



# The RELAY)))

MARCH  
2020



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

Perovskite Solar Cells	1
Prez Sez	2
ARAC Board Minutes	3-4
Club Mtg Minutes	5-6
Hamfest	7
Contest Calendar	8-11
CW Abbreviations	12
Band Plan	12
Nets	13
Upcoming Events	14
Repeaters	15
Members' Email	16
Calendar	17
Committee Chairs	18
MARS	19

## Perovskite Solar Cells: Exciting Leaps Forward in New Energy Sources

**P**owering your ham shack at a lake cabin, camper or other area where access to electricity is scarce can be a logistical and financial challenge. There are a lot of natural sources of energy to produce electricity—solar, wind, and geothermal to name just a few—but solar energy is by far the most abundant source of energy on earth. Because of this, several decades of research and development in the field of photovoltaics has been ongoing, with the goal of achieving reliable long-term electricity production that virtually anyone can afford.

Photovoltaic (PV) devices generate electricity directly from sunlight via an electronic process that occurs naturally in certain types of material, called semiconductors. Electrons in these materials are freed by solar energy and can be induced to travel through an electrical circuit. The circuit can then be used to power your personal electrical devices and if you have excess electricity, you can even send it to the greater power distribution grid and receive a financial credit.

The U.S. power distribution grid is a complex system of 450,000 miles of high-voltage power lines and 160,000 miles of overhead transmission lines that connect homes to the local power plant. The power plants primarily continually produce electricity on demand, as it is used in your home or business. If demand increases suddenly, say from extremely hot weather where a large number of air conditioners are running, the power distribution grid has to reroute as needed to generate the electricity needed. Likewise, if a storm damages a portion of the grid, power plants must reroute and repair lines quickly to meet the need. While many of us in northern Minnesota would rather be “off the grid” instead

Continued on page 20



## Spring 2020



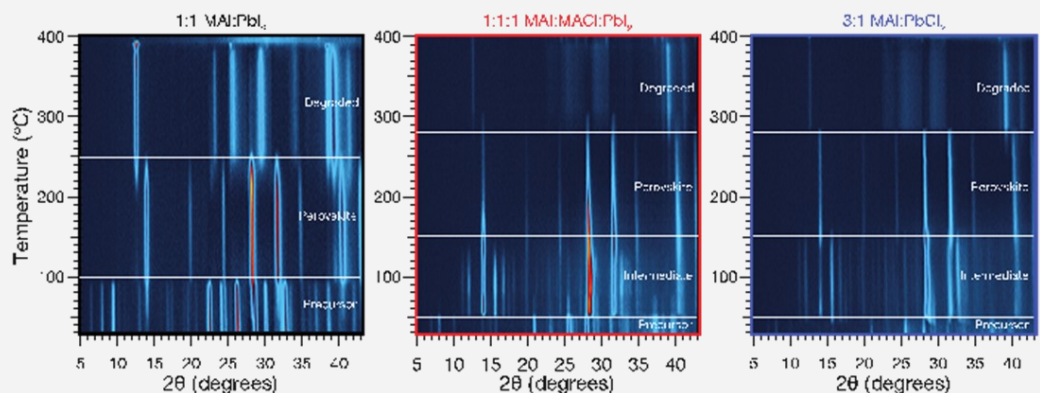
Join us on  
facebook!

Co-Editors:

Kim & Steve Waller

Kim - KEØNQS • Steve - KEØNQT

KEØNQS.mn@gmail.com  
KEØNQT@gmail.com



Structural evolution of the perovskite material from precursor to perovskite to eventual degradation as a function of precursor composition.

Graphic courtesy National Center for Photovoltaics (NCPV)



**March  
2020**

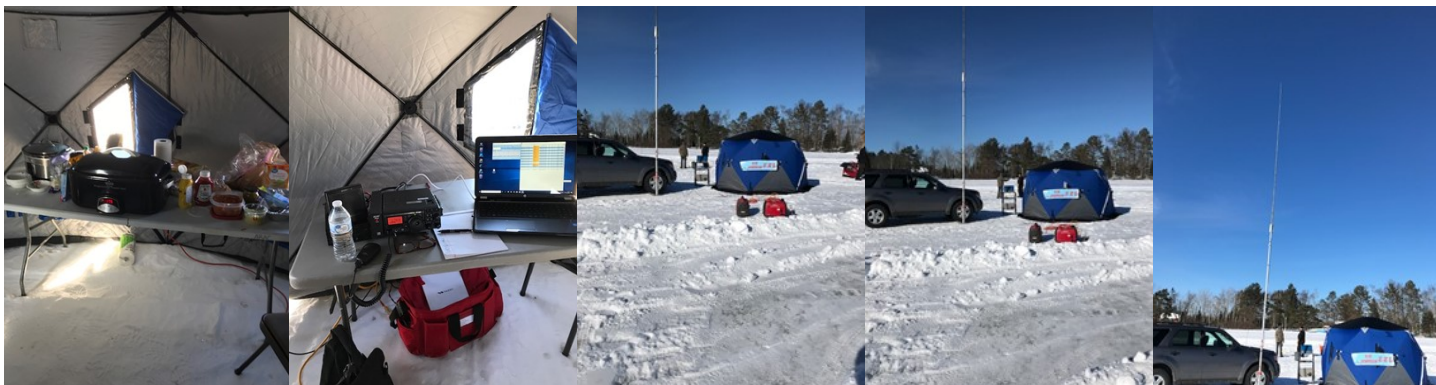
**Prez Sez...**

Hi everyone!

Well we had two events this winter. Winter Field Day in January and Ice Station ZZL in February. Those who attended these events had a good time. Just because it's cold outside doesn't mean we have to give up portable operations!!

Coming up quick will be our Hamfest on May 2nd. We need volunteers for ticket sales, set up and kitchen help so please consider helping out to make our fest successful.

