

## What's in Your Radio Communication Tackle Box?

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The sporting anglers today have the latest gear and lures available to help catch that prize fish in their favorite fishing spot. The new rods are much more flexible, lighter, stronger and the same applies to the reels that hold the fishing line; the use of technology is seen everywhere, right down to the fishing hooks and lures.

We see the same thing with the wireless communications market for the water/wastewater industry. Radios have become faster, smarter and easier than ever to program and upgrade firmware. The biggest advancements are happening on the IO side of the pond. We see more options and frequencies that can be used today than ever before. The same is true with cell modems and satellite radios to competitive radio hardware. With so many possibilities, it is important for an operator to understand these options in order to select the best possible communication tools for their particular water application.



Figure 1. Tackle Box

### **Radio Communication Tackle Box Contents:**

It might consist of a laptop computer; diagnostic software – ToolSuite, Wireshark and others; Bird 43 watt meter; radio spectrum analyzers; test radios; Omni and Yagi antennas; RF coaxial cable; cable jumpers; lightning protection; weather proofing and grounding kits; radio path studies; diagnostic tools; DC power supplies; radio antenna masts and towers; and knowledge of radio types and SS and licensed frequencies and Serial and/or Ethernet devices.

Radio diagnostic information both locally and network wide is much easier and we have added a spectrum analyzer tool that shows what the local noise floor looks like on the frequency that is being used at the time. Programs like Tool Suite have a design template that can be used to create a new network and later the user can program the radios from this template. Those that may have been using older diagnostic tools can import those networks into Tool Suite and perform a reverse design template build and have a template of their existing network.

With the release of several new IO and IP products in both 900MHz and 2.4GHz, users have more options today at a lower price point than ever before utilizing wireless IO and IP SCADA applications for the water/wastewater industry.



Fig. 2: Tool Suite diagnostic software and Bird Model 43 watt meter

### **Radio Communications in the Water/Wastewater Industry – let’s go Fishing!**



Fig. 3.

Wireless technologies are affording new applications that the water/wastewater industry is beginning to embrace, such as incorporating video surveillance or secure access control for certain types of emergencies. A video application can be as simple as monitoring the flow of some type of drainage canal or water tanks. With wireless technologies, water and wastewater treatment plants can monitor the flow of water or water levels via video or monitor storage tanks or reservoirs to maintain security from potential threat.

Regardless of the type of water/wastewater application, there are several important considerations for choosing a wireless radio:

- Preparation and knowledge are essential!
- What are the short- and long-term plans/goals?
- Who is the master/administrator and does he/she know what is expected?
- Who's going to do the work?
- What is the time table and time of completion?
- Do you have a radio path study?
- Do you have a network design and list of end devices and connection types? Will there be IO devices either local or using Modbus protocol?
- Are you looking at hybrid networks using Ethernet and serial radios? Will there be IP security cameras?

The leading radio manufacturers are developing several new products to help with this demand. There are I/O radios and a new series of radios that include I/O expansion modules that utilize Modbus protocol which is the industry standard. A new radio has 4 RJ-45 ports, two for Ethernet and 2 for serial communications. New cathodic radios have the ability to connect to rectifiers from 110-480VAC with a one step down transformer that will drop the voltage down to 12VDC. It can accept either positive or negative voltage shunts as well and bring in your pipe to soil test points. The ease to add I/O into existing networks that already have serial radios makes this task quite easy and if repeaters are needed they can be added to the radio network. There also are new software programs (Tool Suite) that act like a Swiss army knife – it can program the radios, update firmware, create network design templates and gather diagnostics all from the same software. You can create a network design and program the radio for each specific location and know that it has all the correct settings required.

**Critical Steps to Creating a Reliable and Complete Radio Communication Network System:**

<b><u>System Needs and Long-Term Goals</u></b>
1. Understand the current and future needs for your system <ul style="list-style-type: none"> <li>• Involve Stakeholders</li> </ul> Seek input & different perspectives
2. Second, know your organizations long-term communication goal. <ul style="list-style-type: none"> <li>• Communication infrastructure sharing for different applications</li> </ul>
3. Failure to completely understand all of these will increase your odds of failure.

<b><u>Know the Market</u></b>
1. Pay attention to what your neighbors and the market are doing
2. Make your choices based on your individual needs and goals, not what your neighbor does
3. Verify performance and do not blindly trust market buzz or advertising

<b>Detailed Planning</b>
1. Frequency of data acquisition <ul style="list-style-type: none"> <li>• On-demand</li> <li>• Hourly or daily</li> <li>• On exception/change of status</li> </ul>
2. Data or data packet sizes <ul style="list-style-type: none"> <li>• Large or small</li> <li>• Streaming polled or report by exception</li> </ul>
3. Latency requirements

<b>Technology Selection</b>
1. Don't be afraid to learn about technologies, their advantages and limitations
2. Be skeptical; one size does not fit all when it comes to communication networks
3. Hybrid networks may offer the best technical approach to solving diverse needs and requirements

<b>Budget</b>
1. Cost <ul style="list-style-type: none"> <li>• CAPEX; upfront investment</li> <li>• OPEX; recurring charges</li> <li>• Maintenance, repairs, service</li> <li>•</li> </ul>
2. Financing <ul style="list-style-type: none"> <li>• Depreciation (tax write off)</li> <li>• System Needs and Long-Term Goals</li> </ul>

### **Hybrid Networks as an Option!**

Sometimes, there isn't just one solution that can meet all your water/wastewater needs. That is where taking a "hybrid" approach can be best. Hybrid communication networks can have several variations of radio type, frequency, and could be licensed or spread spectrum. In addition, Ethernet, Serial and I/O all can work together as an integrated communication network. Oftentimes, the best solution is not a single technology, but the mixture of two or three different brands. By upgrading critical sites and adding new technology when needed, the end user often can get the biggest bang for the buck. In order to select the best possible hybrid network, operators are advised to do their homework – check references, products, features, warranties, get a path study and find out if they can easily get diagnostic and history information. It is essential for critical decision makers to check their tackle box for all possible options.



Figure 4: Know what tools are available at the right time for the right project

### **Conclusion**

The key to building a successful radio communication network for your water/wastewater application is to examine all the tools in your communication tackle box. The options today are endless with continually improving radios, software and the option of hybrid solutions to optimize your communications. In order to have the most reliable system possible, it is essential to plan, understand the technology, be aware of the total budget and know the market. Being aware of these critical factors will open users up to the infinite possibilities and let them learn about applications others have already tried and proven in the field or pond. Load your tackle box and let's go fishing!