

# What is Through-water Communications?

By Mike R. Pelissier, Ocean Technology Systems



Through-water voice communications usually relates to underwater communications that uses the water to carry the signal. Other titles for the same type of underwater communications are: Wireless, Sonic, Ultrasonic or Acoustic telephones. In all, they achieve the same task, to send voice communications through-water. This differs greatly from a Hard-wire underwater communications device which would rely on a cable to carry the transmission to and from the diver/s. Hard-wire communications has the greatest potential for clear communications. This is due to the fact little outside noise can mix with the signal. As long as the wires are firmly connected and in good order, the communications will be good (like a intercom).

However, the draw back is the diver has to pull a cable along with him while he dives. As you can imagine, this would be greatly impractical for a Sport Diver.

## How are they made?

A basic Sonic underwater communication system is usually compact in design and completely self contained. The constructed is typically as follows: An electronic package carefully waterproofed including a battery source, Transducer (antenna), waterproof earphone/s, microphone and some sort of securing device such as a belt buckle. The designer can choose to incorporate a push-to-talk control and/or Voice Operated Transmitter commonly known as "VOX". An assembly to either mount to a full face mask or mouth mask is necessary.

## How do they work?



Using our MKII-BUDS Sport Diver Buddy Phone transceiver as a model, (transceiver means the unit will both transmit and receive), the units operates as follows: A 9 volt battery is installed into a waterproof compartment. The Buddy Phone using 33 kHz upper sideband as the carrying frequency. The transceiver incorporates an earphone on the back side so the unit is mounted near the ear attaching to a full face masks (ffm) via the head strap. A microphone assembly with a Push-to-talk control (PTT) is installed onto the ffm. The transceiver has a water activated switch which powers the unit ON when the diver enters the water. The transceiver automatically switches to the receive mode when the unit is powered ON. This means when the diver enters the water, he will receive all transmissions from other sonic communication systems within range and on the same frequency.

When the diver wants to talk, he simply depresses the PTT button located on the ffm and talks. The divers speech is picked up via the microphone installed in the ffm and sent to the electronic module. The speech is converted into 33 kHz and sent into the water via the transducer. It goes into the water like sonar waves from a fish finder. The 33 kHz signal goes out omnidirectional and can bounce off the bottom and surface to ranges up to 400

yards (assuming we are using a Buddy Phone). When another transceiver's transducer picks up the sonic signal, the 33 kHz is converted back to intelligible speech, amplified and sent up to the earphone. The diver has the freedom of free swimming without carrying a long wire to the surface.

An option to the diver transceiver is a Receive Only unit. This type of system is basically made the same way but only offers the user to listen. You can hear all underwater communications from other sonic transceiver within range and on the same frequency. However, you can only listen, not transmit. This device is great for instruction and used often by professional underwater photographers and advanced instructors.

### **Options:**

The most common options a manufacture can incorporate to a sonic communicator as described above are as follows: Squelch control, VOX, multi channels, longer battery life, longer range, surface station, more power and whatever else the imagination can come up with. Lets take some of the options and explain them:

**Squelch:** A squelch circuit allows the user to suppress marine back ground noise commonly found in salt water. It will also suppress man made noise which will be found anywhere man is. The draw back to using squelch is that it not only suppresses noise but decreases range. The more squelch you apply, the less range you will obtain. Squelch should be used sparingly. The squelch circuit is usually controlled by an adjusting pot located in the battery compartment. However, on our SSB-2010, it is electronically controlled by the diver via a voice menu (see SSB-2010 for more information).