**73 Gene Ellefsen NØVRM**



**Feb.16 Was the day of Ice Station ZZL. This is an annual event we do up on Caribou Lake. Eleven brave Souls came out to partake in the event. 35 contacts were made in 17 states and British Columbia. Also several fish were taken home and fun was had by all. See you next year!!**

# ARAC Board Meeting Minutes - February 4, 2020

## PRESIDENT



**NØVRM**  
Gene Ellefsen  
371Ø Chambersburg Ave  
Duluth, MN 55811  
218-39Ø-3272  
lspitech@mail.com

## VICE PRESIDENT



**NØPDG**  
Mike Lovold  
386Ø Birchwood Rd  
Downtown Arnold, MN  
558Ø3  
lovoldm@gmail.com

## SECRETARY



**NØCALL**  
Robin Davis  
  
218-391-3Ø77  
davisfam2858@yahoo.com

## TREASURER



**KEØNIT**  
Bruce Carlson  
9Ø6 Anderson Rd  
Duluth, MN 55811  
763-315-2967  
carlsbr@gmail.com

## 3RD YEAR BOARD

**KD9ABS**  
Gary Minter  
1621 N 26th St  
Superior WI 5488Ø

## 2ND YEAR BOARD



**AAØAC**  
Dave Davis  
  
218-348-6649  
aaØac@outlook.com

## 1ST YEAR BOARD

**KDØYLN**  
Robert Boyd  
5054 Boulder Dr  
Hermantown, MN 55811

Present: Gene Ellefsen-NØVRM, Mike Lovold-NØPDG, Bruce Carlson-KEØNIT, Dave Davis-AAØAC, Gary Minter-KD9ABS, Bob Boyd-KDØYLN, Doug Nelson-AAØAW, Bob Schulz-KCØNBF, Randy Wabik-KRØB, Grant Forsyth-KCØWUP, Robin Davis

Guest: Del Minter, Paul

Meeting called to order by President Gene-NØVRM at 6:31 pm

### Minutes:

Minutes of meetings have been published, any discussion? Moved by Dave-AAØAC to approved minutes, seconded by Gary-KD9ABS, motion passed

### Treasurer's Report:

Checking .....	1,390.50
Savings .....	1,373.06
Cash Subtotal.....	\$2,763.56

Outstanding Check (Repeater # 1414) .... **-1,100.00**

Winter CD .....	1,714.03
Summer CD .....	1,700.00
CD Subtotal.....	\$3,414.03

Grand Total .....\$5,077.59

### Membership:

How many paid members so far? It is 176 to date, as of today. Twenty (20) member's dues came due in December 2019, and they have not renewed their membership yet. Good dues collection last month, January 2020, with lots of renewals. How is our percentage of ARRL members? Fifty-three (53) registered ARRL members. Bruce-KEØNIT asks each time someone renews their dues. Active members are around ninety (90) so we're above 50%. Several of the members pay their renewal dues at the Ham Fest or at the Annual Picnic

Motion to approve both as presented by Gary-KD9ABS, seconded by Mike-NØPDG, motion passed

### Education:

February 11, 2020, starts the new Community Education Technician class. Four (4) people have registered to take the class at this time. One week we will be moving the class because of a large event at the church, March 12, 2020. We will call it a Field Exercise and possible hold it in Douglas County

### Testing:

Super test session, six times as many VEs as testers this time but that's okay. Two (2) testers and both passed the Technician and one (1) also passed the General:

John Schulz-KD9OSV is new General  
Brandon Ware-KEØZDF is a new Technician

Doug-AAØAW has received a couple of emails from people interesting in testing, one who is a wheelchair, questioning access to the testing site. The church would be perfect as it is handicapped accessible. Next scheduled test is May 2, 2020, at the Ham Fest. Second testing session in May will be at the end of the class, May 12, 2020. July 1, 2020, new Extra test question pool, then a year off with no changes and then Tech will refresh.

Continued on Page 4

# ARAC Board Meeting Minutes, continued

## **Ham Fest:**

Ham Fest is coming soon, first weekend in May. We need more barkers outside selling tickets for the Swap Fest. We also need better information about testing, where to test (location), without entering the actual Ham Fest, etc. Bob-KC0NFB sent out Vender notices inviting past vendors to send in their reservation. Nine (9) tables are reserved. Sent in Venue notice and forwarded to proper people looking for the contract for 2020. Emailing of the notice will be done by the end of the month. We will have the card checker again this year. We are already ARRL approved with the normal stuff coming up.

Gene-N0VRM talked to Pastor Rollie (Rolland Bockbrader-KB0CK) about getting a \$300.00 gift card from Thrivent Lutheran again this year. We used it for purchasing the supplies for the Ham Fest such as the pork, bratwursts, the buns, pop, condiments, etc., for the last two (2) years.

We have a good reputation and we want to keep that. Mike-N0PDG overdid it but he needs to ask Scott (Scott Ahlgren-N0VYU) to help haul stuff from the Storage Unit. Expenses up to \$500.00 for the food, door prizes up to \$100.00, \$500.00 cash Grand Prize. Mike-N0PDG will talk to John to get approval to donate a radio as a raffle prize again this year. Last year's radio was an excellent prize

Motion for \$500.00 for Cash Grand Prize, up to \$500.00 for food, \$100.00 for door prizes by Gary-KD9ABS, many seconds, motion passed to bring the motion to the Membership meeting for a vote. We will need volunteers for set up and take down, security at the doors, etc.

## **St Cloud Ham Fest:**

St Cloud Ham Fest, this year, is at the Eagles Club, entry fee is \$10.00, up from last year. One (1) week from Saturday, February 15, 2020. Table rental went up to \$20.00, or if you bring your own table, it is only \$15.00. Venue is smaller and divided into two (2) side-by-side halls. This is the first year for the move to the new venue

## **MN Repeater Council:**

Status of MN Repeater Council? Ray Barnes-KE0ZN is the Trustee. Recommendation to check with him as the letters go to him directly as he is the Trustee. He has been asking Gene-N0VRM about Mahtowa Repeater

## **Repeater:**

Thursday, two (2) fusion repeaters went on the air in Superior, digital fusion, tied into the Dark Room, St Peter MN to Carlsbad, MN, over into Wisconsin. 444.3 (TAC 4) analog tied into its own room along with NA0RC and N0MR machines. Anticipating using that for tying into Skywarn

## **Program:**

Skywarn Training is scheduled for April 9, 2020. Confirmed with the Weather Service. Setting up Skywarn Responder's group, talked to Pastor Rollie-KB0CK to use the basement room otherwise Grant-KC0WUP offered Midway Town Hall because he has a key. Severe weather season is almost upon us

Motion to adjourn by Robin, seconded by Gary-KD9ABS and Bruce-KE0NIT, motion passed





