



The RELAY)))

MARCH
2019

The Official Publication of the Arrowhead Radio Amateur Club

A.R.A.C. Inc.

P.O. Box 7164 Duluth MN 55807-7164

<http://www.thearac.org>

Dues: Member \$20/Family \$25

INDEX

| | |
|-------------------|-----|
| IS ZZL & ISS | 1 |
| Board Mtg Minutes | 2-4 |
| Silent Key | 4 |
| Club Mtg Minutes | 5-6 |
| MARS | 7 |
| Prez Sez | 8 |
| Contest Calendar | 9 |
| Band Plan | 10 |
| CW Abbreviations | 10 |
| Nets | 11 |
| Meeting Notice | 12 |
| Upcoming Events | 12 |
| Repeaters | 13 |
| Membership | 14 |
| Calendar | 15 |
| Ask Elmer | 19 |



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facebook!

1. Type ARAC in the search box to find us.

2. Click "Join" to gain access.

Open to all Club Members

Co-Editors: Kim & Steve Waller

Kim - KEØNQS • Steve - KEØNQT

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Ice Station ZZL & Amateur Radio in Space

By Steve Waller KEØNQT
& Kim Waller KEØNQS

On Sunday February 10, 2019 a passionate group of amateur radio enthusiasts gathered together on the frozen ice of Caribou Lake, some 15 minutes north of Duluth for that which is known as Ice Station ZZL. Ice Station ZZL started out years ago, as legend has it, by a few hams after the cancellation of the Wolf Track Sled Dog Race, as a way to combat the cabin fever effect of Minnesota winter. At a time of year when many people fly south for refuge to places like Pensacola or Tucumcari, the devoted group continued the tradition and braved a -1 degree wind chill on the cusp of a polar vortex to set up IS-ZZL.

Arriving on scene, I was greeted by a well-oiled machine. Dave, AAØAC had plowed the perfect spot on a prime flat area of ice, the BBQ Brat station was well managed by Randy, AAØME, and Doug, AAØAW augured the ice fishing holes. Gene, NØVRM and crew assembled the HF shack and saw to the antenna hoisting.

Looking around at the line-up of 4x4 trucks, I found Al Nordin, WBØDBQ in his Ford Ranger manning an impressive mobile command center with a large Circular Polarized Antenna on a 30' mast, complete with the American flag. As I soon discovered, this was ground zero for contacting the International Space Station as part of a 9 hour window when the Space Station exchanges greetings.



Al Nordin, WBØDBQ and his mobile command center at IS-ZZL

[See Ask Elmer on page 19 with KCØNFB Bob Schulz on building your own!](#)

I also learned that Al has been a Ham radio operator for fifty years, back when Apollo 8 first launched in 1968. Apollo 8 was the first crewed space craft to orbit the moon and return to Earth as well as the first crew to actually photograph the astounding sight of an Earth-rise in space. Back then at age 14, Al got hold of his Grandmother's radio and ever since, the hobby has firmly held his interest.

All these years later on a mid-winter morning at a frozen Minnesota lake, Al was happy to take some time to explain his set-up to a newer Technician-licensed ham who'd heard people talk about contacting the ISS, but had never seen it for himself. Al's enthusiasm about sharing this was truly infectious and I really appreciated his


Continued on Page 17

PRESIDENT



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KD9ABS
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2ND YEAR BOARD



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Dave Davis

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1ST YEAR BOARD

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Hermantown, MN 55811

ARAC Board Meeting Minutes for February 5, 2019

Present Gene Ellefsen-NØVRM, Mike Lovold-NØPDG, Bruce Carlson-KEØNIT, Gary Minter-KD9ABS, Dave Davis-AAØAC, Bob Boyd-KDØYLN, Bob Schultz-KCØNFB, Diane Saunders-KØDSL, Randy Wabik-KRØB, Doug Nelson-AAØAW, Grant Forsyth-KCØWUP, Kim Waller-KEØNQS, Steve Waller-KEØNQT, Tom Dorr-KEØRHA, Robin Davis

Guest Del Minter-KEØCLI

Meeting called to order at 6:37 by President Gene-NØVRM

No Board meeting last month but let's get going for this month

Treasurer's Report

| | |
|----------------|------------|
| Checking | 3,121.44 |
| Savings | 1,868.25 |
| Subtotal | \$4,989.69 |

Outstanding Check (Repeater # 1400)-\$1,100.00

| | |
|------------------|------------|
| Winter CD..... | 1,707.19 |
| CD Subtotal..... | \$1,707.19 |

Grand Total\$5,596.88

Expenses over the last month were coffee, donuts, food for Christmas party, and the annual liability insurance

Question - Why do we have this insurance? Covers Ham Fest, Picnic, Articles of Incorporation, etc. The insurance is required for our events and covers the Officers of ARAC

Bruce-KEØNIT will be tracking our income and expenses different from last year, starting fresh in January of this year and each year forward. He will continue the master tracking system but will only provide a copy of it when requested by an officer or member. Our fiscal year follows the calendar year

Motion to approve by Dave-AAØAC, seconded by Gary-KD9ABS & Bob-KDØLYN, motion passed

Minutes

Posted on web page and in newsletter. Motion to accept by Dave-AAØAC, seconded by Mike-NØPDG, motion passed.

Committee Reports

Testing

Nothing scheduled right now. Last sessions were very successful. David Lovshin passed his Tech license. We now have the ability to test individuals without the seven (7) days' notice to ARRL. We have plenty of VEs available for testing so if you are interested in testing, please contact Doug-AAØAW. No tests are scheduled until the end of the Community Ed Class, at the Ham Fest, May 4th. The last test session in January had six (6) people that test with five (4) Hams upgrading and one (1) getting his Tech license.

ARAC BOARD Meeting Minutes, Continued from Page 2

Education / Ham Fest

Not here

Program

February program is Brandon Weathers, WDIO's weatherman
March Kim-KEØNQS is going to present a program on historical documents. Also going to play the Kahoot game, download an app on your phone to play
April is Skywarn Training. We start our business meeting early at 6:00 pm

Newsletter

Diane-KØDSL had tendered her resignation as the Newsletter Editor. Kim-KEØNQS and Steve-KEØNQT have volunteered to take that over. Thank you to Diane-KØDSL for what you did as the Newsletter Editor.

