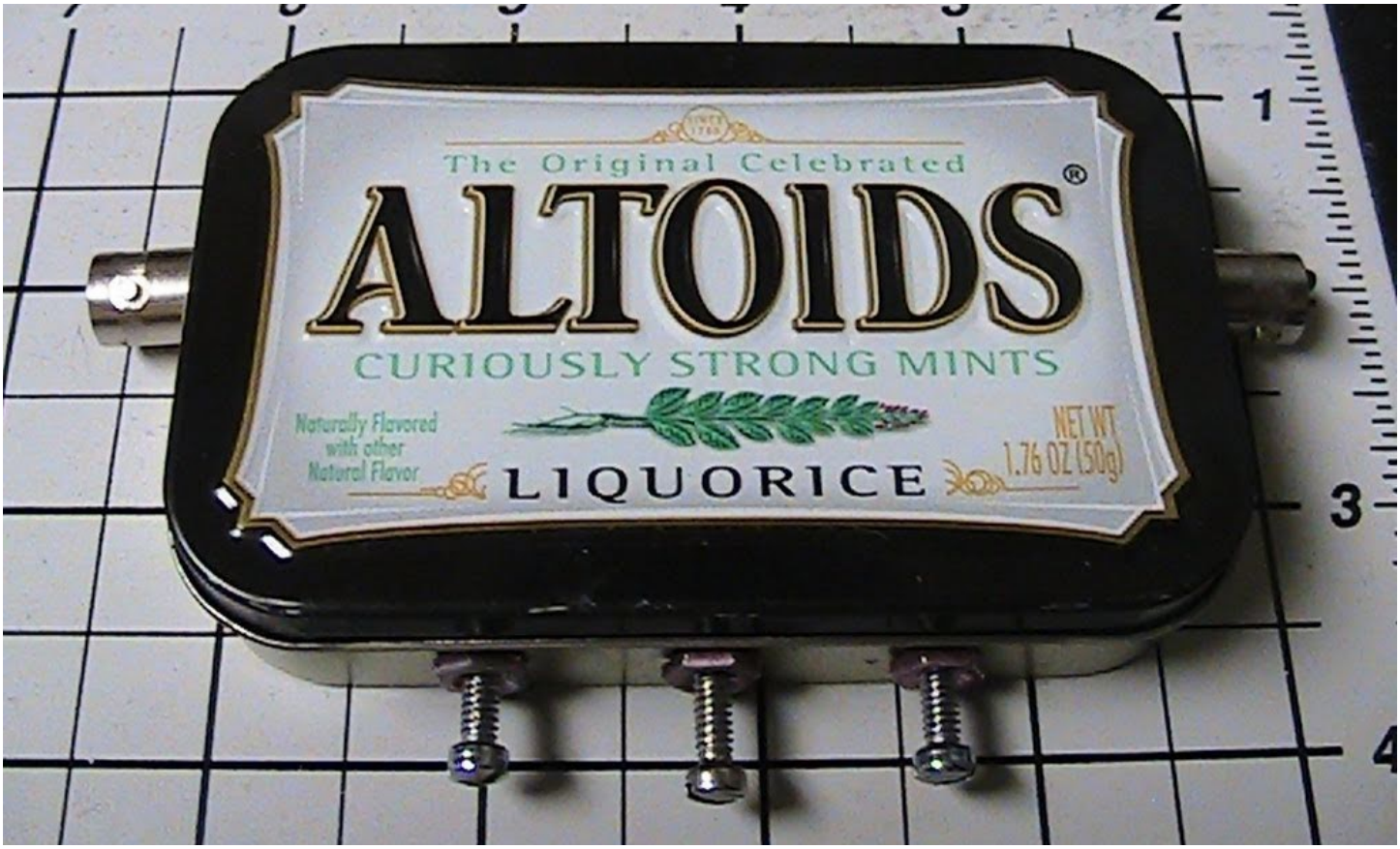

Wavelengths

Xenia Weather Amateur Radio Net Jan 2019
XWARN (W8XRN)

147.1650+ (123.0) (Analog Only)
443.1000+ (123.0) (Analog + System Fusion)

Meetings: 2nd Monday, 7:30PM, Greene Memorial Hospital (1141 N Monroe Dr, Xenia, OH) Herman Menapace Auditorium

President's Message

Happy New Year!