# ARAC Club Meeting Minutes

February 13, 2020

**Present:**

- President Gene Ellefsen-N0VRM
- Vice President Mike Lovold-N0PDG
- Treasurer / Membership Bruce Carlson-KE0NIT
- Secretary Robin Davis
- Third Year Board Dave Davis-AA0AC
- Second Year Board Bob Boyd-KD0YLN
- First Year Board Gary Minter-KD9ABS
- Chaplain (Visiting) Rolland Bockbrader-KB0CK
- Parliamentarian Grant Forsyth-KC0WUP
- Special Events – Open / Gene Ellefsen-N0VRM acting
- Ham Fest / Education Bob Schultz-KC0NFB
- Property / Picnic Scott Ahlgren-N0VYU
- Repeater Randy Wabik-KR0B
- Testing Doug Nelson-AA0AW

**Absent:**

- Newsletter / Historian Kim Waller-KE0NQS
- Newsletter Steve Waller-KE0NQT
- Repeater Derek McCorison-W0DNF
- Repeater Randy Haglin-N0BZZ
- Web Site Thomas Dorr-KE0RHA

Meeting called to order at 7:05 pm by President Gene-N0VRM

Thank you from Rowena Olson concerning the passing of her husband Lloyd Olson, Sr-KC0SJB

Silent Key - Roger Freeman-N0GRX, moment of silence in honor of his passing

Good to see Joe Meese-W0LWU home safe and sound again

Recognize new Club Member - Brandon Ware-KE0DZF, who recently passed his Tech License Test

**Minutes:**

Posted on web page and in the newsletter. Move to approve by Grant-KC0WUP, seconded by many, motion passed

**Treasurer's Report:**

Checking.....	1,390.50
Savings.....	1,373.06
Cash Subtotal .....	\$2,763.56
Outstanding Check (Repeater # 1414).....	-1,100.00
Winter CD .....	1,714.03
Summer CD .....	1,700.00
CD Subtotal .....	\$3,414.03
Grand Total.....	\$5,077.59

Point of Interest - \$414.03 is the interest we earned on the CD over the years.

Move to approve by Bob-KC0NFB, seconded by Gary-KD9ABS, motion passed

Continued on Page 6

# ARAC Club Meeting Minutes, continued

## **Committee Reports:**

### **Testing:**

Two (2) tested with one (1) new Tech Brandon Ware-KE0ZDF and one (1) new General John Schulz-KD9OSV

Testing, May 2, 2020, at the Ham Fest, is the next scheduled testing session and then May 12, 2020, which is the end of the Community Education class. Ready to test? Get a hold of Doug-AA0AW and testing can be scheduled for one (1) when someone is ready to test with a couple of VEs

### **Parliamentarian:**

All cleared by FBI investigation

### **Education:**

First class last Tuesday, February 11, 2020, seven (7) people in the class. We also have the General and Extra study group available. See Diane-K0DSL if interested

### **Ham Fest:**

New Management at the Curling Club. New contract was sent to Bob-KC0NFB with some big changes that need to be discussed. If we make food on site, we have to use an authorized caterer. We can serve food on site, reheat and serve, have to sell their pop, not bring in our own, clean up afterwards, take tables down, more information to follow. Same price \$600.00 for rental, \$100.00 security deposit. Saturday May 2, 2020. Breakfast is at McDonalds on Tower, around 5:00 am. Set up at 6:00 am at the Fairgrounds, vendors in at 7:00 am, help for the kitchen, empty garbage cans, check bathrooms, etc. Good response in past, good moneymaker for the Club.

Asking members to get gift certificates or tools, etc., to donate as door prizes at the Fest. Mike-N0PDG has talked with John Kruk-N9UPC, Yaesu Rep, about a possible donation as a door prize. John-N9UPC directed him to talk Yaesu, who donated a 7250 dual band fusion radio as a prize for the Fest (value \$200.00) as well as mugs and hats. DX Engineering will also be there with some giveaways. Save your pennies

### **Meetings:**

April is Skywarn, May hoping for the Duluth Robotics Team, and June is Grandma's Marathon presentation

### **Old Business:**

Joe Meese-W0LWU wanted to talk about raising the entry fee for the Ham Fest from the \$7.00. St. Cloud Ham Fest is \$10.00. We already posted the flyers with the \$7.00 entry fee for this year. We will look at it again next year. Good observation, with thanks from the President Gene-N0VRM

### **New Business:**

Board made a motion of \$500.00 for grand prize, up to \$500.00 for food and \$100.00 for door prizes. Grant-KC0WUP seconded the motion from the Board, motion passed

### **Upcoming Events:**

St. Cloud Ham Fest – Saturday, February 15, 2020, new location, entry fee is \$10.00, tables \$20.00

Brainerd Ham Fest, May 18, 2020 - new location as well, more information will follow

Ice Station ZZL, Sunday, February 16, 2020, Caribou Lake public boat launch, on the ice, broadcast from the tent, pot-luck to share, fishing if you have the license and the equipment, operate radios making contacts, annual event for the last six (6) years. We have been checked by the DNR Game Wardens. Fun activity to promote the hobby of Ham Radio

Mark Soder-KI0DB - won Door Prize drawing and said to put the money into the coffee kitty

Motion to adjourn by Bob-KC0NFB, seconded by Dave-AA0AC, motion passed at 7:26 pm



# Arrowhead Radio Amateur Club **HAM FEST!**

**Sat. May 2nd, 2020 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!*

Yaesu Representative John N9UPC will be on site with new radio equipment displayed and for sale.

<<< QSL card checking for ARRL awards program by Mike Cizek W0VTT >>>

Mike's email: [mgcizek@gmail.com](mailto:mgcizek@gmail.com)



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

**Talk-in on W0GKP 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 Nelson**  
**AA0AW / 218-391-5874**  
**aa0aw@arri.net**