Web Page

We have a new web page master, Tom-KEØRHA. He is slowly trolling through stuff from Doug-AAØAW to determine which direction we should go with the Web Page. If you find anything wrong, please e-mail Tom. One item to change is the Rosters are mixed for the month of February, Net Control Roster. A couple Hams mentioned it is difficult to read the web page because the background and text are too light

Doug-AAØAW will still mail out the newsletter at the beginning of each month. He will let Tom-KEØRHA know each month so he can make sure it is on the web page

Ice Station ZZL

This event came about after the cancellation of the Wolf Track race one (1) year that lead to the creation of a new event. It is not an ARAC event but still is a lot of fun. These are some of the types of the things we need to get into the newsletter and keep as part of our history

Historian

Suggestion to give the Club historical documents to Kim-KEØNQS for archiving. We haven't filed a membership report with the ARRL for the last four (4) years, which we should do because we have 50% ARRL members in the Club. We need to update our membership list including ARRL membership along with e-mail/contact information. There are concerns about privacy. Kim-KEØNQS suggested we need a privacy policy. Mailing lists are worth money but we don't sell it. We would maintain a public membership list with a box to be checked as to whether or not you want your information released. It is something to be discussed at the Membership meeting

Repeater

No update. We have the heat on and the air conditioner is covered, thanks to Dave-AAØAW who donated the cover.

Ham Fest

We have to start thinking about Ham Fest. We believe that Bob-KCØNFB is trying to contact the Fair Board without success. We need door prizes. Doug-AAØAW changed the end time to 1:00 pm. By noon, most vendors have packed up and left. Suggestion to ask Rolly Bockbrader-KBØCK if Thrivent would be willing to donate another gift card, which covered the Ham Fest food and the picnic food.

Upcoming Events

Grandma's is coming and we can always use help. Scott Aslgren-N0VYU, will be equal with Doug-AA0AW this year on Communications. The following year, Scott-N0VYU will run it with Doug-AA0AW's supervision. It is the same weekend as Field Day this year.

Field Day

The gentleman (Ken Vertin-KE0LOX) from the Red Cross, said we can use the trailer again this year for Field Day

New Business

There is a change on the Superior Ironman Trialathon, moved up to August 10th, because of the construction on Superior St, Eugene Curnow Trail Marathon is July 14th, Minnesota Voyageur 50M Trail Ultramarathon is July 28th, etc. The Wild Duluth Race is now a two day race, October 19th and 20th. They will have four (4) races this year

Bruce-KE0NIT paid our rent at the Chuch Office in December and our rate is \$25.00 per month. There were smiles all around. They charge us so little and are very accommodating

Dorothy Anway-KC9LSG, can't go home from the hospital because her need for oxygen is very high as reported on the Sunday night net. Allen Anway-KC9LJN, reported she is in the hospital and not doing well. He covets our well wishes

Motion to adjourn by Mike, seconded by Bob, motion passed at 7:15 pm

Silent Key

Dorothy W. Anway, KC9LSG

July 2, 1942 - February 27, 2019

DULUTH, Minn. - Dorothy W. Anway, 76, of Superior, Wisconsin, passed away on Wednesday, February 27th

A gathering will be from 10:00 a.m. - 11:00 a.m., followed by a memorial service at 11:00 a.m. on Saturday, March 16, at First United Methodist Church in Duluth. The Reverend Janine Alexander will officiate.

Arrangements by Affordable Cremation & Burial

ARAC Club Meeting Minutes

February 14, 2019

President - Gene Ellefsen-N0VRM
Vice President - Mike Lovold-N0PDG
Treasurer / Membership - Bruce Carlson-KE0NIT
Secretary - Robin Davis
Third Year Board - Gary Minter-KD9ABS
Second Year Board - Dave Davis-AA0AC
First Year Board - Bob Boyd-KD0YLN
Parliamentarian - Grant Forsyth-KC0WUP
Special Events – Open / Gene Ellefsen-N0VRM acting
Ham Fest / Education - Bob Schultz-KC0NFB
Newsletter - Kim-KE0NQS & Steve-KE0NQT Waller
Newsletter / Historian - Kim-KE0NQS Waller
Property / Picnic - Scott Ahlgren-N0VYU
Repeater - Randy Wabik-KR0B
Testing - Doug Nelson-AA0AW
Web Site - Thomas Dorr-KE0RHA

Absent:

Chaplain (Visiting) Rolland Bockbrader-KB0CK
Repeater Derek McCorison-W0DNF
Repeater Randy Haglin-N0BZZ
Web Site Thomas Dorr-KE0RHA

Meeting called to order at 7:04 pm by President Gene-N0VRM

Minutes:

Minutes have been posted on the web page and in the Newsletter, approved by Bob-KD0LYN, seconded by Grant-KC0WUP, motion passed

Treasurer's Report:

1,068.25
4,989.69
CD 1,707.19
Outstanding Check 1,100.00
5,959.88

Motion to accept as presented by Bob-KD0YLN, seconded by many motion passed

Tags:

N0VYU
KB0VHD
KB0JRQ Lucy
KD0JMW Jason
KD0HHQ David

Reminder, when you pay your dues, let the Bruce-KE0NIT know if you are an ARRL member. Gene-N0VRM will bring that up under new business

Testing:

Nothing scheduled outside of May 4th, after the end of the Class. If you want to test, even just for one, contact Doug.

Education:

Five (5) people showed up for class even though Community Ed classes for ISD #709 were cancelled due to the weather. We have twelve (12) signed up for the class. Quite a good class. Testing will be at the Ham Fest

Ham Fest:

Twenty-Four (24) tables reserved. We have a confirmation on the building reservation. The flyer is on the web site. If you need to reserve a table, please contact Bob-KC0NFB via e-mail

Newsletter:

Kim Waller-KE0NQS and Steve Waller-KE0NQT are the new newsletter editors. Any articles or things you wish to see in the Newsletter see them

ARRL:

We haven't filed a report with the ARRL for the last 4 years. We are asked to file this annually. They would like us to have 50% of our membership be ARRL members as well. Everyone who thinks our frequencies are golden, they are not. ARRL works to prevent the government from selling out frequencies. They have offered billions, latest for 2 meter. Please consider joining ARRL

Ham Fest:

We only have a couple of meetings before the Ham Fest. We need volunteers to have a good Ham Fest. A core group has been doing all the work. The Kitchen is a lot to set up and clean up but that is a big money maker for the Club. We need door prizes.

We went to St. Cloud to their Ham Fest last Saturday. They had nine (9) vendors sign up and pay that did not show up. We need help to set up, clean up, lift the coffee pots. Tear down takes a little while to accomplish. There is a lot of work for some of the events such as Ham Fest, Field Day, Picnic, etc.

On the Web Site, there is a donation part on the Web Page. Some of that stuff is very heavy. Question: Do we have a sign up sheet for the Ham Fest? No, we have tried this in the past and it hasn't worked in the past.

The program in April is Sky Warn training. We start early at 6:00 pm to accommodate the training.