I hope everyone's holidays were wonderful. Now it is time to start a new year and make our club better than ever.

This month we will have two presentations. Jim Storms will come to talk about the Youth DX adventure and we will have a group of young kids from St. Brigid Xenia, the "Brigid Builders," present their project that they are taking to competition for the Lego League. They look forward to receiving our feedback and learning more about amateur radio.

Our youth are our future so it is fitting that we start out the new year with presentations on and for our future. We are going to have a full year of exciting opportunities and I look forward to sharing them all with you.

73,

Elizabeth Klinc, KE8FMJ

Club Contacts

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Minutes: Dec 10, 2018

December's regular meeting was the annual holiday party at Golden Corral. As such, the Minutes have a decidedly different flavor this month. Since I could not attend the party, Bob Baker was kind enough to send me the following:

Steve and Jason,

At the XWARN Christmas Party, I presented some special awards. The two of you were included and I wanted to send a copy of my words that I spoke as I presented the awards. I will present the framed certificates to each of you at the next meeting. Jason, I think it would be appropriate to include this in the next newsletter. I feel that there are several members who have made contributions of their time and talent that deserve special recognition. Once a member has been inducted into the "Hall of Honor" there is not an official means of further recognition, so I made up my own award, the "President's Star Award".

First, I'd like to ask Janice Crawford to step forward. Janice has managed the XWARN t-shirt sales at Hamvention for some time now and has done a wonderful job. From creation of the final design through recruiting volunteers and running the sale, Janice has made sure that the operation was a success.

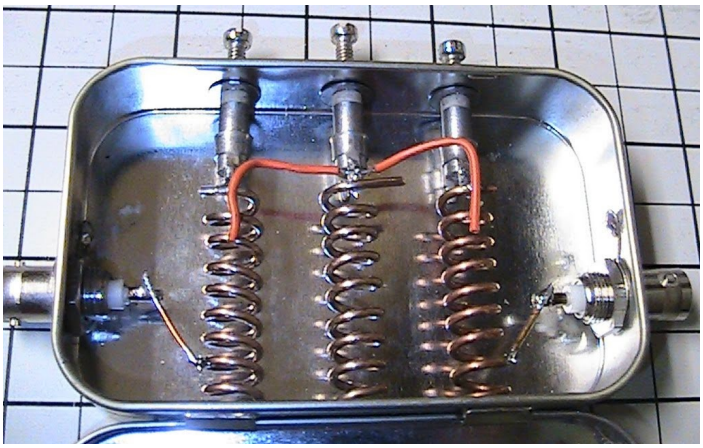
Next, I'd like to ask Mike Crawford to come forward. Mike keeps the Communications Support Trailer ready for use and helps Janice with many of the logistic issues related to the t-shirt sales, but this award is to recognize his performance of leading the food operation as part of Field Day.

Next, I'd like to recognize Steve Mackey. Steve is out of town and could not be here, tonight, but I will introduce the award. For longer than I even know, Steve has managed the club treasury, paid the bills, and taken care of club business. When Janice took a year off from t-shirt sales to prepare for Christi's wedding, Steve stepped up to take her place.

Next, I would like to recognize Jason Bowman. XWARN is now a Not For Profit Ohio Corporation and is recognized by the United States Internal Revenue Service as a 501 (c)(3) organization. Thank you, Jason, for leading the effort to make this happen. Finally, I ask Karen Baker to come forward. Karen does not have an amateur radio license, but she has contributed to XWARN in significant ways. For example, I hope that all of you are enjoying this party that she arranged.

Bob Baker December 10, 2018

222 MHz Helical Bandpass Filter in an Altoid's Tin



To help with ideas for the newsletter, I subscribe to a Facebook group called Ham Radio Homebrew (http://bit.ly/2VxlDKb). On Christmas Day, I noticed a post from Carol Milazzo about a filter made with the help of an Altoid's tin. Altoid's tins and other similar cases are great for radio projects because they are all metal — they provide a common ground for the various components inside, a shield, and protective case all in one!

The stated purpose of this particular filter (222-225 MHz band) is to "suppress the low level local oscillator, harmonics and spurious intermodulation emissions from the UT5JCW 222 MHz transverter."

If I had more time, I'd research the math here for filter design. The layman's bottom line is that this circuit acts as an oscillator resonant on certain frequencies determined by the values of the inductance and capacitance. At other frequencies, it doesn't oscillate as well and, therefore, won't pass the energy as well.