**W  
W  
W  
-  
t  
h  
e  
a  
r  
a  
c  
-  
o  
r  
g**

**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 - March 2020

+ SARL Hamnet 40m Simulated Emerg Contest	1200Z-1400Z, Mar 1
+ North Carolina QSO Party	1500Z, Mar 1 to 0059Z, Mar 2
+ RSGB 80m Club Championship, Data	2000Z-2130Z, Mar 2
+ ARS Spartan Sprint	0200Z-0400Z, Mar 3
+ AGCW YL-CW Party	1900Z-2100Z, Mar 3
+ QRP Fox Hunt	0200Z-0330Z, Mar 4
+ Phone Fray	0230Z-0300Z, Mar 4 1300Z-1400Z, Mar 4 and
+ CWops Mini-CWT Test	1900Z-2000Z, Mar 4 and 0300Z-0400Z, Mar 5
+ UKEICC 80m Contest	2000Z-2100Z, Mar 4 1800Z-1900Z, Mar 5 (CW) and 1900Z-2000Z, Mar 5 (SSB) and 2000Z-2100Z, Mar 5 (FM) and 2100Z-2200Z, Mar 5 (Dig)
+ NRAU 10m Activity Contest	
+ SKCC Sprint Europe	2000Z-2200Z, Mar 5
+ NCCC RTTY Sprint	0145Z-0215Z, Mar 6
+ QRP Fox Hunt	0200Z-0330Z, Mar 6
+ NCCC Sprint	0230Z-0300Z, Mar 6
+ ARRL Inter. DX Contest, SSB	0000Z, Mar 7 to 2400Z, Mar 8
+ Novice Rig Roundup	0000Z, Mar 7 to 2359Z, Mar 15 0600Z-0629Z, Mar 7 and 0630Z-0659Z, Mar 7 and 0700Z-0729Z, Mar 7 and 0730Z-0800Z, Mar 7
+ Wake-Up! QRP Sprint	
+ SKCC Weekend Sprintathon	1200Z, Mar 7 to 2400Z, Mar 8 1800Z-2059Z, Mar 7 (Low Band) and 2100Z-2359Z, Mar 7 (Low Band) and 0800Z-1059Z, Mar 8 (High Band) and 1100Z-1359Z, Mar 8 (High Band)
+ Open Ukraine RTTY Championship	

*Continued on Page 9*



# Contest Calendar - March 2020, Continued

+ UBA Spring Contest, CW	0700Z-1100Z, Mar 8
+ WAB 3.5 MHz Phone/CW	1800Z-2200Z, Mar 8
+ 4 States QRP Group Second Sunday Sprint	0000Z-0200Z, Mar 9
+ QRP Fox Hunt	0100Z-0230Z, Mar 11
+ Phone Fray	0230Z-0300Z, Mar 11 1300Z-1400Z, Mar 11 and 1900Z-2000Z, Mar 11 and 0300Z-0400Z, Mar 12
+ CWops Mini-CWT Test	
+ RSGB 80m Club Championship, CW	2000Z-2130Z, Mar 11
+ AWA John Rollins Memorial DX Contest	2300Z, Mar 11 to 2300Z, Mar 12 and 2300Z, Mar 14 to 2300Z, Mar 15
+ NCCC RTTY Sprint	0145Z-0215Z, Mar 13
+ QRP Fox Hunt	0200Z-0330Z, Mar 13
+ NCCC Sprint	0230Z-0300Z, Mar 13
+ YB DX RTTY Contest	0000Z-2359Z, Mar 14
+ RSGB Commonwealth Contest	1000Z, Mar 14 to 1000Z, Mar 15
+ South America 10 Meter Contest	1200Z, Mar 14 to 1200Z, Mar 15
+ F9AA Cup, SSB	1200Z, Mar 14 to 1200Z, Mar 15
+ SARL VHF/UHF Analogue Contest	1200Z, Mar 14 to 1000Z, Mar 15
+ AGCW QRP Contest	1400Z-2000Z, Mar 14 1500Z, Mar 14 to 0200Z, Mar 15 and 1400Z-2100Z, Mar 15
+ Oklahoma QSO Party	
+ Stew Perry Topband Challenge	1500Z, Mar 14 to 1500Z, Mar 15
+ EA PSK63 Contest	1600Z, Mar 14 to 1600Z, Mar 15
+ QCWA QSO Party	1800Z, Mar 14 to 1800Z, Mar 15
+ TESLA Memorial HF CW Contest	1800Z, Mar 14 to 0559Z, Mar 15
+ Idaho QSO Party	1900Z, Mar 14 to 1900Z, Mar 15
+ QRP ARCI Spring Thaw SSB Shootout	2200Z-2300Z, Mar 14
+ North American Sprint, RTTY	0000Z-0400Z, Mar 15
+ UBA Spring Contest, 2m	0700Z-1100Z, Mar 15
+ Wisconsin QSO Party	1800Z, Mar 15 to 0100Z, Mar 16

Continued on Page 10



# Contest Calendar - March 2020, Continued

+ Run for the Bacon QRP Contest	1900Z-2400Z, Mar 15
+ Bucharest Digital Contest	1800Z-2059Z, Mar 16
+ RSGB FT4 Contest Series	2000Z-2130Z, Mar 16
+ CLARA Chatter Party	1700Z, Mar 17 to 1700Z, Mar 18 and 1700Z, Mar 21 to 1700Z, Mar 22
+ QRP Fox Hunt	0100Z-0230Z, Mar 18
+ Phone Fray	0230Z-0300Z, Mar 18 1300Z-1400Z, Mar 18 and 1900Z-2000Z, Mar 18 and 0300Z-0400Z, Mar 19
+ CWops Mini-CWT Test	0030Z-0230Z, Mar 19
+ NAQCC CW Sprint	1930Z-1959Z, Mar 19 (CW) and 2000Z-2029Z, Mar 19 (SSB) and 2030Z-2059Z, Mar 19 (RTTY)
+ BCC QSO Party	0145Z-0215Z, Mar 20
+ NCCC RTTY Sprint	0200Z-0330Z, Mar 20
+ QRP Fox Hunt	0230Z-0300Z, Mar 20
+ NCCC Sprint	0200Z, Mar 21 to 0200Z, Mar 23
+ BARTG HF RTTY Contest	1200Z, Mar 21 to 1200Z, Mar 22
+ Russian DX Contest	1400Z, Mar 21 to 0400Z, Mar 22 and 1200Z-2400Z, Mar 22
+ Virginia QSO Party	1400Z-1700Z, Mar 21 (144) and 1700Z-1800Z, Mar 21 (432)
+ AGCW VHF/UHF Contest	2000Z-2159Z, Mar 21
+ Feld Hell Sprint	0700Z-1100Z, Mar 22
+ UBA Spring Contest, SSB	1200Z-1600Z, Mar 22 and 1800Z-2200Z, Mar 22
+ NSARA Contest	



*Continued on Page 11*

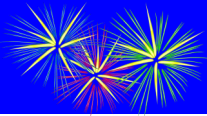
# Contest Calendar - March 2020, Continued

+ SKCC Sprint	0000Z-0200Z, Mar 25
+ QRP Fox Hunt	0100Z-0230Z, Mar 25
+ Phone Fray	0230Z-0300Z, Mar 25 1300Z-1400Z, Mar 25 and 1900Z-2000Z, Mar 25 and 0300Z-0400Z, Mar 26
+ CWops Mini-CWT Test	2000Z-2100Z, Mar 25
+ UKEICC 80m Contest	2000Z-2130Z, Mar 26
+ RSGB 80m Club Championship, SSB	0145Z-0215Z, Mar 27
+ NCCC RTTY Sprint	0200Z-0330Z, Mar 27
+ QRP Fox Hunt	0230Z-0300Z, Mar 27
+ NCCC Sprint	0000Z-2359Z, Mar 28
+ FOC QSO Party	0000Z, Mar 28 to 2359Z, Mar 29 1300Z-1400Z, Mar 30 and 1900Z-2000Z, Mar 30 and 0300Z-0400Z, Mar 31
+ CQ WW WPX Contest, SSB	
+ QCX Challenge	

Our thanks to **Bruce Horn, WA7BNM** for use of this calendar!