This year Grandma's and Field Day are on the same weekend. Please consider helping to set up for Field Day and/or work Grandma's Marathon.

ISS Slow Scan TV on 2 Meters. Consider getting tracking software. Heavens Above.

Picnic:

Officially reserved August 4, 2019, for the picnic, at Chambers Grove.

Consider coming to Sky Warm training because this is Carol's last year, as she is retiring on April 30th. Please consider coming to honor Carol and all her work.

Door prize drawing was won by KC0FO

Membership:

New member – Scott-W4LGG

U.S. AIR FORCE MILITARY AUXILIARY RADIO SYSTEM

Minnesota State MARS Director
Reginald B. Cass / AFS5MN



Gene Ellefsen
NØVRM

Thank you for your time and interest.

Air Force MARS membership could be for you. We do hope that it is.

If you have the following interests, and capabilities, we are interested in recruiting you to become an Air Force MARS member. Completion of the following on line training is mandatory:

Personally, Identifiable Information (PII) <https://iatraining.disa.mil/eta/piiv2/launchPage.htm>

Cyber Awareness https://iatraining.disa.mil/eta/disa_cac2018/launchPage.htm

If you have completed: Incident Command System (ICS) -100, 200, 700, and 800 training, and have obtained certification for Air Force MARS or are willing to obtain this training, again, Air Force MARS could be for you.

You must be interested in joining a group of individuals that are dedicated to amateur radio, emergency communications, and willingness to learn and used military communications procedures for voice and digital communications.

You must have equipment that will meet the minimum requirements for voice and digital operation. The equipment will be: transmitter, receiver, (transceiver) modified to operate out of amateur radio bands, computer, modem, and antenna's that are designed to operate on military assigned frequencies. (The best antenna's will be a dipole cut to the operational frequency. NVIS antennas work best. You will not need a linear amplifier, however if you have one that will operate on out of amateur radio bands that will be a plus)

You must go through and complete training. You are allowed up to 180 days to do so.

Air Force MARS operation's and procedures are based upon "MARS Operating Instruction", (MOI). The MOI manual uses as its basis for instruction a series of Allied Communications Publications (ACP's), Department of Defense Directives, Department of Defense Instructions, and Department of Defense Manual.

If you already belong to a MARS program and would like to consider Air Force MARS, please contact one of the recruiting team members.

For even more information please open and read the attachment.

Our recruitment team is as follows:

AFA5XK Dave, WB7DRU wb7dru@gmail.com

AFA5ZV Randy, KRØB afa5zv@gmail.com

AFA5JY Reg, KAØRJY reg_cass@msn.com

Happy March everyone!

We have two big events coming up in the next few months. First, at our April 11th club meeting we will be having our annual **Sky Warn Training**. The Club meeting will start at 6:00 PM that night and this training is open to the public so expect more people than usual at the meeting.

Second, coming May 4th is the **ARAC Hamfest**. It is held at the multi-purpose building on the Head of the Lakes fairground in Superior Wisconsin. Doors open to the public at 9:00 AM. **We will need volunteers to help setup and work in the kitchen.** We meet at McDonalds on 21st Street And Tower Ave for breakfast at 5:00AM, then head over to setup at 6:00 AM so the vendors can come in at 7:00AM.

Reminder: If you did not sign up on the list for **ARRL members** at the last club meeting, please let me know. We have to turn in a list to the ARRL to keep up our affiliation with them. My email is ispitech@mail.com

73 and enjoy the Snow!!

- Gene NØVRM



National Weather Service SKYWARN® Program

Skywarn Spotters
for the
National Weather Service
play an important role
in our warning process and
help our communities stay
safe!

Arrowhead Radio Amateur Club HAM FEST!

Sat. May 4th, 2019 9:00am – 1:00pm

HEAD OF THE LAKES FAIRGROUNDS – MULTI
PURPOSE BUILDING

4700 Tower Ave. (Wisconsin Hwy 35) Superior, WI 54880

Fairgrounds are located next to the Superior Airport.

Admission: \$7.00 (12 & under FREE!)

Free parking for most vehicles.

Used and like new radios, supplies, equipment, and computer related items including software and hardware! Personalized Ham items also available!

<<< QSL card checking for ARRL awards program by Mike Cizek WØVTT >>>
Mike's email: mgcizek@gmail.com



This is an A.R.R.L. sanctioned event.

Talk-in on WØGKP Repeater:
146.940(-) [103.5] Duluth
147.000(-) [103.5] Mahtowa
146.940(-) [114.8] 2-Harbors

Testing on site!

10:00 AM 4-H Building
Contact: Doug
AAØAW / 218-391-5874
aa0aw@arrl.net

www.thearac.org

Dealer / Vendor Tables:
4 foot table: \$5.00
8 foot table: \$10.00
Vendor setup starts at: 7:00am

Table Reservations:

Robert Schulz, KC0NFB
115 Eden Lane
Duluth, MN 55805-1533
218-481-7458
arac_hamfest@charter.net

Hourly Drawings!

Contest Calendar 2019

MARCH

| | |
|------------------------------|--|
| Stew Perry Topband Challenge | 1500 UTC March 9 to 1500 UTC March 10 |
| Oklahoma QSO Party | 1500 UTC March 9 to 0200 UTC March 10, and 1400 UTC to 2100 UTC March 10 |
| Idaho QS Party | 1900 UTC March 9 to 1900 UTC March 10 |
| Wisconsin QSO Party | 1800 UTC March 10 to 0100 UTC March 11 |
| Louisiana QSO Party | 1400 UTC March 16 to 0200 UTC March 17 |
| Virginia QSO Party | 1400 UTC March 16 to 0400 UTC March 17, and 1200 UTC to 2400 UTC March 17 |

APRIL

| | |
|--------------------|--|
| Georgia QSO Party | 1800 UTC April 13 to 2359 UTC April 14 |
| Michigan QSO Party | 1600 UTC April 20 to 0400 UTC April 21 |
| Ontario QSO Party | 1800 UTC April 20 to 1800 UTC April 21 |
| Florida QSO Party | 1600 UTC April 27 to 2159 UTC April 28 |

MAY

| | |
|-------------------------|----------------------------------|
| 7th Call Area QSO Party | 1300 UTC May 4 to 0700 UTC May 5 |
| Indiana QSO Party | 1600 UTC May 4 to 0400 UTC May 5 |
| Delaware QSO Party | 1700 UTC May 4 to 2359 UTC May 5 |
| New England QSO Party | 2000 UTC May 4 to 2400 UTC May 5 |

JUNE

| | |
|-----------------------|--------------------------------------|
| ARRL June VHF Contest | 1800 UTC June 8 to 0300 UTC June 10 |
| ARRL Field Day | 1800 UTC June 22 to 2100 UTC June 23 |