The "tripled tuned" design results in a higher order filter capable of much sharper attenuation outside of the passband. In fact, the creator stated that the drop-off is about 3dB at the edges of the 222Mhz band necessitating some stray capacitance or what Carol calls "gimmick capacitors" to increase the bandwidth.

These gimmick capacitors are short pieces of wire (red in the picture above) connected at one end to one of the piston capacitors. Recall that all electrical components have small amounts of inherent resistance, capacitance, and inductance. These type of "tricks" can be used when the required electrical values are exceedingly small. Something similar is being used to fix an electromagnetic interference (EMI) problem I am having with a medium wave infrared gimbal in my day job. The first time we flew the gimbal, there was a horrible banding and noise problem in the video being sent back. The gimbal manufacturer tracked the problem down to noise being given off by 3 signal traces coming from the GPS receiver inside the gimbal. Guess what the fix is? Add a very small amount of series resistance to the traces. This interacts with the inherent or stray capacitance in the signal traces to form a low pass filter rounding off the square waveform just a little bit to eliminate the high frequency content and therefore the EMI.

Back to the 222Mhz filter. I'll include the basic specifications and instructions down below, but the original source can be found on a Google Photos page the creator made for the project (http://bit.ly/2RanGoJ).

To get started, you will need 2x of your favorite coax connector. This project used BNC connectors. Next you'll need 3x piston capacitors in the neighborhood of about 10pF. You'll

(Continued on page 5)

XWARN Mission

The mission of the Xenia Weather Amateur Radio Net (XWARN) amateur radio club is to conduct weather spotting nets during severe weather and other communication services for the City Of Xenia and all other Greene County communities.

In this capacity, we are set up to provide communication services as required to the Greene County Ohio Public Service Agencies and other local government entities. The communications services provided to the supported agencies may be for emergency purposes or to simply enhance their communications abilities. On an as needed basis XWARN provides similar services to various government entities of our surrounding counties.

Additionally, XWARN provides communications support to various community organizations in support of marathons, 5K runs, 10K runs, bicycle events, etc. to provide health and safety assistance to the participants and sponsors of said events.

In support of these goals, XWARN operates and maintains amateur radio repeaters and other equipment in Greene County.

Shape Memory Alloy Antennas & Software Defined Radios — Cool "Drone" Project

I have an interesting project going on at work I'd like to share that involves radios and amateur radio equipment, at least in the prototype stage.

Maybe some of you recall that I throw small airplanes out of big airplanes. Well, a colleague of mine in a very different part of my organization came to me with an interesting problem — land one of my air-launched "drones" on a battlefield and transmit some data from a payload up into the ether somewhere.

Our current drone is designed for long endurance battlefield targeting, which means that the payload area is on the nose to provide the best field-of-view for a video camera. The nose is about the size of a 5-inch sphere with a 5-inch cylindrical base about 1-2 inches in height. We have to fit the payload, radio, antenna, amplifier, and payload battery into that volume.

Furthermore, these air-launched drones are shot from tubes, so you can't have antennas hanging out, at least initially. Our command-and-control (C2) antenna operates in S-band (think 2.4GHz WiFi), and it's on a spring-loaded hinge. But the payload requirement is for transmissions somewhere in the military UHF band.

That antenna is sufficiently long (300MHz = 1m wavelength) that we don't want to deploy it immediately after launch due to the large increase in drag and commensurate decrease in endurance. What about a 1/4 wave or something even shorter, you say? Well, we'd have a heck of a time getting a decent ground plane for a 1/4-wave antenna. We could go even shorter. But, while we would get a less directed (low gain) antenna pattern, which is good because the drone may come to rest at awkward angles, we do have a range requirement to meet. A stubby antenna just won't meet the range requirement. So something like a half wave is probably going to be what works for us — dipoles don't lose a lot of gain until past 45° broadside or so allowing for extreme orientations after the drone comes to rest.

If you do the math, half wave at 300Mhz is about 19 inches. In addition to not deploying it while flying, we also don't want it snagging on things as the drone comes in from a landing. So we need a way of storing an antenna of that size in a 5-inch sphere until the drone comes to rest on the ground.

One possible solution that we considered was to use a telescoping mechanism. However, the automobile versions are simply too large, and we really don't want to try to miniaturize that mechanism.