Please visit Bruce's site at  
[www.contestcalendar.com/contestcal.html](http://www.contestcalendar.com/contestcal.html)  
for many other helpful contest calendar formats.





# 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 Busy? | QRU Have anything for me |                   |
| QRV Are You Ready?       | QRX Standby       | QRS Transit Slower       |                   |



A	●	M	—	Y	— ● — ● — ● —
B	— ● ● ●	N	— ●	Z	— ● ● ●
C	— ● ● ● ●	O	— — — —	1	● — — — — —
D	— ● ● ●	P	— ● ● ● ●	2	● ● — — — —
E	●	Q	— — — ● — —	3	● ● ● — — —
F	● ● ● ●	R	— ● ● ●	4	● ● ● ● —
G	— ● ● ●	S	● ● ●	5	● ● ● ● ●
H	● ● ● ●	T	— —	6	— ● ● ● ●
I	● ●	U	● ● — —	7	— ● ● ● ● ●
J	— ● — — — —	V	● ● ● — —	8	— ● — — — ●
K	— ● — — —	W	— ● ● — —	9	— ● — — — ● ●
L	— ● ● ● ●	X	— ● ● ● ●	0	— — — — — ●

## US Amateur Radio Bands

### US AMATEUR POWER LIMITS

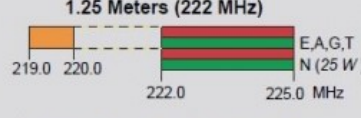
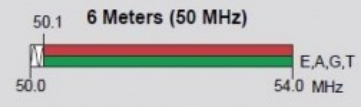
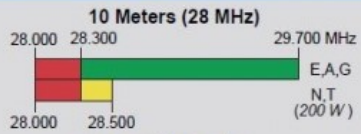
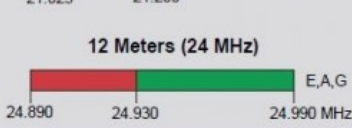
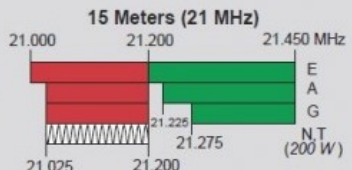
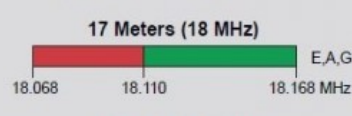
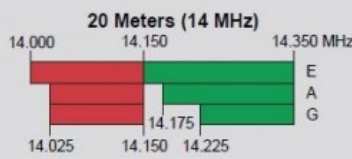
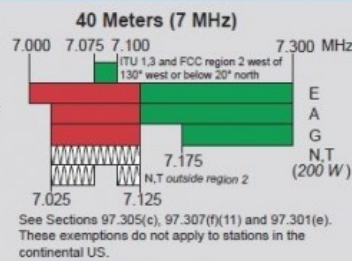
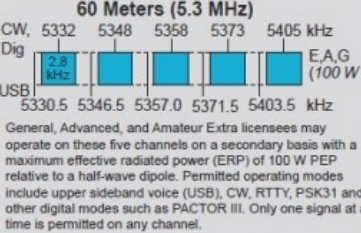
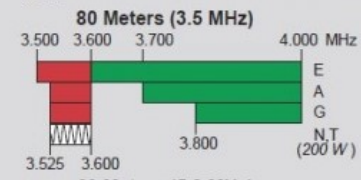
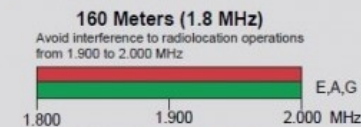
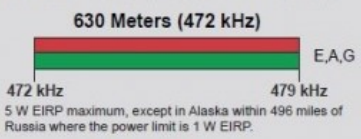
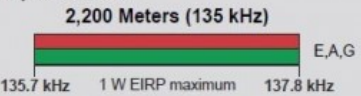
FCC 97.313 An amateur station must use the minimum transmitter power necessary to carry out the desired communications. (b) No station may transmit with a transmitter power exceeding 1.5 kW PEP.

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

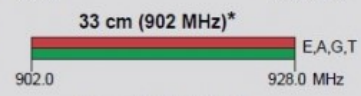
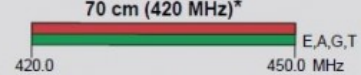


**ARRL** The national association for AMATEUR RADIO®

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](http://www.arrl.org/graphical-frequency-allocations) when the bands are fully available for use.



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



- 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

**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](http://www.arrl.org) for detailed band plans.

**ARRL**  
**We're At Your Service**

ARRL Headquarters:  
860-594-0200 (Fax 860-594-0259)  
email: [hq@arrl.org](mailto:hq@arrl.org)

Publication Orders:  
[www.arrl.org/shop](http://www.arrl.org/shop)  
Toll-Free 1-888-277-5289 (860-594-0355)  
email: [orders@arrl.org](mailto:orders@arrl.org)

Membership/Circulation Desk:  
[www.arrl.org/membership](http://www.arrl.org/membership)  
Toll-Free 1-888-277-5289 (860-594-0338)  
email: [membership@arrl.org](mailto:membership@arrl.org)

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

Exams: 860-594-0300 email: [vec@arrl.org](mailto:vec@arrl.org)

# 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 KEØNQS.mn@gmail.com.

- **Northland Weather Group Net:** Mondays 2000 on the ARAC repeater (146.940 MHz with a tone of 103.5 and standard offset).
- **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](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](mailto: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



## Next ARAC Board Meeting

Tuesday, March 3, 2020  
@ 6:30 p.m.  
Sammy's West Duluth

### Next ARAC Club Meeting

Thursday, March 12, 2020  
7 p.m.