JULY

| | |
|--------------------------------|--------------------------------------|
| CQ Worldwide VHF Contest | 1800 UTC July 20 to 2100 UTC July 21 |
| North American QSO Party, RTTY | 1800 UTC July 20 to 0559 UTC July 21 |

AUGUST

| | |
|--------------------------------------|------------------------------------|
| ARRL 222 MHz and Up Distance Contest | 1800 UTC Aug 3 to 1800 UTC Aug 4 |
| North American QSO Party, CW | 1800 UTC Aug 3 to 0600 UTC Aug 4 |
| Maryland-DC QSO Party | 1600 UTC Aug 10 to 2400 UTC Aug 11 |
| Hawaii QSO Party | 0400 UTC Aug 24 to 0400 UTC Aug 26 |
| Ohio QSO Party | 1600 UTC Aug 24 to 0400 UTC Aug 25 |

CW abbreviations

| | | | |
|--------------------------|-------------------|--------------------------|-------------------|
| AR End of Message | AS Pse QRX | BK Back to You | SK End of Contact |
| TU Thank You | PSE Please | K Invite to Transmit | |
| QST Calling all Amateurs | QRL Are You Buzy? | QRU Have anything for me | |
| QRV Are You Ready? | QRX Standby | QRS Transit Slower | |



US Amateur Radio Bands

US AMATEUR POWER LIMITS
FCC 97.313 An amateur station must use the minimum transmitter power necessary to carry out the desired communications. (b) No station may transmit with a transmitter power exceeding 1.5 kW PEP.

On March 28, 2017, the Federal Communications Commission adopted rules that will allow Amateur Radio access to 472-479 kHz (630 meters) and to 135.7-137.8 kHz (2,200 meters). However, amateurs cannot use these frequencies until 30 days after the Report and Order is published in the Federal Register and the final procedures for registering stations with the Utilities Telecom Council (UTC) have been approved and announced. At the time this chart was created, the Report and Order had not been published and the UTC online registration site is not yet available. Follow ARRL news for further information. New charts will be published at www.arrl.org/graphical-frequency-allocations when the bands are fully available for use.

**Effective Date for
2,200 and 630 Meters
to be announced**

ARRL
The national association for
AMATEUR RADIO®

KEY

Note: CW operation is permitted throughout all amateur bands.
 MCW is authorized above 50.1 MHz, except for 144.0-144.1 and 219-220 MHz.
 Test transmissions are authorized above 51 MHz, except for 219-220 MHz.

- = RTTY and data
- = phone and image
- = CW only
- = SSB phone
- = USB phone, CW, RTTY, and data
- = Fixed digital message forwarding systems only

E = Amateur Extra
 A = Advanced
 G = General
 T = Technician
 N = Novice

See ARRLWeb at www.arrl.org for detailed band plans.

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Getting Started in Amateur Radio:
 Toll-Free 1-800-326-3942 (860-594-0355)
 email: newham@arrl.org

Exams: 860-594-0300 email: vec@arrl.org

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2,200 Meters (135 kHz)

135.7 kHz 1 W EIRP maximum 137.8 kHz

E, A, G

630 Meters (472 kHz)

472 kHz 479 kHz

5 W EIRP maximum, except in Alaska within 496 miles of Russia where the power limit is 1 W EIRP.

E, A, G

40 Meters (7 MHz)

7.000 7.075 7.100 7.300 MHz

ITU 1.3 and FCC region 2 west of 130° west or below 20° north

E, A, G (200 W)

N, T (200 W)

7.025 7.125 7.175

N, T outside region 2

See Sections 97.305(c), 97.307(f)(11) and 97.301(e). These exemptions do not apply to stations in the continental US.

10 Meters (28 MHz)

28.000 28.300 29.700 MHz

E, A, G (200 W)

N, T (200 W)

6 Meters (50 MHz)

50.1 54.0 MHz

E, A, G, T

2 Meters (144 MHz)

144.0 148.0 MHz

E, A, G, T

1.25 Meters (222 MHz)

219.0 220.0 222.0 225.0 MHz

E, A, G, T (25 W)

N (25 W)

*Geographical and power restrictions may apply to all bands above 420 MHz. See *The ARRL Operating Manual* for information about your area.

70 cm (420 MHz)*

420.0 450.0 MHz

E, A, G, T

33 cm (902 MHz)*

902.0 928.0 MHz

E, A, G, T

23 cm (1240 MHz)*

1240 1295 MHz

E, A, G, T (5 W)

N (5 W)

15 Meters (21 MHz)

21.000 21.450 MHz

E, A, G (100 W)

N, T (200 W)

21.025 21.200 21.225 21.275

12 Meters (24 MHz)

24.890 24.930 24.990 MHz

E, A, G

17 Meters (18 MHz)

18.068 18.110 18.168 MHz

E, A, G

20 Meters (14 MHz)

14.000 14.350 MHz

E, A, G

Avoid interference to fixed services outside the US.

30 Meters (10.1 MHz)

10.100 10.150 MHz

E, A, G (200 W PEP)

60 Meters (5.3 MHz)

5330.5 5346.5 5357.0 5371.5 5403.5 kHz

CW, 5332 5348 5358 5373 5405 kHz

Dig 2.8 kHz

USB

General, Advanced, and Amateur Extra licensees may operate on these five channels on a secondary basis with a maximum effective radiated power (ERP) of 100 W PEP relative to a half-wave dipole. Permitted operating modes include upper sideband voice (USB), CW, RTTY, PSK31 and other digital modes such as PACTOR III. Only one signal at a time is permitted on any channel.

All licensees except Novices are authorized all modes on the following frequencies:

| | | |
|---------------|-----------------|-------------------|
| 2300-2310 MHz | 10.0-10.5 GHz ‡ | 122.25-123.0 GHz |
| 2390-2450 MHz | 24.0-24.25 GHz | 134-141 GHz |
| 3300-3500 MHz | 47.0-47.2 GHz | 241-250 GHz |
| 5650-5925 MHz | 76.0-81.0 GHz | All above 275 GHz |

‡ No pulse emissions

Nets... Nets... Nets... Nets... Nets... Nets... Nets... Nets...

Have a favorite HF/6m/2m/1.25m/70cm net that you check into or listen in on? Also, please send corrections and we will add it to the list below - Kim KEØNQS at my email KEØNQSmn@gmail.com.