Another possibility is to use a shape memory alloy (SMA) wire as an antenna. In a previous life, I was involved with various efforts to bring morphing technology to aircraft wings. The basics of SMAs are that you "train" it to a certain shape above a threshold temperature. Then you can deform it any way you want below the threshold temperature. When you need the original shape back, simply apply heat and it will magically return to its original shape.

We don't actually need the shape memory effect. What we do need is another property of SMAs called *superelasticity*. Regular metals and alloys can be strained about 2% before permanent deformation occurs. SMAs can be strained about 8% before permanent deformation occurs. What this means is

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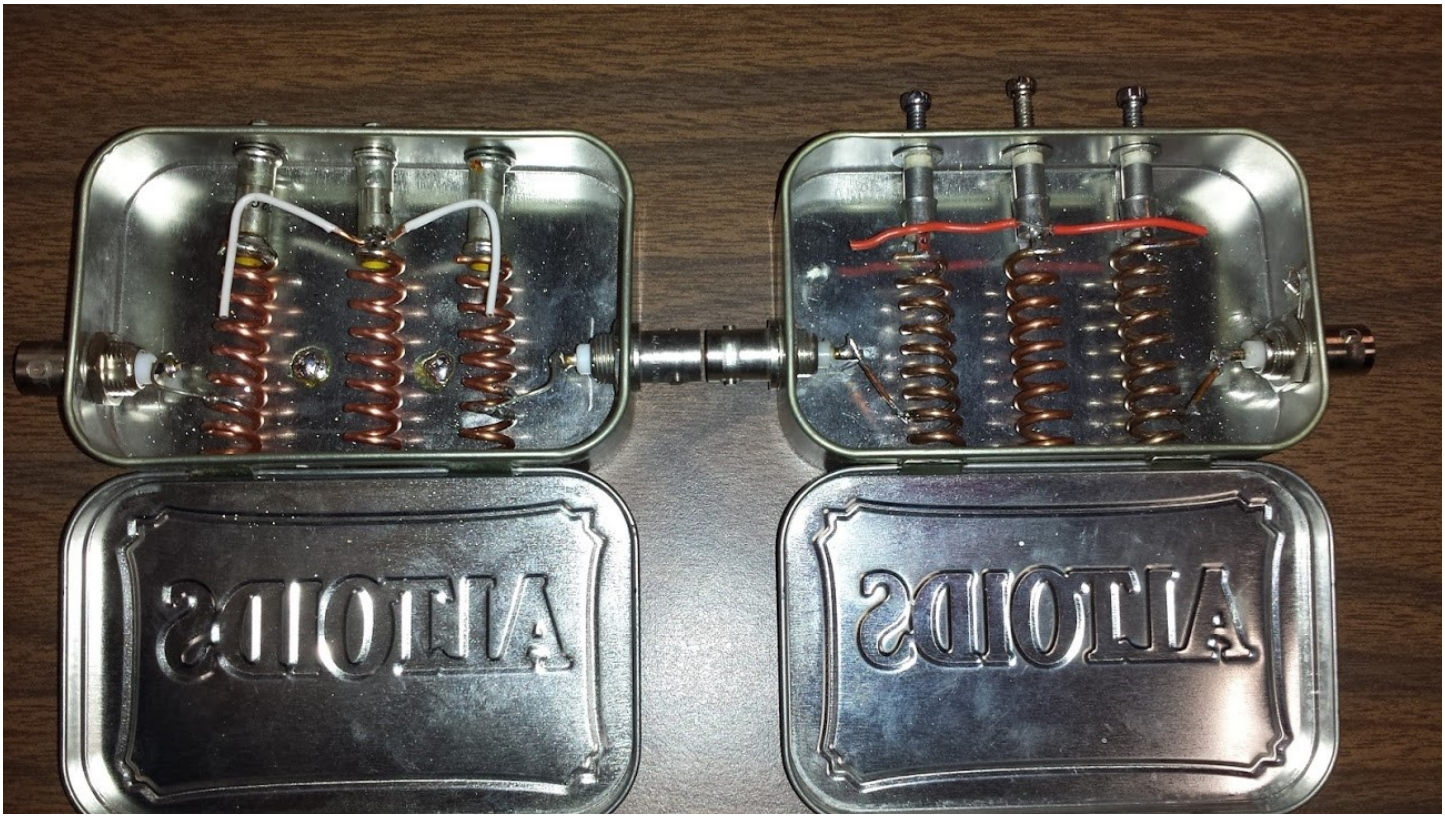
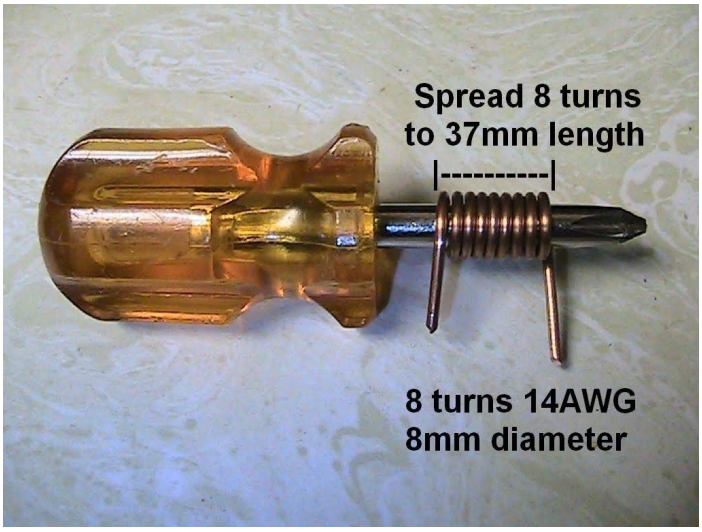
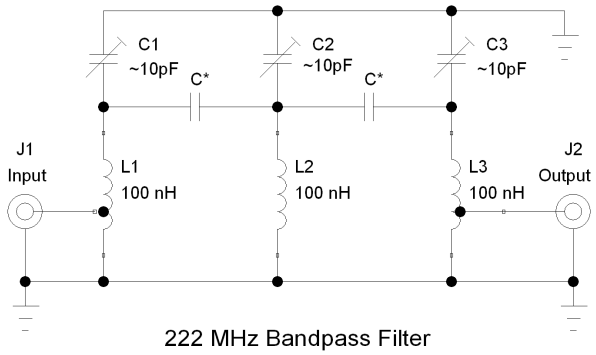