Copper Top Church

Interested in providing a program, or have an idea for one? Contact Mike NØPDG at [lovoldm@gmail.com](mailto:lovoldm@gmail.com)

### CONGRATULATIONS

To new hams who have joined our amateur radio community in the last few months, as well as those who have newly upgraded to General or Extra!

- ♦ John Schulz—KD9OSV  
is a new General
- ♦ Brandon Ware KEØZDF  
is a new Technician

Next scheduled test is **May 2, 2020**, at the Ham Fest. Second testing session in May will be at the end of the class, **May 12, 2020**. July 1, 2020, new Extra test question pool, then a year off with no changes and then Tech will refresh.

**CLUB REPEATER**  
**WØGKP**

146.94 (-)  
CTCSS TONE  
103.5

**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](http://www.fcc.gov/uls).

### Amateur Radio License Class

Tuesdays, 7-9pm  
Feb 11th - May 12th

House of Refuge  
115 West Myrtle, Duluth, MN

Course fee \$10  
License Test on 5/12; \$15 test fee

Instruction and testing for those who want to become Ham Radio operators. **Invite friends & family to join the hobby!**

Participants will learn communications for weather spotting, marathons, and disasters. Class will cover what you need to know to get your Technician license. We use the Gordon West manual that may be purchased the first night of class for \$25.

Contact Bob KCØNFB at [kc0nfb@charter.net](mailto:kc0nfb@charter.net) for information on signing up.

**General & Expert License Study Group**  
With Diane Saunders KØDSL

Tuesdays 7pm - 9 pm  
House of Refuge  
115 West Myrtle, Duluth, MN

# 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

*Monday Nights at 2ØØØ on the ARAC System*

## 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-mær/ [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...

# Membership E-mail Directory

Ahlgren, Scott NØVYU  
sahlgren01@msn.com  
Anderson, Jim NØJWA  
kcØmko@centurylink.net  
Anway, Allen KC9LJN  
allen@a2d2.com  
Anway, Dorothy KC9LSG  
dorothy@a2d2.com  
Bakke, Richard KDØQHE  
rabakke46@aol.com  
Barnes, Ray KEØZN  
KEØZN@outdrs.net  
Blodgett, Warren KDØXI  
kdØxi@aol.com  
Blotti, Nick KBØMHD  
NickBlotti@hotmail.com  
Bockbrader, Jonah KEØCXD  
j@pelirrojo.ninja  
Bockbrader, Rollie KBØCK  
Rollie.bockbrader@q.com  
Clemens, Butch KBØSMG  
kbØsmg@2z.net  
Currier, Barb  
bjcurrier@peoplepc.com  
Dall, Jim WDØGVW  
Dall, Teresa KAØCDO  
wdØgvw@gmail.com  
Dallavia, Paul KCØWDQ  
kcØwdq@yahoo.com  
Daly, Ed KØYMF  
eddalymn@aol.com  
Ellefsen, Gene NØVRM  
Ispitech@mail.com  
Ferch, Tim AKØTF  
akØtf@aol.com  
Fisher, Bud NØGGF  
nØggf@arrl.net  
Ferguson, Tom WBØDHB  
tferg5@msn.com  
Fleischman, Bill KCØZZL  
wfleisch@d.umn.edu  
Forsyth, Grant KCØWUP  
forsythgrantc@gmail.com  
Frederick, Jerry NØBNG  
nØbng@mchsi.com  
Frederick, Julie NØPIE  
jfreds@mchsi.com  
Freeman, Roger NØGRX  
rf2134@aol.com  
Gibbs, Rex NØKXT  
nØkxt@yahoo.com  
Godbout, Med WØEEZ  
wØeezmedgodbout@centurytel.net  
Hanson, Gary NUØW  
captaingary@chartermi.net  
Harstad, Ben KEØJDB  
coast\_guard\_aux\_duluth@yahoo.com  
Hawkinson, Garry WØELH  
garryhawkinson@yahoo.com

Contact Kim or Steve Waller to include your name in this listing!

Jakubek, Patrick KDØSGK  
kdØsgk@gmail.com  
Johnson, Randy AAØME  
randy@nsw4x4.com  
Leslie, Shirl KBØSBM  
dsleslie@centurytel.net  
Makowski, Cletus KBØLBS  
kbØlbs52@msn.com  
Makowski, Karen NØWEZ  
k-wez1@hotmail.com  
Marchetti, Jim KEØLHX  
jim\_marchetti@live.com  
Mattson, Bing KCØKRA  
, Kathy KCØTIV  
HamToHam@msn.com  
McCorison, Derek WØDNF  
derek1Ø68@hotmail.com  
Meese, Joe WØLWU  
rxcpd@yahoo.com  
Miller, Dave WØNWO  
dmiller@nwoutlet.com  
Mullozzi, Anthony (Nick)  
KDØYQA  
AJ KDØYPZ  
Ben KDØYQB  
Joe KDØYQC  
amulloz@hotmail.com  
Murray, Edwin W1ELM  
w1elm@arrl.net  
Nast, Jeffrey KCØMK5  
kcØmks@gmail.com  
Nelson, Doug AAØAW  
aaØaw@chartermi.net  
Nelson, Glen KAØGGG  
mgnelsonØ1@gmail.com  
Nelson, John KBØSUW  
jon275@q.com  
Nordin, Al WBØDBQ  
anordin@aol.com  
Olson, Lloyd Sr. KCØSJB  
rdrunner5Ø7@aol.com  
Olson, Lloyd Jr. KC9JTC  
kc9jtc@yahoo.com  
Pearson, Wayne WØKRH  
meppsy@netzero.net  
Pettit, Kathy KCØYVM  
kcØyvm@gmail.com  
Pomroy, Deb KCØUKC  
dpomroy@d.umn.edu  
Pyrlik, David KEØHHQ  
David.pyrlik@gmail.com  
Reger, Bernard KB9KQZ  
Mike KB9KRA  
Brian KB9KUX  
Chris KB9WJQ  
bjr5488@yahoo.com

Contact Kim or Steve Waller to include your name in this listing!