- **Northland Weather Group Net:** Sundays 1930 on LSAC. Web site: <http://www.northlandweathergroup.net>
- **Minnesota D-Star Net:** Sundays at 19:30 on Reflector 53A
- **Minnesota Section Net** 1200 and 1730 on 3.860 [Net Manager: NØYR] http://www.mn-section.org/dept_stm.html
- The non-non-net: Evenings 2000 144.200 USB except for Sunday evenings.
- Badger WX Net: 0500-0715 on 3.985. Give 24 hour high/low/current temperature, precipitation and snowfall.
- **PICONET:** 3.925 from 0900-1100 CT Mon-Sat and 1600-1700 CT Mon-Fri. Info at: <http://www.piconet3925.com>
- Michigan Upper Peninsula Net: 1600 (CST) on 3.921 MHz Sun-Sat and 1200 Sun. Info: <http://www.michupnet.com>
- Great Lakes Marine/Maritime Mobile Net: Morning 07:30 - 3.932; 08:15 - 7.261 MHz and evening 18:30 - 3.1730927; 19:15 - 7.268 MHz. Weekend extra net: 10:00 - 7.261/7.268 MHz. All CST, LSB and +/- QRM. See: <http://www.sailblogs.com/member/glimmnet/>
- MIDCARS: 07:30-13:00 - 7.258 MHz. See: <http://www.midcars.net>
- Iowa snowbird net on 14.257MHz, M-W-F at 10:00 am Local Time. This is an open net.
- Spider Web Net (Marco Island FL) on 14.347 every morning at 0730 CST/CDT: <http://www.spiderwebnet.net>
- Maritime Mobile Service Network: Daily at 1100—2100 Central on 14.300. <http://mmsn.org> and <http://www.14300.net>
- RV Radio Network: Every day at 1900 Central on 7.265 MHz. Web site: <http://www.rvradionetwork.com>
- Upper Midwest Ten Meter Net: Every Thursday Evening @ 8 PM – 28.480 MHz USB
- Wisconsin Sideband Net: Daily @ 5:15 PM – 3985 [or 3982.5] KHz LSB
- Upper Midwest Ten Meter Net: Every Thursday Evening @ 8 PM – 28.480 MHz USB
- Hobby Helpers Net - Tuesday @ 8 PM – 28.330 MHz USB (Isanti MN) LSB [Net Manager: WOØA].
- Northstar Trader Net: 3.908 +/- at 0830 CST Sundays
- WARFA: 3.908 +/- Sun/Tue/Thu nights at 2200 CST, <http://warfa.org/>
- Youth Net: 14.320-14330 Sundays 1800-1900 UTC, Net Control: AC8PI
- YACHT: Saturdays 1900 CST on EchoLink #481872, <http://yachthams.webstarts.com>
- Northwestern Ontario ARES Net: Evenings at 20:15 (Central) on +/- 3.750Mhz
- The Iron Range Net: Saturdays at 0800 Central time on or near 3.919 Mhz. Look them up on Facebook!
- FORX Net: Mondays at 1900 Central at 3.941 Mhz +/- QRM. WAØJXT — Grand Forks, North Dakota
- HF CW: Fridays 08:00 CST, 7.112 MHz. Informal slow speed CW Net. W8IRT NCS. Email: w8irt@aol.com
- Minnesota ARES Digital Net: Thursdays at 2000 CST, 3.5835 MHz USB +/- QRM, Mode: Olivia 8/500.
- SARA Digital Net: Sundays at 1900 Local, 3.582.150 MHz USB +/- QRM, Mode: BPSK31/BPSK63
- Spider Web Net (Marco Island FL): 14.347 every morning at 0730 CST/CDT: <http://www.spiderwebnet.net>
- Broadcaster Net: 7.231 or 3.855 M/W/F @ 1500 UTC. 14.255 M-F @ 2130 UTC. <http://www.cbsretirees.com/ham.htm>
- Old Military Radio Net: 7.268 +/- nightly at 0200z. Other times/Frequencies too. See: <http://www.mrca.ar88.net/>
- Rag Chew Crew/Tailgaters/Freewheelers Nets: 3.916 +/- nightly at 1900 CST, <http://www.tailgatersnet.com>
- North South Net: 7.214.6 +/- at 0700 CST, Monday-Saturday

Wanted!

Looking to buy a non-working Icom 706 for parts. Email me anordin@aol.com

Please email your for sales or wanted items to Kim, KEØNQS, at KEØNQSmn@gmail.com.

Next ARAC Board Meeting Tuesday, April 2, 2019 @ 1830

KCØNFB, Bob, would like to remind all hams to make sure your license is current and up-to-date on your address. You can visit the FCC ULS to check it and make changes at www.fcc.gov/uls.

QSO Party Note: State/Province/National QSO Parties are abbreviated with the 2 or 3 letter abbreviation for the state/province/national designation followed by QP for QSO Party:

Examples: Minnesota QSO Party is MNQP
British Columbia QSO Party = BCQP

QRZ web site at www.qrz.com
VHF Propagation site at www.aprs.mountainlake.k12.mn.us

Contest Calendar at www.contestcalendar.com
National Contest Journal at www.ncjweb.com

Club Repeater
WØGKP
146.94 (-)
CTCSS Tone
103.5

Next ARAC Club Meeting Thursday April 11, 2019 Copper Top Church

Reminder: The **Contest Corral** monthly listing of contests can be found in each issue of **QST**. ARRL sponsored contests can be found in Contest Corral, highlighted, or on the ARRL's web site at arrrl.org.

Silent Keys

KC9LSG—Dorothy Anway (see Page 4)

2019 HOLIDAYS

| | |
|--------------------|-------------------------|
| May 18 | Armed Forces Day |
| May 27 | Memorial Day |
| July 4 | Independence Day |
| September 2 | Labor Day |
| November 11 | Veteran's Day |
| November 28 | Thanksgiving |
| December 25 | Christmas Day |

Upcoming 2019 Local Events

Confirmed Dates for 2019 (Correct as of publication)

- March 10 WI QSO Party
- April 11 Skywarn Training
- May 4 Hamfest

Upcoming 2019 Meeting Programs

TBD

Interested in providing a program, or have an idea for one? Contact Mike NØPDGP at lovoldm@gmail.com

Duluth Area Repeaters



ARAC System WØGKP

| Freq. | Offset | Tone | Location |
|---------|--------|-------|-----------------------|
| 146.940 | minus | 103.5 | Duluth |
| 146.940 | minus | 107.2 | Lakeside (rcv) |
| 146.940 | minus | 151.4 | Two Harbors (rcv) |
| 146.940 | minus | 100.0 | Gary-New Duluth (rcv) |
| 146.940 | minus | 123.0 | Solway (rcv) |
| 146.940 | minus | 110.9 | Cloquet (rcv) |
| 147.000 | minus | 103.5 | Mahtowa |
| 444.100 | plus | 103.5 | Duluth UHF Link |

