



MIRION
TECHNOLOGIES



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Radiation. **Safety.**

Using Telemetry for Diving Applications



Introduction

- Training this year is broken up into smaller modules. This allows more flexibility for the customer to determine attend only the training needed.
- While the time for each class is more limited, if you have specific issues, problems or applications you need to work out ,let me know and we'll see if we can work it in as part of the class.
- We hope that you will enjoy this class, have some fun, and maybe even learn something.



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Agenda

- Introduction
- Equipment
 - Passive
 - Active
 - Dosimeter Transmission
- Testing
- Setup
- Monitoring



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Introduction

- **Diving - We receive a lot of calls on Diving operations, normally because it is an infrequent task (except at Ocone) and personnel are not familiar with the set up of the equipment, or they don't have all of the correct equipment for the job.**
- **Because many times diving is an emergency task during an outage and becomes critical path, spare equipment is highly recommended.**
- **Also, it is very important to assemble and test all of the equipment as it will be used prior to placing it onto the diver and into the water.**
- **Before we assemble and test the dive equipment, we need to discuss first what equipment is typically used.**
- **We have two different types of antenna systems for underwater work: a Passive system and an Active system. How each site plans on utilizing the equipment will help determine what type of equipment is best to use.**





Equipment – Passive Antenna System

Passive Antenna System – This can be used in two ways

- **With the repeater:** In this scenario you have two radios in the repeater instead of one - and they are connected by an internal serial cable. One radio is connected to the remote underwater antenna and the other has an external antenna that broadcasts the signal out to be picked up by a local or system Base Station
- **Direct to base station:** Instead of connecting to the repeater, the antenna can be connected directly to a Base for local monitoring with a serial cable or for system monitoring. This method is the simplest with the least points of failure for critical activities – but it is limited to one diver at a time (or one diver per base).
- **When using the 300' antenna,** there is a supplied amplifier that should be used. Be sure to power the amplifier with the provided 15V power supply (you do not need to use this for the 100' antenna).
- **Drawbacks with this system include:** the coax cable can be more easily damaged and is difficult to repair for U/W use. Also there is additional signal loss (especially with the longer cable lengths). Finally, when multiple divers are in the water, the repeaters can feed back on each other causing crosstalk interference and loss of data so you need separation distance.



Equipment – Active Antenna System

Active Antenna System

- The active system must be used with the active repeater, and cannot be mixed with the passive system.
- In this system, one of the repeater radios is actually incased in epoxy in the paddle to use underwater. This provides much better coverage than the passive system since the radio is actually on the diver instead of just the antenna. Thus, there is no signal loss through the cables. The underwater radio is connected to the topside radio by a standard underwater AMP cable which carries serial data.
- Drawbacks with this system include the fact that it cannot be used directly with a Base, and will feed back into itself when out of the water. It is also more difficult to test since you cannot easily isolate the active antenna.
- One of the keys to using the Active system is to be able to test both components. We have created a procedure to do this which we will go through at part of this application.



Equipment – Dosimeter Transmission

iMUX - Typically most plants use an iMUX. The reason for this is that it ensures better coverage for multiple dosimeters since the iMUX can be placed close to the antenna regardless of where the dosimeters are placed on the diver.

- **ALWAYS use new Alkaline batteries in the iMUX for each dive. Also place new batteries in the dosimeters to be used at the start of the job, and ensure the battery cover is torqued correctly on the dosimeter. Weak batteries and poor contact in a DMC can cause the dosimeter to loose contact due to flexing under pressure at certain depths.**
- **The drawbacks for using an iMUX are that it is a little bulky, and the connection to the dosimeters are some times difficult to keep secure. Also, no enhanced alarms.**

iPAM TX / DMC-3000 Transmitter - It is possible to use iPAM's/3k Tx instead of an iMUX in certain scenarios. This can work with a limited number of dosimeters kept in relatively close proximity but will typically not maintain as continuously strong a contact as with an iMUX. You can use an iPAM in addition to an iMUX for an enhanced alarm if needed. Using an active antenna will improve the coverage for this methodology.

- **The drawbacks as noted include: the coverage, each dosimeter is more bulky, and the system is more susceptible to moisture / water intrusion**



Testing – Dive Equipment

- **iMux – This is pretty easy. Connect all dosimeters to the adapters, plug the adapters into the iMux, power the iMux and see if all the lights blink correctly. Then look you your telemetry software and verify all the dosimeters are being received.**
- **Active System – See Mirion Testing Procedure 12-00256 Handout**
- **Passive System**
 - **Repeater – In general you can perform a similar test to the above procedure to verify the repeater works, simply change the channel of Radio 1 of the repeater and the channel of an iPAM. This isolates the set so the base cannot see them directly, only through the repeater.**
 - **Base - A lot of plants connect the Passive antenna directly to a base and do not use the repeater. In this case the base is easily tested with or without the dive antenna so the real focus is the antenna.**