Rosell, Dawson KEØHEL  
rosel032@d.umn.edu  
Saunders, Diane KØDSL  
kØdslae@gmail.com  
Scholz, Greg KDØUYN  
kdØuyn@gmail.com  
Schreyer, Dave WAØAWZ  
kaØfyb@mediacombb.net  
Schulz, Robert KCØNFB  
kcØnfb@charter.net  
Snyder, Mark ACØLE  
snyds1118@msn.com  
Stark, John KCØYVH  
johnviny1@yahoo.com  
Stroud, Butch KCØPDK  
kenwren@netzero.net  
Swanson, Scott N9DMG  
sswanson6749@charter.net  
Waller, Kim KEØNQS  
keØnqs.mn@gmail.com  
Waller, Steve KEØNQT  
keØnqt@gmail.com  
Whelan, Jacqui KBØJIM  
cndymx@gmail.com  
Whelan, John KØJRW  
jr-whelan@hotmail.com  
Winterscheidt, Heinz  
KD6FSA  
alter.skipper@gmail.com  
Wulf Gar WU1FGR  
wu1fgr.ham@gmail.com

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 us with your info. If you need to make a change, please let us know at KEØNQS.mn@gmail.com Or KEØNQT@gmail.com

Co-Editors,  
Kim & Steve Waller  
KEØNQS & KEØNQT







# MARCH

## CLUB EVENTS

### SUNDAY NIGHT NETS

1930 - CW - 28.125 MHz USB-CW  
 2000 - USB 28.450 MHz  
 2100 - Southern St. Louis County  
 Emergency Services Net  
**MONDAY NIGHT NETS**  
 2000 - Northland WX Net - ARAC Repeater

### TUESDAY NIGHT NETS

2000 - Douglas Cty 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  CW 1930 NØPDG USB 2000 WØDIO ES 2100 NØVRM	2	3  <b>ARAC BOARD MEETING</b> 6pm Sammy's West Duluth  DC Net 2000 CC Net 2030	4  2100 - BWAR	5	6	7
8  CW 1930 AAØAW USB 2000 NØVRM ES 2100 KØDSL	9  DC ARES/ RACES Mtg 1900 DC EOC  WX 2000 KCØMKS	10  DC Net 2000 CC Net 2030	11  Lake County ARES/RACES Meeting 1800  Lake County Net 1900 2100 - BWAR	12  <b>ARAC Club Meeting</b> Coppertop Church  7 pm	13	14
15  CW 1930 NØPDG USB 2000 NØPDG ES 2100 AAØME	16  WX 2000 KCØMKS	17   DC Net 2000 CC Net 2030	18  St. Louis County ARES/ RACES Mtg 1630 Pike Lake EOC 2100 - BWAR	19	20	21
22  CW 1930 AAØAW USB 2000 AAØAW ES 2100 N9DMG	23  WX 2000 KCØMKS	24  DC Net 2000 CC Net 2030	25  Lake County Net 1900  2100 - BWAR	26  Carlton County ARES/RACES Meeting 1900 CC EOC	27	28  Club Breakfast @ The Chalet 0730-0830
29  CW 1930 NØPDG USB 2000 WØLWU ES 2100 AAØAW	30  WX 2000 KCØMKS	31  DC Net 2000 CC Net 2030				

Get this newsletter *faster*  
via email!  
Email Doug AAØAW at  
[aa0aw@arrl.net](mailto:aa0aw@arrl.net)

Next Meeting: Thursday,  
*March 12, 2020 - 7 pm*  
Coppertop Church

## 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

**Contest Calendar** at [www.contestcalendar.com](http://www.contestcalendar.com)

**National Contest Journal** at [www.ncjweb.com](http://www.ncjweb.com)

**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](http://www.qrz.com)

**VHF Propagation** site at [www.aprs.mountainlake.k12.mn.us](http://www.aprs.mountainlake.k12.mn.us)

**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



# 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](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](mailto:wb7dru@gmail.com)

AFA5ZV Randy, KRØB [afa5zv@gmail.com](mailto:afa5zv@gmail.com)

AFA5JY Reg, KAØRJY [reg\\_cass@msn.com](mailto:reg_cass@msn.com)

## Perovskite Solar Cells, Continued from Page 1

of being dependent on our local power company for our electricity, the cost of the average home solar energy system in Minnesota has been about \$20,000 and takes 8-10 years of use to pay for itself. While traditional solar panel cost and efficiency has improved in the past decade, photovoltaic research has recently produced an exciting new technology: **perovskite solar cells**.

Chris Warren of *Off the Grid Ham* says, “This still-emerging technology uses perovskite-structured crystals to pull energy from different colors of light. Silicon panels by comparison make electricity from a narrow band of light. The process for making perovskite solar is also cheaper and more environmentally friendly than silicon. Lastly, perovskite is **over 25% efficient** versus 13%-17% for conventional panels. But nothing is perfect. One of the components of perovskite solar is lead. As most everyone knows, lead is a heavy metal that cannot be released uncontrolled into the environment. A broken or otherwise compromised perovskite solar network is a serious contamination hazard to soil and water. This is (or rather, **was**) one of the biggest obstacles to making perovskite solar a real product that can be placed on the market.”

Now there’s a genuine breakthrough in making perovskite solar cells viable: Scientists at **Northern Illinois University** in DeKalb, Illinois have developed a plastic film that will absorb and sequester the lead in the event that the panel is compromised. They recently explained this as follows:

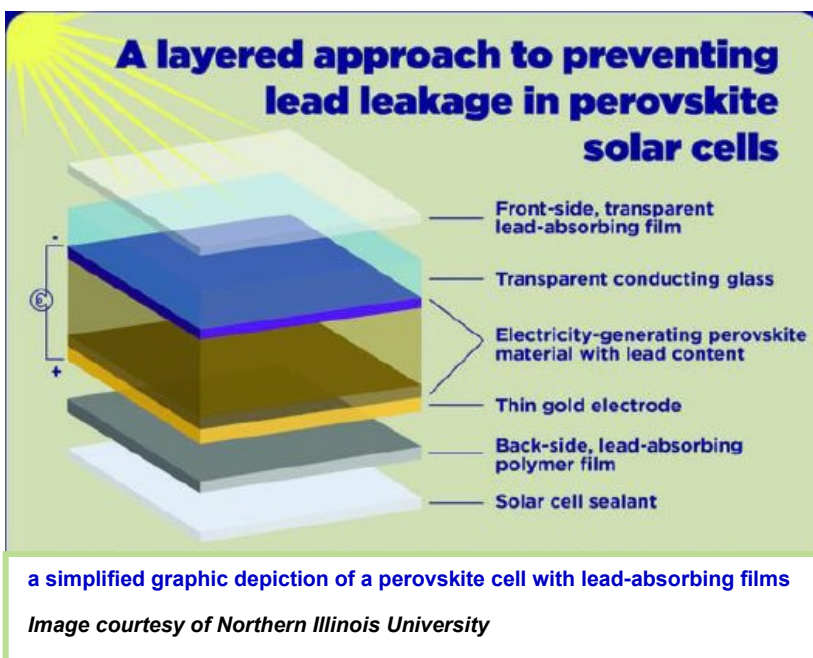
*“The lead toxicity issue has been one of the most vexing, last-mile challenges in the perovskite solar cell field,” said Xu, an NIU professor of chemistry. “We think we have a highly promising remedy to this problem—and it could be a game-changer. In the event of a damaged cell, our device captures the great majority of the lead, preventing it from leaching into groundwater and soils. The films that we use are insoluble in water.”*