N9MMU/N9QWH System (WI)

| | | | |
|---------|-------|-------|---------------|
| 145.310 | minus | 110.9 | Duluth |
| 145.490 | minus | 110.9 | Solon Springs |
| 147.255 | plus | 110.9 | Hayward |
| 145.110 | minus | 110.9 | Rice Lake |
| 147.345 | minus | 136.5 | Holcombe |
| 145.230 | minus | 110.9 | Eau Claire |

WECOMM – WI Statewide Linked System WE9COM

147.075 plus 110.9 Meteor Hill (closest repeater to Duluth)

LSAC System #1

| | | | |
|---------|-------|-------|----------------------------|
| 147.330 | plus | 151.4 | Proctor |
| 147.330 | plus | 103.5 | Duluth (rcv for Proctor) |
| 147.330 | plus | 156.7 | Duluth (North) (Fish Lake) |
| 147.270 | plus | 114.8 | Two Harbors |
| 147.270 | plus | 103.5 | Wales |
| 147.090 | plus | 114.8 | Silver Bay |
| 145.410 | minus | 114.8 | Finland |
| 147.300 | plus | 114.8 | Isabella |
| 145.150 | minus | 103.5 | Washburn, WI |
| 146.700 | minus | 103.5 | Bayfield, WI |
| 443.850 | +5.00 | none | Bayfield, WI |
| 147.165 | plus | 110.9 | Hurley, WI |
| 146.640 | minus | 151.4 | Ely |
| 443.500 | +5.00 | 141.3 | Gilbert |
| 147.060 | plus | 103.5 | Virginia |
| 147.360 | plus | 162.2 | Cook |
| 147.165 | plus | 114.8 | Coleraine |
| 443.925 | +5.00 | 110.9 | Brainerd |

NARC System NAØRC

| | | | |
|---------|-------|-------|------------------|
| 145.45Ø | minus | 1Ø3.5 | Solway Twp |
| 145.45Ø | minus | 114.8 | Park Point (rcv) |
| 147.135 | plus | 114.8 | Park Point (rcv) |
| 147.135 | plus | 1Ø3.5 | Knife River |

Stand Alone Repeaters

| | | | |
|---------|-------|-------|---------------|
| 145.21Ø | minus | 11Ø.9 | Clam Lake, WI |
| 146.88Ø | minus | 123.Ø | Grand Rapids |
| 146.91Ø | minus | 146.2 | Duxbury, MN |

Fusion and D Star

Fusion (Analog has tone and C4FM digital with no tone)

| | | | |
|---------|-------|-------|---|
| 147.15Ø | plus | 151.4 | NTØB Gilbert Fusion Rptr |
| 145.17Ø | minus | 11Ø.9 | WA9KLM Superior – Douglas County RACES/ARES Fusion Repeater |

443.1ØØ +5.ØØ 1Ø3.5 KBØYHX Cloquet – Carlton County RACES/ARES Fusion Repeater

444.3ØØ +5.ØØ 1Ø3.5 NØEO Spirit Valley Amateurs Fusion Repeater WIRES-X NØEO

147.375 plus NØEO D Star
442.2ØØ plus NØEO D Star

[Repeater list compiled by Dr. Frequency—KCØWDQ]

ST. Louis County Department of Emergency Services Net Control Roster

| | | | |
|-------|----------------|--------|-----------------|
| N9DMG | Scott Swanson | NØVRM | Gene Ellefsen |
| AAØAW | Doug Nelson | KCØWDQ | Paul Dallavia |
| WØNWO | Dave Miller | WØDIO | Dennis Anderson |
| KØDSL | Diane Saunders | AAØME | Randy Johnson |

*Sunday Nights at 21ØØ on the ARAC System
(See Calendar for net control schedule)*

Ten Meter SSB Net Control Roster

| | | | |
|-------|-----------------|-------|----------------|
| AAØAW | Doug Nelson | WØLWU | Joe Meese |
| NUØW | Gary Hanson | K9KDK | Al Babcock |
| WØDIO | Dennis Anderson | NØVRM | Gene Ellefsen |
| AAØME | Randy Johnson | KØDSL | Diane Saunders |

Sunday Nights at 2ØØØ on 28.45Ø MHz USB

Ten Meter CW Net Control Roster

| | | | |
|-------|-------------|-------|-------------|
| AAØAW | Doug Nelson | NØPDG | Mike Lovold |
|-------|-------------|-------|-------------|

Sunday Nights at 193Ø on 28.125 MHz

Northland Weather Group Net Control Roster

KCØMKS Jeff Nast

Sunday Nights at 193Ø on LSAC 1 and EchoLink Node 239444

Douglas County Net

Tuesday Nights at 2ØØØ on 145.49Ø (N9QWH System)

Central Carlton County Net

Tuesday Nights at 2Ø3Ø on the ARAC System

Lake County RACES/ARES Net

2nd & 4th Wednesday Nights at 19ØØ on the LSAC 1 System



Elmers



El-mer / el-mər/ [el-mer]

1. a male given name: from Old English words meaning "noble" and "famous."
2. an adhesive used to bond like or unlike materials
3. An experienced ham radio operator who mentors new and prospective hams.

| Name | Call | Expertise |
|--------------|--------|--|
| Jeff Nast | KCØMKS | APRS, EchoLink, WinLink, Fusion, Contesting |
| Bob Schulz | KCØNFB | Contesting |
| Jim Anderson | NØJWA | QsoNet |
| Doug Nelson | AAØAW | HF, VHF/UHF, Contesting, Packet, APRS, Morse Code, VE testing, Echolink, Allstar, EmCom... |

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Members, please check your name and email address for accuracy. If you are not on this list and want to be on the list, contact me with your info. If you need to make a change, please let us know at KEØNQSmn@gmail.com Or KEØNQ T@gmail.com

Co-Editors,
Kim & Steve Waller
KEØNQS & KEØNQ T



The greatest gift of life is friendship,
and I have received it.
Hubert H. Humphrey

BrainyQuote

SUNDAY NIGHT NETS

1930 - CW - 28.125 MHz USB-CW
 1930 - Northland WX Net LSAC 1
 2000 - USB 28.450 MHz
 2100 - Southern St. Louis County
 Emergency Services Net
 146.940 MHz PL 103.5