**Voice Operated Transmission (VOX):** A VOX circuit is designed to allow hands free operation. How the circuit operates is simple, when the circuit hears sound, it triggers the transmitter. As long as it hears sound it keeps the transmitter ON. When it does not hear anything for a set time, typically about 1 to 1 1/2 seconds, it turns off the transmitter and cycles back to the receive mode. In concept a VOX circuit is great. In practicality, they are more complicated to use. This is due partly to how they function in the diving environment. We already said they work when they hear a sound. Well, divers make lots of noise in a mouth or full face mask. When a diver off gasses, lots of noise is created which a VOX circuit hears and triggers the transmitter. It is for this reason most good VOX designs have some sort of control over the sensitivity setting. A good setting is when the unit will not trigger the transmitter when it hears breathing, mask noise or the like but fires up when it hears the divers speech. A typical VOX sensitivity control is a small adjusting pot located inside the battery compartment. The diver must make adjustments before diving. A good setting would be so the diver can exhale into the ffm and the VOX will not trigger but when he talks in a moderate voice, the VOX turns on the transmitter. This adjustment should be made for each user since most people have a different sounding voice. Regarding the VOX adjustment, uniquely, our SSB-2010 has a voice menu and the VOX and/or PTT can be adjusted on the fly while diving).

Once the VOX has been triggered, the VOX circuit will stay ON until it does not hear anything for approximately 1 to 1 1/2 seconds. This is the biggest problem with VOX circuits. Anyone who wants to respond back to a VOX user, must wait at least 1 to 1 1/2 seconds before responding. If you do not wait, the VOX user will not hear anything until his transceiver cycles back to the listening mode. This sounds easy but in practicality, it is hard to remember to wait. Most of the time when a VOX diver talks to you, you answer him back immediately. In most cases, the VOX user misses your first couple of words and will ask you to repeat the message.

In most Search & Rescue or Military type operations, the users will prefer PTT over VOX. They do not have time to wait for the 1 1/2 seconds. They want to be able to answer immediately after someone talks to them. That is exactly what happens when you use a PTT system. As long as you depress the PTT button, you are transmitting. As soon as you release the PTT button, you are listening (no lag time). This seems to be a safer way to transmit if a fast response is required.

**Multi-channels:** Commercial and Military divers like to have alternate channels they can choose in the

event two or more teams are operating in the same area. Although the Buddy Phone are being used by many Search & Rescue Teams as well as Military divers, it is a one channel system. However, the SSB-2010 is a four channel system and our SSB-1001M is an 8 channel system.

**Power:** How many watts a transceiver has usually dictates how far it will transmit. Our Buddy Phone transceivers are 1/2 watt system and in good conditions they can achieve ranges to 400 yards or further. Our SSB-2010 is a 3 watt transceiver and have achieved ranges up to 1000 yards. Our SSB-1001M is a 5 watt transceiver with ranges reported out to 3000 meters in good conditions. Our Magnacom is a 30 watt transceiver and ranges out to 5 miles were reported. As you can see, even a 1/2 watt transceiver with only a 400 yard range should be plenty.

**Batteries:** Batteries are necessary to support power. In some cases, its the battery that dictates the size of the unit. Electronics can be made tiny as well as the housing. However, batteries required to support the range and longevity cause the housings to grow in size. Todays battery technology is getting better, but still not what we would like to see.

A few examples of what we are up against, to make a Military unit with a 3,000 meter range, we had to use a double Metal Hydride AA battery pack. This was necessary to support the power and battery life required by the client. Our SSB-2010 with a 1000 meter range and same battery life only uses a single AA battery back where as a Buddy Phone with a 400 yard range, 14 hour life only uses a single 9 volt battery!



**Surface Station:** In order to talk to free swimming Scuba divers using through-water communications, you must have a through-water device on the same frequency, be within range and have a transducer in the water. For example, our SP-100 Buddy Phone surface station is basically a MKII-BUD in a box. It has a panel speaker, batteries, hand-held microphone and transducer on the end of a 35' cable. The user simple lowers the transducer into the water and all divers talking within range and on the same frequency will be heard. To talk the user depress the PTT button located on the hand-held microphone and talks. Again, all divers within range and on the same frequency will hear him. We have several surface station to choose from (see Sport, Commercial, Search & Rescue or Military). Some of our diver transceiver can be easily converted from a diver unit to a portable surface station by addition of a surface conversion kit (see SSB-2010).