In “light” of these statements (sorry for the pun) from the NIU team, Chris Warren of *Off the Grid Hams* excitedly echoes the truly extraordinary aspect of this breakthrough that has been eluding researchers for many years. He says, “When we’ll be able to buy perovskite solar is still not determined, but with this development that day may come **a lot sooner**. The benefits of perovskite cannot be oversold. When this product hits the market, it’s going to be a game changer.”

A scientist identifying himself only as “Ted K.” also offers this super in-depth description regarding emerging new-generation photodetectors based on low-dimensional halide perovskites:

*“Organic–inorganic halide perovskites have attracted enormous attention for future optoelectronic applications because of their remarkable optical and electrical properties, solution process ability, low cost, and large-scale fabrication capabilities. In addition to their use in photovoltaics and light-emitting diodes, halide perovskites have recently emerged as promising candidates for new-generation photodetectors. However, conventional three-dimensional halide perovskite*

*photodetectors suffer from current–voltage hysteresis, unreliable performance, and instability. By controlling the morphological dimensionality of bulk three-dimensional and quasi-two-dimensional structured perovskites, low-dimensional halide perovskites (LDHPs, such as two-dimensional, one-dimensional, and zero-dimensional halide perovskites), which have robust chemical stability and optoelectronic tunability owing to the quantum size effect, can be obtained, providing an alternative solution to overcoming the aforementioned limitations. We examine the current state of the art and highlight the recent advances in photodetectors based on LDHPs, with a focus on their operation mechanisms, device architectures, synthesis and modification methods, and photo detection performances. We also discuss the current challenges for and provide a future perspective on the creation of LDHP-based photodetectors with unprecedented performance and opportunities for commercialization.”*



Continued on page 21

## Perovskite Solar Cells, Continued from Page 20

This new generation of photovoltaic energy is not just a far-off pipe dream of a few zealous scientists. Research and development has been robustly funded and is proving successful. Here's what the National Center for Photovoltaics (NCPV) said before Northern Illinois University's breakthrough announcement:

"Work on solar cells using perovskite material has advanced rapidly as a result of the material's excellent light absorption, charge-carrier mobilities, and lifetimes, resulting in high device efficiencies with significant opportunities to realize a low-cost, industry-scalable technology. This potential for low cost and scalability requires overcoming barriers related to stability and environmental compatibility. However, if these concerns are addressed, a perovskite-based technology holds transformational potential for rapid terawatt-scale solar deployment. The basic materials properties have also sparked interest in using the hybrid perovskite semiconductors in a broader class of energy applications that span traditional electronic and optical systems."

NCPV acknowledged that when the problem of stability and environmental compatibility was addressed that commercial opportunities for broad, scalable application of the technology would be transformative. Now that the long-elusive solution has been developed by Northern Illinois University, the next wave of development in the field will seek to create products that can be scaled by companies for mass production that spawns an entirely new industry. An enormous private and public funding stream is already in place to quickly develop products that come to market.

In fact, that has been the highly-funded purpose of the U.S. government's **National Center for Photovoltaics** for years. They say it this way at [www.nrel.gov](http://www.nrel.gov) :

*"In a few short years, the National Center for Photovoltaics (NCPV) has made significant technical contributions to research in perovskites, as demonstrated by a large number of field-leading publications and significant interest by industry. The NCPV's impact has been enabled by short-term Laboratory Directed Research and Development (LDRD) funding and early investments from the Department of Energy's (DOE's) Office of Science, Office of Basic Energy Sciences (BES), Solar Photochemistry program, followed by efforts funded by DOE's Office of Energy Efficiency and Renewable Energy that focused on photovoltaics (PV). To date, NCPV scientists have more than 60 articles published in high-impact journals in this field. NREL's applied perovskite PV program seeks to make perovskite solar cells a viable*

*technology by focusing on removing barriers to commercialization by increasing its efficiency, controlling stability, and enabling scaling."*

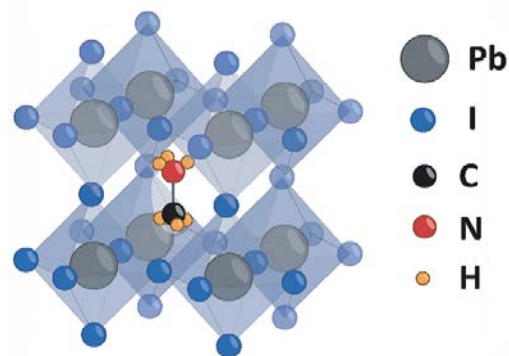
Because of the fast-tracking by the federal government that is already in place, some energy industry experts say that in just 2 years perovskite solar cells can be produced for large scale continuous commercial use as a test. They estimate that within the next 5 years consumer products will be available on the market at an affordable price.

Wow. Exciting stuff on the horizon to be sure.★



**Above: One test unit of the SPA system can enable the simultaneous study of 12 1"x1" devices.**

**Solar parameter analysis (SPA) system** enables a unique suite of long-term reliability characterizations on individual PV cells. The system has four main components: a flow cell; individually addressable, matrixed electrical channels for devices under test; a series of sensors/sensor channels; and control/measurement electronics. In addition to PV applications, the system can be applied to solid-state lighting, testing of coatings and barriers, batteries, and more. *Graphic courtesy NCPV*



**Methyl ammonium lead triiodide ( $\text{CH}_3\text{NH}_3\text{PbI}_3$ , or  $\text{MAPbI}_3$ ), is one of the perovskites that the NCPV has been exploring**  
*Graphic courtesy NCPV*