MARCH

CLUB EVENTS

TUESDAY NIGHT NETS

2000 - Douglas Cnty 145.490 MHz
 2030 - Central Carlton County
WEDNESDAY NIGHT NETS
 1900 - Lake County - LSAC1
 2nd & 4th Wednesdays
 2100 - BWAR

| Sun | Mon | Tue | Wed | Thu | Fri | Sat |
|--|--|---|--|---|-----|---|
| | | | | | 1 | 2 ARRL DX Phone |
| 3 ARRL DX Phone CW 1930 NØPDG WX 1930 KCØMKS USB 2000 WØLWU ES 2100 NØVRM | 4 | 5 ARAC BOARD MEETING 1900 Sammy's West Duluth DC Net 2000 CC Net 2030 | 6 | 7 | 8 | 9 |
| 10 CW 1930 AAØAW WX 1930 KCØMKS USB 2000 NUØW ES 2100 KØDSL | 11 DC ARES/ RACES Mtg 1900 DC EOC | 12 DC Net 2000 CC Net 2030 | 13 Lake County ARES/RACES Meeting 1800 Lake County Net 1900 | 14 ARAC Club Meeting @ 1900 Coppertop | 15 | 16 |
| 17 CW 1930 NØPDG WX 1930 KCØMKS USB 2000 K9KDK ES 2100 AAØME | 18 | 19 DC Net 2000 CC Net 2030 | 20 St. Louis Coun- ty ARES/ RACES Mtg 1630 Pike Lake EOC | 21 | 22 | 23 Club Breakfast @ The Chalet 0730-0800 |
| 24 CW 1930 AAØAW WX 1930 KCØMKS USB 2000 WØDIO ES 2100 N9DMG | 25 | 26 DC Net 2000 CC Net 2030 | 27 Lake County Net 1900 | 28 Carlton Couny ARES/RACES Meeting 1900 CC EOC | 29 | 30 |
| 31 CW 1930 NØPDG WX 1930 KCØMKS USB 2000 WØLWU ES 2100 NØVRM | | | | | | |

Get this newsletter *faster*
via email!

Email Doug AAØAW at
aa0aw@chartermi.net

Next Meeting: Thursday,
MARCH 14, 2019

New hams who have joined our community in the last few weeks, as well as those who have newly upgraded — to General or Extra:

Pat Hayden, KC0JRJ, upgraded to General Class

Congratulations to: New members of ARAC:

ARAC Committee Chairs

Club License Trustee:

Ray Barnes KEØZN

Control Operators:

AAØAW - NØKXT - KCØNFB

Newsletter:

Kim KEØNQS & Steve KEØNQT Waller

Education Chair:

Bob Schulz KCØNFB

Hamfest Chair:

Bob Schulz KCØNFB

Chaplains:

Visiting Chaplains:

Denny Anderson WØDIO

Parliamentarian:

Grant Forsyth KCØWUP

Website:

Thomas Dorr KEØRHA

Membership:

Bruce Carlson KEØNIT

Property Chair:

Wulf Gar WU1FGR

Testing:

Doug Nelson AAØAW

Field Day:

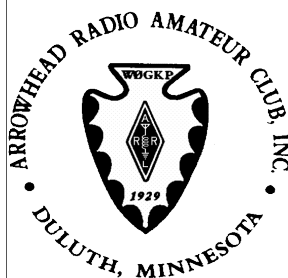
Dennis Anderson WØDIO

Picnic Chair:

Scott Ahlgren, NØVYU

Repeater Chairs:

Randy Haglin NØBZZ
Randy Wabik KAØJZV



The ARAC RELAY

Published monthly and distributed free to members, "The RELAY" is the official publication of the Arrowhead Radio Amateur Club, Inc. Members are encouraged to submit articles, opinions, and classifieds. Your submission will be placed as soon as possible providing it does not conflict with the bylaws of the Arrowhead Radio Amateur Club, Inc. The editors reserve the right to omit any submission that is not a required item. If a submission is questionable, it will be presented to the Board of Directors at the next scheduled board meeting for authorization.





Ice Station ZZL & Amateur Radio in Space, Continued from Page 1

expertise and passion for the hobby.

His command center consisted of an ICOM IC-706MK-IIG HF/6 Meter/2 Meter/440MHz radio, a satellite tracking program, a slow-scan TV program on a laptop with a signal link interface, and that massive circular polarized antenna I'd seen when I first drove up. "In about 31 minutes it's going to be overhead. If the conditions are good," Al said, "Ice Station ZZL will actually receive a **picture** from the International Space Station Ice Station".

The IS ZZL's mission was successful and Al accomplished what he set out to do. That day, Al also launched another important mission. He inspired Kim and me to learn more about how--and when--ham radio came to be part of the space program. Here's what we found...

In 2013, Radio Amateur Satellite Corporation's (AMSAT) Frank H. Bauer, KA3HDO wrote an article appearing in several publications entitled **Amateur Radio on Human Spaceflight Missions—30 Years**. Bauer succinctly summarizes the span of time, saying,

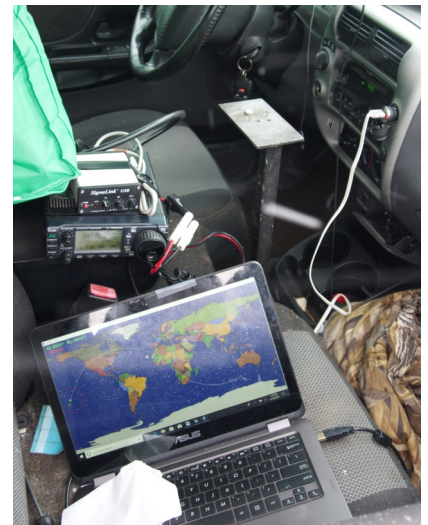
"Starting with the U.S. operations on the Space Shuttle and culminating with sustained international ham radio cooperation on the International Space Station (ISS), amateur radio on human spaceflight missions has evolved through 3 developmental and operational phases. As NASA, its international partners, and commercial space have shifted their human spaceflight objectives and priorities, the amateur radio human spaceflight team has worked diligently to stay in lock-step with the plans and visions of the space agencies and commercial human spaceflight. We are now an integral part of the International Space Station program, having continuous presence as crew flight equipment and a payload since Expedition 1. And we continue to work and evolve our systems to be relevant to the space agencies, to the amateur radio community and to the world's youth."

Bauer goes on to document in great detail the 10-year lead-up to amateur radio being approved as an experiment on the Space Shuttle Challenger mission STS-9 on November 28th, 1983. Astronaut Owen Garriot, W5LFL, operated an amateur radio station that was comprised of a Motorola MX-300 series 2-meter handheld radio connected to a signal adapter module that made it possible to use a Shuttle headset for communication. A loop antenna was to be temporarily installed in a Shuttle window when needed.

Garriot's transmissions could be heard at various times during the first two days of the mission on 145.55 MHz FM by excited listeners. On day three, Garriot was elated to successfully conduct the first 2-way amateur radio communication to someone on Earth, with Lance Collister, WA1JXN, in Frenchtown, Montana. During the remaining 7 days of the mission, Garriot was able to contact more than 250 ham radio operators around the world. The historic experiment was a resounding success.