222 MHz Bandpass Filter

(Continued from page 3)

also need 3x inductors with an inductance of 100nH. The creator made these herself by wrapping solid 14 AWG copper wire around the shank of a screwdriver (8mm diameter) 8x turns spread to 37mm length.

Drill appropriate size holes for the connectors and capacitors and install them. The capacitors were spaced 2cm apart. I'm not sure if this matters or not. Solder one end of each coil to its respective capacitor and the other end to the tin. Then solder a short piece of wire from the center pin of each BNC connector to the 2nd turn (from the end soldered to the tin) of the respective outside coil (L1 and L3). To add the gimmick capacitors, strip a small piece of insulation off of 2x short pieces of wire and solder to the capacitor end of the center inductor (L2). Spread the ends of the wires over towards L1 and L3. The creator suggests you will have to play with this positioning to achieve the desired bandwidth.

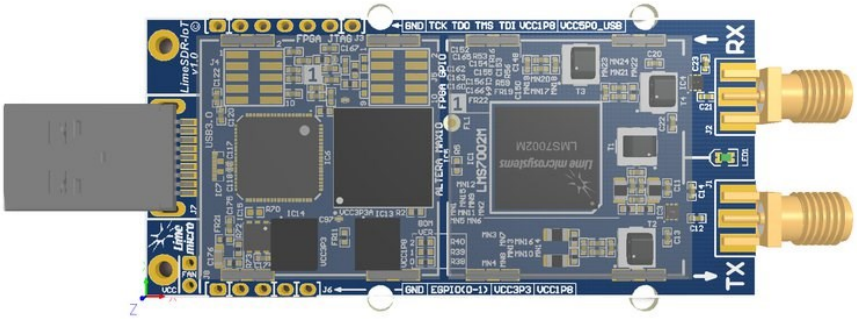
Shape Memory Alloy Antennas & Software Defined Radios — Cool "Drone" Project

(Continued from page 4)

that we can jam a 19-inch SMA antenna into a 5-inch sphere and it should come out straight.

