.

Bill Burger & Bob Carroll



Kangaroo

µMK7 Mid-Power Transmitter

A complement to the MK4/5/6 and CHP VHF systems.

In the past our customers have had several choices in VHF transmitters: the standard power MK4/5/6, very high power MK4/5/6, and low power CHP. Now Telonics is introducing a new transmitter for use in applications where the CHP's low power output is insufficient, but size and battery constraints do not allow use of a standard power unit. (See figure for comparison of relative power outputs and useful range.)

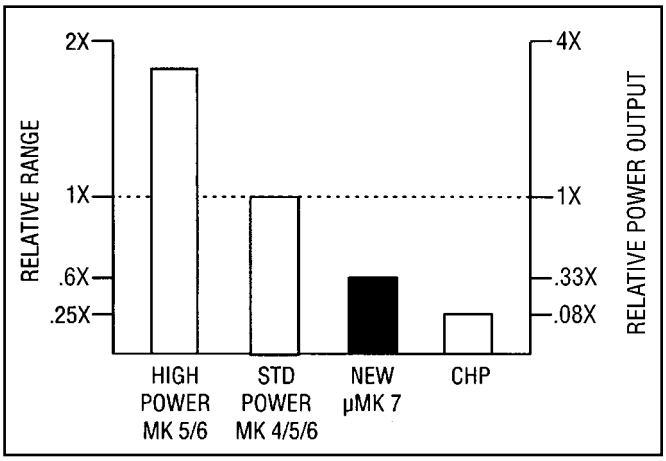
The standard power MK4/5/6 transmitter line has been around for a long time. In fact, thousands of them have been deployed over the past 20 years! It has proven very versatile and has been incorporated in configurations with many form factors (from the 15g MOD040 to the 500+g MOD600). The nominal power output is adjustable by about ±50% (with standard battery pack). This 'workhorse' of transmitters continues to provide good range and its efficiency allows maximum use of battery capacity.

In some applications (e.g. wide ranging species such as caribou), we found that a higher power transmitter was desirable to allow researchers to make contact with the animal at greater distances from aircraft. Consequently, we developed the high power versions of the MK5/6 transmitter to facilitate location of wide ranging animals in vast habitats. The higher output power extended the range of these transmitters to almost twice that of the standard power. This increased range was not without cost, however. Its use was limited to larger configurations.

While the high power transmitters filled the need to track large species over large areas, the need for smaller transmitters for smaller species grew as well. This demand resulted in development of the CHP transmitter. Its low power requirement allowed the use of smaller batteries (and, thus, much smaller packaging), while dramatically extending operational lifetimes. As you would expect, its reduced power output also reduced effective range to about 20-30% that of a standard transmitter.

Although the reduced power output of the CHP has proven adequate for many applications, there has been a continuing need for a CHP-sized transmitter with a power output that falls between that of the CHP and the standard power transmitter. In response to this need, Telonics has developed a tiny, medium power transmitter, the micro MK7 (µMK7) — targeted for configurations in the 10 to 20 gram range. The µMK7's lower power output allows the use of physically smaller batteries than the MK4/5/6 and extends useful lifetimes. In addition, depending on the antenna system selected, this new transmitter can provide up to 60% of the effective range of a standard power transmitter. Best of all, by using state-of-the-art micro-processor technology, we have squeezed all of the sensing capabilities of our larger transmitters into a package about the same size as the CHP!

A very important capability of the µMK7 is its ability to employ a sophisticated duty cycle. This means that it can be programmed to stop transmitting during times when the researcher may not need to establish position (e.g. at night or when the animal is hibernating). Since the transmitter consumes much less energy when it is not transmitting, the technique of duty cycling can extend transmitter lifetimes, allow the use of smaller batteries, or both! Other capabilities of the µMK7 include I.D. coding (where a transmitter can identify itself), mortality sensing, motion sensing, activity sensing, position sensing, and temperature sensing (future release). If required, we can even increase the power output of the µMK7 to match that of a standard power transmitter.



Although we still haven't figured out

how to build the 'ideal transmitter' (i.e. zero weight, infinite lifetime, and gobs of power output), the µMK7 provides the researcher one more option in selecting the optimum balance among power output, size and weight.

The standard power transmitter will continue to be the transmitter of choice for most larger applications. The CHP will continue to perform well in the tiniest and lightest applications. The µMK7 will provide a balance between the small size and light weight of the CHP and the range and sensing capabilities of the MK4/5/6 transmitters. *Timo Hansen*

Things are changing again!

It's "out with the old and in with the new" — telephone and filing system, that is. After extensive evaluation of both telephone and filing systems, we have finally put the old systems to rest. They have been replaced with modern, updated systems to better serve you, our valued customers.

Filing System

We are excited about our new filing system. It allows greater flexibility in locating orders and/or customer correspondence. Since Telonics not only produces new equipment, but also supports refurbishing of existing equipment, it is necessary to access the original orders. In the past, vast amounts of time have been spent plowing through paperwork to locate specifications for transmitters and receivers. We are very optimistic that our new system will provide the means to access old orders more rapidly, thus saving valuable time.

When a customer places an order, a Telonics order number is assigned. Anyone calling or corresponding with Telonics about an order should reference the Telonics order number. This enables us to update and process orders more quickly and efficiently.

Telephone System

Upon returning after Telonics annual Christmas shutdown, there was another challenge — our new DSP-based digital telephone system. The new system has many great features which should prove to be a benefit to the Telonics staff and our customers.

One of the features we hope will better serve our combined needs is VOICE MAIL. It can be used 24 hours a day. Of course, during business hours, we will make every attempt to put you into direct contact with the party to whom you wish to speak. However, should that staff member not be available, our Telonics operator will ask you if you would like to leave a recorded message on Voice Mail. After hours, you have the choice of leaving a message on an individual's Voice Mail or with the Automated Attendant. Your message will then be forwarded to the appropriate person at the beginning of the next business day.