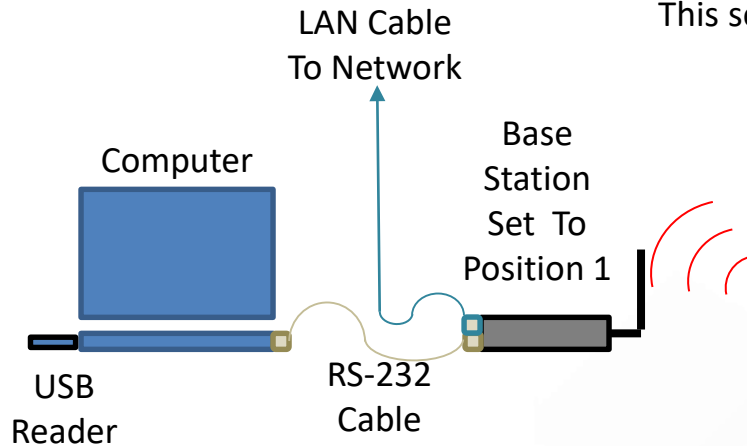
Testing – Dive Equipment

- **Passive System**
 - **Antenna** - The easiest way to check operability of the passive dive antenna is to place in a coil and read the resistance across the center pin and shield. It should read ~1.1k Ohms. While reading the resistance, flex and stress the cable and look for changes in the reading to verify there are no breaks. However, for additional assurance, you can also try to shield the antenna and transmitter (you can use an iPam). Basically wrap the antenna paddle and an iPAM in several layers of foil, sealing well up the cable. Disconnect the antenna from the base and move the shielded paddle far enough away from the base that you no longer receive the iPAM. Then connect the antenna to the base and verify you can no receive the iPam.
 - Another indication of a problem with the passive antenna is the light on the amplifier blinks out after being turned on.



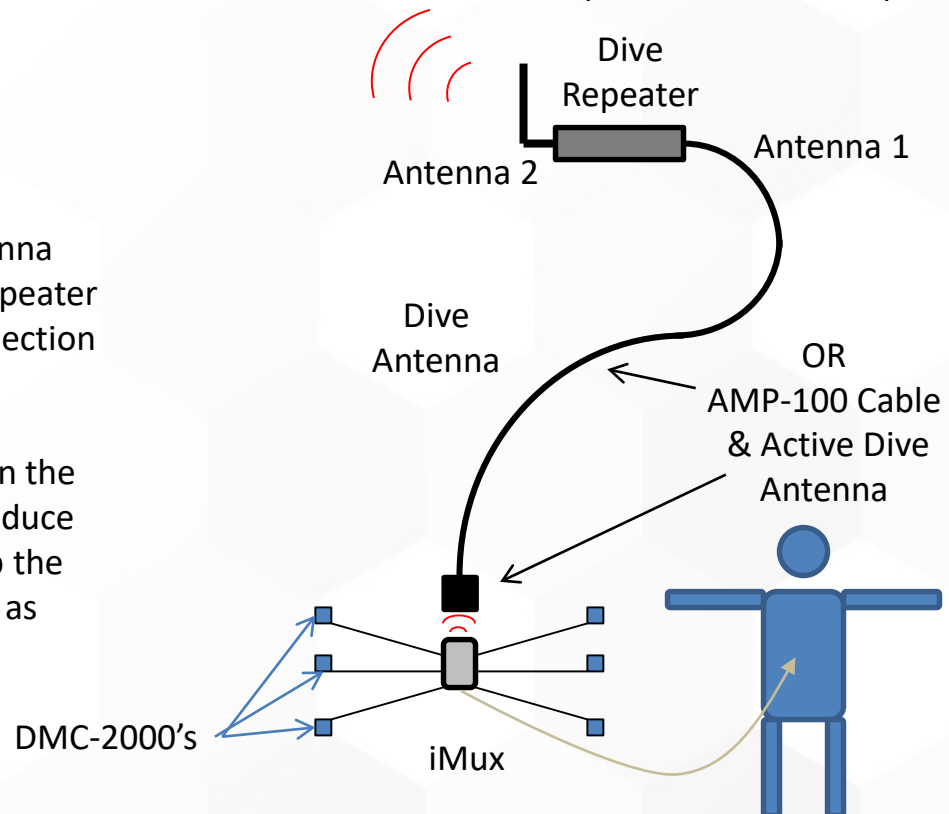
Setup - Dive System (Active)

There are number of way to set this equipment up and provide coverage.
This setup depicts local coverage. It also allows for the most flexibility.



For Example: You could connect the computer to the network, if available, and pick up data from a base in another area via WR2 repeaters.

Each site must determine their setup based on their requirements.



NOTE: When using the "Passive" dive antenna and repeater, you can eliminate the dive repeater and connect directly into the antenna connection on the Base Station.

This is useful for trouble shooting and will prevent interference if multiple divers are in the water at the same time. Another way to reduce interference with multiple divers, it to keep the dive repeaters as far away from each other as possible.