How do we jam it in? Well, we're working on that. The going in position is that we can wind the antenna on a spindle with a torsion spring and damper and have it unwind out a tube through the outer mold line. We even found some SMA (the connector not the shape memory alloy wire) rotary connectors that will allow us to jump the signal onto the spindle. But since the real mission only requires the system to operate once, we can probably get away with an MMCX connector, which is designed to rotate, or even a cheap U.FL connector, which can rotate but isn't meant to once installed. The superelasticity property allows us to wind the antenna into a fairly tight coil and have it still pop up straight when deployed. A regular whip antenna will take a permanent set and not perform correctly when deployed.

Do SMA antennas exist? They sure do. You can buy them from various sources, but I bought two Signal Sticks (http://bit.ly/2CSnly8) for prototyping from the guys that run Hamstudy.org (http://bit.ly/2C3hiW9). They cost $20 each, and proceeds go to support Hamstudy.org. Signal Sticks are 1/4 wave and 3/4 wave on VHF and UHF amateur bands, respectively. Physically, the antenna is 18.25 inches long, which is about 3 inches longer than the typical aftermarket VHF/UHF HT whip.



One of the inventors reviewed (http://bit.ly/2Fc5JQc) the antenna design, and a couple of hams conducted some basic performance measurements comparing the Signal Stick to other antennas (http://bit.ly/2CQ1zv8). The punch line is that the Signal Stick is one of the top performers as far as HT antennas go.

But you can buy SMA wire in various diameters and build your own if you want. We'll eventually do that when we need to cut for the actual frequency and when we get tired of whacking ourselves in the face when winding it on the spindle. Version 2 of the Signal Sticks use a thicker wire than Version 1, and I'm afraid it's going to whack me in the eye every time I coil it. The guys at Hamstudy.org did that so the antenna doesn't flop around as much while on an HT. But we don't mind it flopping around if it means a safer and more reliable deployment mechanism.

Onto the radio …

Military radios simply don't fit into a 5-inch sphere, even the handheld military radios such as the PRC-152. But we don't need a military radio per se. This particular radio only has to work one time and doesn't need interfaces for people such as keypads and displays.

That leads us to the world of software-defined radios or SDRs. The ubiquitous RTL-SDR dongles are one example, but they are receive-only. For transmit, you can to look towards the various Kickstarter projects out there. One of the contractors on my program is a fellow ham, and it turns out he has a handful of Lime SDRs sitting in a project box collecting dust.

One problem with these SDRs is that they're really designed for experimentation on a bench. So output power is 10dBm (10mW) at best. We actually measured one and for most of the frequency coverage it's hovering around -30dBm. Sounds like they cherry-picked the 10dBm number — not only will we need an amplifier but we will also need a preamp! I can't go into the transmit power requirement, but I can say it's definitely above 10dBm!

For prototyping, we aren't going to bother with an actual military waveform. Not only don't we have the resources to program a military waveform into an SDR but we simply don't have the expertise. For our prototype, we will most likely use an off-the-shelf waveform such as continuous wave or 802.11 (WiFi) to demonstrate the proof-of-concept and then hand it to real SDR experts to code up the relevant military waveform for the real mission.

That's it for now. As we make progress on the prototype, I will try to keep you informed with the hobby aspects. Obviously I can't go into the military aspects. Well, I could, but then I'd have to kill you :-)