On the heels of mission STS-9, NASA decided to approve continued experiments with ham radio on shuttle missions, calling the program SAREX, or the Shuttle Amateur Radio Experiment. In addition to funding by NASA, SAREX was sponsored by the Radio Amateur Satellite Corporation (AMSAT) and the American Radio Relay League (ARRL).

The Shuttle's on-board station hardware for SAREX would continue to be the Motorola radio system and antenna that



**Al Nordin's - WBØDBQ
Mobile Command Center Interior**

Continued on Page 18

W5LFL used on STS-9 for voice operations. Added were Panasonic cameras and monitors and a Robot 1200C Slow Scan Television (SSTV) converter furnished by Robot Research. These supported automated SSTV picture uplink and downlink.

By designing SAREX experiments that allowed pre-scheduled classrooms to talk to astronauts via amateur radio, NASA aimed to inspire students to pursue careers in science, technology engineering and math. Additionally, SAREX invited amateur radio operators around the world to talk to Shuttle astronauts. A schedule was developed and communicated to ham magazines and bulletins with times when the Shuttle crew might be available for ham start and stop times and radio mode of operation for QSOs. Additionally, during missions the NASA Amateur Radio Clubs at Goddard (WA3NAN), Johnson (W5RRR) and JPL (W6VIO) provided bulletins, pass times and updates to keep the ham radio community informed. WA3NAN provided simulcast information and shuttle mission audio retransmissions on up to 3 HF frequencies and VHF.

Many subsequent Shuttle missions resulted in SAREX's continuing changes to station hardware and experiments aboard the Shuttle and the establishment of SAREX II, which was considered a permanent, 4-5 missions per year program with experiments centered around amateur radio. These paved the way the third phase in NASA employing amateur radio programming in space at the end of Space Shuttle operations in 1999. In Phase III, SAREX transitioned from short duration Shuttle flights to longer duration use via Russian Space Station MIR missions and then ultimately lead to the Amateur Radio on the International Space Station (ARISS) group that formed for permanent international use on the International Space Station. ARISS coordinates all amateur radio activities on the ISS and is essential to inspiring the next generation of amateur radio operators to join the hobby and pursue careers in Science, Technology, Engineering and Math.

ARISS says that through their program "students have the opportunity to learn about space technologies and the technologies involved with space communications through exploration of amateur radio. Hundreds of Amateur Radio operators around the world work behind the scenes with ARISS to make these educational experiences possible. Amateur Radio is a popular hobby and a service in which licensed participants operate communications equipment with a deep appreciation of the radio art."

Researching this article, we learned a lot about the exciting history of amateur radio in space. Remembering the awe and pride we felt as young people watching the development of the Space Shuttle program, we were encouraged that ARISS is working hard to instill that same inspiration in today's youth—and succeeding! Children all over the world are engaging in ham radio because of those efforts. We are convinced that for the sake of our hobby and our Club's future, it is essential that we reach out to local youth groups to ensure they are aware and engaged with ARISS. ★



Ice Station ZZL , February 10th 2019



ARISS

Amateur Radio on the International Space Station

ARISS Goals are:

- Inspire an interest in science, technology, engineering and math (STEM) subjects and in STEM careers among young people
- Provide an educational opportunity for students, teachers and the general public to learn about space exploration, space technologies and satellite communications
- Provide an educational opportunity for students, teachers and the general public to learn about wireless technology and radio science through Amateur Radio
- Provide an opportunity for Amateur Radio experimentation and evaluation of new technologies
- Provide a contingency communications system for NASA and the ISS crew
- Provide crew with another means to directly interact with a larger community outside the ISS, including friends and family

This Month's Elmer is Bob Schulz, KCØNFB

Q: How is Slow Scan Television Used to Contact the International Space Station?

A: Slow Scan Television is the transmission of images over the radio spectrum, typically in JPEG, BMP, or GIF file format images. Anyone can receive SSTV, all you need is the right hardware and software. On the origination side, colors are assigned their own unique frequency in SSTV mode and the software 'codes' the color into an audible frequency that is translated through the microphone or line in of the transmitting radio. On the receiving end, the software simply decodes the frequency tone to match the transmitted color.



How It's Done

We've asked local ARAC Elmer KCØNFB Bob Schulz to guide us through the steps needed to be able to track the International Space Station and receive their Slow Scan transmissions.

What You Need

- ◆ You will need a VHF-FM Radio (HF can be used as well) tuned to 145.800 – normally this is the channel for SSTV transmissions.
- ◆ An audio interface to your computer – connect either an audio cable or Signal Link interface from the line-out on the radio and connect this into the computer audio input and adjust attenuation. Some hams use a dual-band pass filter allowing more freedom in RF control and AF gain.
- ◆ The computer requires appropriate software for receiving the signal and translating the image. Bob recommends using MMSSTV - 1.13A is the current version.
- ◆ You will also need an International Space Station prediction program, he uses Heavens Above <https://heavens-above.com>. Enter your location, and click on ISS and the site will generate the details on the ISS current location and predictions for all passes overhead. An image on the website will detail where the ISS will originate in the sky, how high it will be in the sky, and where it will leave in the sky. Usually anything from a 30 degree to an 80 degree is a good window to receive the signal. More than 80 degrees will pass over your Null point on your antenna, anything less than 30 degrees and you probably won't get enough signal.
- ◆ Now test the system, tune your radio to 145.800 FM and make sure you are getting audio.
- ◆ Next, check and see when the next active International Space Station transmission will be coming. Bob uses ARISS SSTV: <https://ariss-sstv.blogspot.com/> for details on schedules. It's hard to tell exactly when they transmit as the ISS has other work duties, potentially receiving a cargo ship, etc. that they are involved in, so the schedule is somewhat unpredictable.

Once you find out generally when the next active slow scan TV timeframe is, turn on your radio and computer and your system will receive any image that is transmitted. Images will download this to your history file on the computer. You could set the system up in the morning and check back on it in the afternoon.

It turns out there are some people who transmit back and forth at the HF level. If you go to 14.230 (20 meters) slow scan TV you will hear them occasionally, they will send out a CQ with some sort of image behind it, you would copy down their call sign in the MMSSTV program, and you would then transmit back to them your image and have a QSO. You are required to have a General License in order to do this.

Thanks again to KCØNFB Bob Schulz for his help on this topic.

*~ Ask Elmer's purpose is to relay our common ham radio knowledge to other members through fellowship and our stewardship of our hobby.
Elmers are key to the success of all members.*