Setup – Dive System (Dosimetry)

Things to Remember:

- **When connecting the DMC's to the iMux adapters ensure the ISO connections are clean on both the dosimeter and adapter (wipe with alcohol and replace any with corrosion)**
- **Ensure the pins or plastic nubs on the adapter are aligned to the notches in the DMC. This can be felt by sliding the adapter up and down the dosimeter. Continue to verify this alignment as the adapter is tightened. If this is not done correctly the nubs can be broken off. If this occurs or if the U/W work will be vigorous then electrical tape should be used in addition to secure the adapter.**
- **Remove the clips on the DMC-2000's unless needed to secure in position. This is done to make the slightly more comfortable inside the suit.**
- **iMux's set up / purchased specifically for diving will have their clips removed also for the same reason.**



Setup – Dive System

Putting it all together

- **One other comment in setting up for diving is underwater survey instruments. In addition to monitoring the diver, it is always good to have two underwater survey instruments available. One should be included in the diver's tether with the probe attached close to one wrist of the diver so that the diver can provide additional survey readings (some locations cannot be reached by dropping a probe down from above). The other instrument would be the meter used by HP personnel for the initial survey and to survey new areas prior to allowing the diver to move to those areas. We actually have two instruments that we can do this with, the AMP-100 with Ext. Transmitter, and the RDS-31 with the external GMP-12UW probe.**



Setup – Monitoring Station

- **There are two way to provide monitoring. Either utilize a local system hooked to a local base, or a network system and network base. Part of this depends on if you have LAN capability in the area being worked. Each has it's advantages and disadvantages.**
- **A local system with a local base, hooked to a passive antenna.**
 - **It is the simplest setup with the fewest points of failure.**
 - **It is normally limited to one diver due to the use of a com port.**
 - **Requires manual log on (no access control hook up)**
 - **Local Readout Only (this could be good or bad)**
- **Next would be local system / Base with the use of dive repeaters (either passive or active).**
 - **You add a point of failure.**
 - **Other personnel may be able to see the data since it is broadcast.**
 - **Can cover multiple divers (Note using multiple Passive dive repeaters in close proximity may cause bleed over and may reduce the number of packets being received).**



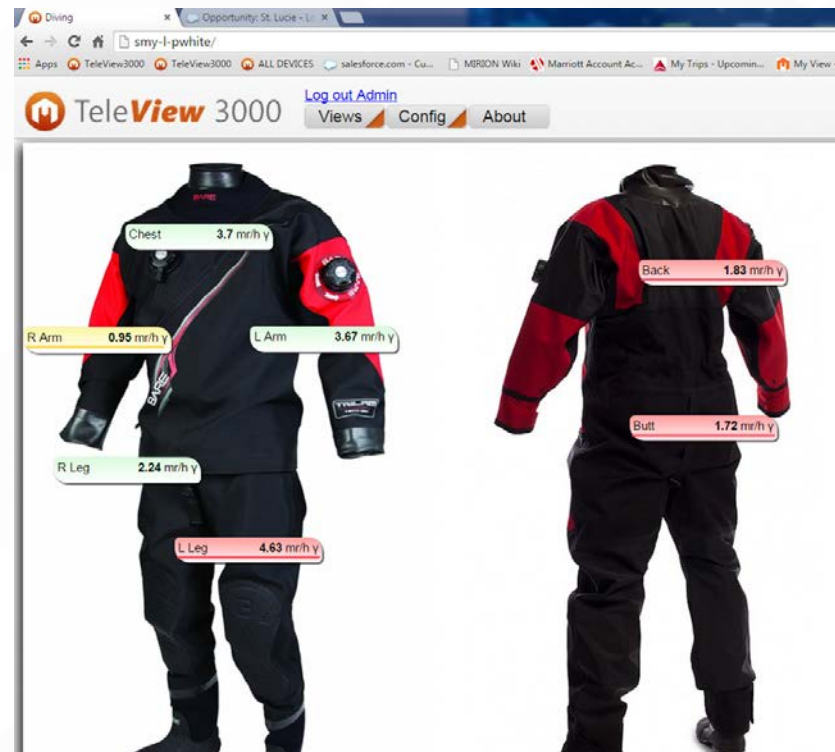
Setup – Monitoring Station

- **Finally you have the active or passive dive repeater with a network system and network base station.**
 - **This has the most possible points of failure (only real negative).**
 - **It allows the use of Auto Log on (may be some manual logging for multipacks).**
 - **It allows data to be viewed on the normal telemetry system.**
 - **Can cover Multiple divers (Note using multiple Passive dive repeaters in close proximity may cause bleed over and may reduce the number of packets being received).**



Monitoring - Software

- We won't talk much about the software because there are a number in use. Our version, Teleview 3000 allows multiple ways to cover the work. You can use the normal tabular format, or you can use a card format, but I think the new way using an Image screen may be the most helpful.





The End

- If you have any suggestions for improvement in the future please let us know. As always this is your training class, we just facilitate.
- Rather than paper feed back forms this year, you will get a link to provide feedback electronically. If you thought the class beneficial and would like to see it in the future please provide that feedback. Your feedback helps determine what the agenda is for next year so please provide it.
- Thank you for attending!



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