ENGINEER
2018
CHAMPIONS

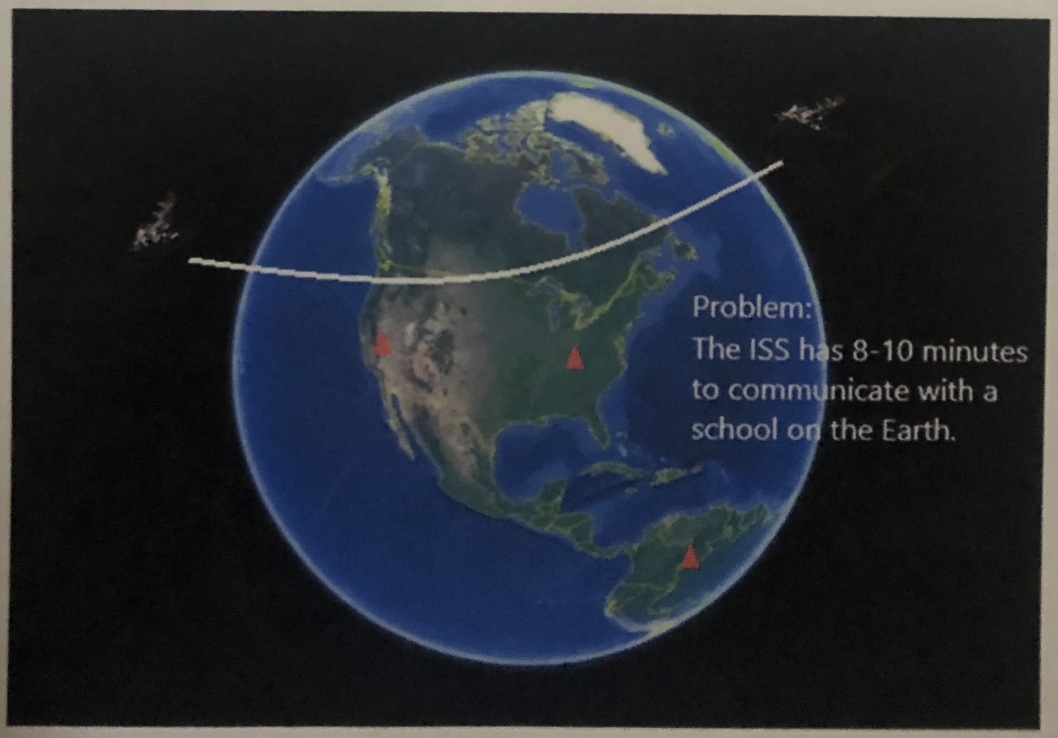
Into Orbit Project
By The BRIGID BUILDERS

Introduction

Messages travel through space as radio waves, just like the radio waves that you receive with a car radio. All spacecrafts have a transmitter and a receiver for radio waves as well as a way of interpreting the information received and acting on it. Radio waves from a spacecraft need to be received on Earth and are often quite weak when they get there. NASA has big radio receivers to gather information from space missions. These must be precisely aimed so they can get the waves. Likewise, NASA must precisely aim transmissions to spacecrafts so that the ships will hear the messages.

Problem

One main problem for astronauts is that they are very socially isolated. People in the International Space Station (ISS) have limited time to talk to children in schools. The ISS goes around the Earth 16 times a day at the speed of 17,500 mph. and there is only a limited time for people to talk to the astronauts because the ISS goes out of range. The estimated time to talk to people in space is 9 to 10 minutes. That's like having a guest speaker come into your classroom for ten minutes. That is not enough time for the astronauts and students to talk.



Proposed Solution

If people put amateur radio ground stations all over the world and network them together, then we could send the signal to the other ham radio ground stations and then they can send that signal to someone in space. This will extend the time that you get to talk to people in space. This will turn that 10-minute guest speaker into a 30 minute guest speaker.

Research

Ham radios are amateur radios that are used all over the world. These radios are used to communicate to the ISS. The International Space Station ham radio is also called the Amateur Radio on the International Space Station (ARISS). They use this to communicate with the world. The ISS can only talk to people for about ten minutes with a frequency of about 145.8 MHz, but there are global positioning systems that can locate the ISS.

Repeaters are another object used to help during the telecommunication process. Repeaters are usually located on hilltops and tall buildings in order to cover more ground. This device basically receives messages, copies it and sends it back out. According to DCS 2 Way, "a radio repeater simultaneously receives a radio signal and re-transmits it at a higher power, so it can cover greater distances," (DCS paragraph 3). The repeater takes in the message from the antenna which is sent to the Duplexer. The Duplexer receives the input and sends it to the receiver. The receiver then receives the audio of the message and sends it to the controller. This controller transmits the audio and sends it to the transmitter. Lastly the transmitter feeds it out and back to the next location.

Ham radio repeaters exist and are usually maintained by individual hobbyists and groups. However, there are not very many. Western Michigan is covered by the Independent Repeater Association. Also, there is the Western Intertie Network system which covers a large part of California, along with seventeen other states and parts of Australia, Canada, Great Britain, and Japan.

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«FNAME» «LNAME» - «CALL»
«ADDRESS»
«CITY», «STATE» «ZIP»

Wavelengths

Wavelengths is published monthly by the Xenia Weather Amateur Radio Net. Our meetings are currently held on the 2nd Monday of each month at **7:30 pm** at the Greene Memorial Hospital Auditorium. You can find additional information about our organization at www.xwarn.net . We welcome new and experienced Amateur operators and those interest in becoming an Amateur operator to attend our meetings.