Our experience so far with Voice Mail is that it has enhanced communications, both among our staff and between staff and customers. Some of the specific benefits we have already seen are:

- Reduced telephone tag.
- Accurate message content.
- Shorter holding times for callers.
- Increased confidentiality.

When your Telonics contact is not able to immediately respond to your call, these benefits can help us meet your needs. The operator will "walk you through it" and we will look forward to returning your call in person as soon as possible.

Changes! Changes! Changes! It seems things are always changing. We know it is sometimes difficult to digest all of these things, but we appreciate your continued patience and cooperation. In the long run, we feel our new systems will be more efficient — thus allowing us to offer you the best service possible

Jean Hall and Brenda S. Milam

Would You Care For A Date?

The twelve number arrayed pages (with picture) hanging on my wall and the 365 page Larsen cartoon stack (with numbers) on my desk have an intriguing history.

Over the centuries, many calendar schemes have been used to relate times and seasons to a recordable number. However, because the time relationships between seasons, moon phases and days are not evenly divisible by each other, attempts at recording dates contained errors which accumulated over time.

As the errors became apparent, individuals in power made modifications to improve accuracy. The Babylonians attempted to compensate for these errors by employing a calendar with twelve months, but three times in eight years they inserted an extra 29 or 30 day month. The Egyptians did a little better by making a calendar with twelve 30 day months, then adding 5 days at the end of each year. It was still off by about a day every four years.

About 50 BC, while courting Cleopatra in Egypt, Julius Caesar was introduced to the Egyptian calendar. He took it back to Rome, modified it by adding a day every fourth year (leap year), and called it the Julian Calendar. However, by 1580, the calendar was 10 days off. The Church got involved when Pope Gregory XII declared that leap year would be skipped on years divisible by 400. With this minor adjustment, he attached his name giving us the very much improved Gregorian Calendar. By then, the Reformation was in full swing, and it was many years before the rest of the world was willing to bow to his decree.

England, for example, wasn't willing to remove the accumulated eleven extra days until just 26 years before the 13 American Colonies declared their independence. The Russians didn't capitulate until the Bolsheviks came into power in 1918, and the Turks put off the change another ten years. I mention all this so the very minor changes we are making will appear trivial yet important.

As long as I can remember, dates were written in the form 1/7/64 or Jan. 7, 1964 or 7th January 64. That is — until I started doing work for the military where they demanded that dates be written 7 JAN 67. A few years later, I became aware that if I received a letter from Europe dated 1/7/71, it was written in July and not January. Back then, few people ever thought of the consequences of leaving the 19 off the 1971. Even 10 years ago, it was still not a great concern. With all this confusion, and the beginning of the 21st century just a few years away, we must take action.

Admitting our dependence on computers, and their unwillingness to accept disorganization and missing digits, we feel we must standardize on a more logical date format. For the past several months, we have been converting our dates to "yyyy.mm.dd" (year month day) all in numbers. The idea is to put the most significant part on the left and the least significant on the right so that they agree with the way most other numbers are written. This is known as the ANSI format, so I don't think there is much chance for a "Boydean" date format.

I hope this won't cause too much confusion, but there seems to be a worldwide trend toward it. There is one consolation, however — it could be written MCMIXIV.III.XXIV instead of 1994.03.24!!! *Boyd Hansen*

Telonics in Space

Three, two, one, blast off! Telonics tags along with every Space Shuttle mission.

In 1992 the NASA Crew Escape Group, located at Johnson Space Flight Center in Houston, Texas, approached Telonics about developing an emergency locator beacon to be carried in the survival pack of each astronaut. In the event of an emergency where the crew is required to parachute out of the shuttle, the beacon would assist rescue crews in locating the astronauts anywhere in the world they might land.

The beacon which was developed, the Telonics Satellite Uplink Beacon Version A (TSUB-A), transmits on three frequencies. 121.5 MHz is used for emergency locator beacons in civilian aircraft. 243 MHz is the military emergency locator beacon frequency, and 406.025 MHz is the frequency set aside for international use with the satellite-aided search and rescue system known as SARSAT.

The 121.5 MHz and 243 MHz emissions are the standard swept tone signal which is compatible with the direction finding receivers used by rescue personnel. Once the rescue personnel are within receiving range of these signals, they are able to 'home in' on the location and effect the rescue.

The 406 MHz signal is a digital message that is transmitted to the SARSAT satellites. These satellites are located in a low altitude (531 miles, 856 km above the earth) polar orbit. The operation of the SARSAT system is virtually identical to the ARGOS system with the major difference being the transmitter frequency. Due to the type of signal the transmitter sends, the satellite is able to collect a variety of information. By providing this information to control centers on the ground, the location of the TSUB-A beacon can be calculated. This location is accurate enough (typically within 1 mile) to put rescue personnel well within the range of the 121.5 and 243 MHz beacons, allowing rescue teams to track directly to the location of the TSUB-A transmitter.

The other advantage of the 406 MHz message is that it contains data that identifies exactly which TSUB-A is transmitting. By comparing this data with information stored at the ground control centers, it is possible to know where the transmitter was manufactured, its serial number, who owns it, and telephone numbers to call to verify an emergency.

After completion of the development and testing by NASA, the TSUB-A transmitters were procured and are now carried by each astronaut on board every flight. *Jim Carter*

TELONICS INC.
TELEMETRY-ELECTRONICS CONSULTANTS
932 E. IMPALA AVE. • MESA, ARIZONA 85204-6699 U.S.A.
(602) 892-4444, FAX (602) 892-9139

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