



The RELAY)))

OCTOBER
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

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Observing Jupiter by Radio

Editors' Note: A version of this article appeared in our newsletter several years ago, courtesy the Thrush Observatory. With NASA recently putting Jupiter front and center along with its moons, we thought it interesting to re-visit this, especially for those of us newer to the hobby. Though old equipment is mentioned at times, it's still a fun project that is adaptable for today. Tell us about your experiences in observing space via radio at KEØNQS.mn@gmail.com

If you have been an amateur radio operator or shortwave listener for some time, you probably have already heard it; an unmistakable rush of soft static that sounds amazingly like waves crashing on a seashore. You may not have known however, that this "interference" was not of earthly origin, rather it originated at least 500,000,000 miles away from us with the planet Jupiter.

Jupiter is the largest and closest to the sun of the "gas giant" planets in our solar system. Like the sun, Jupiter is composed primarily of hydrogen. If Jupiter had been several magnitudes larger during its formation, the core of the planet would have been under sufficient pressure to induce nuclear fusion and our solar system would have had two stars instead of one. As it is, the hydrogen gas within the deeper reaches of the planet (there is no solid surface) is compressed into a "metallic" state where electrons become freely shared by the proton nuclei. Above this inner region lies an "atmosphere" of hydrogen and other gases. Clouds of methane, ammonia, ammonium, hydrosulfide, and water form complex stormy bands which encircle the planet. The Great Red Spot is the most famous feature of Jupiter. It is actually a long duration storm, which because of its tremendous size, has a life expectancy of hundreds of years. From our vantage point, even through a 2" telescope, we see Jupiter as a banded sphere flanked by many tiny but bright moons. The innermost moon, Io, is of interest to us as radio observers of the planet.



Jupiter, the largest planet in the Solar System with 79 known moons, is the third-brightest object in the night sky. Photo Courtesy Thrush Observatory

Early observations of Jupiter at the microwave wavelength of 3 cm corresponded to a blackbody (broadband thermal emission) of 150 Kelvin.

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There are no ARAC Board Meeting Minutes for Sept 3, 2019

As there were not enough Board Members available to constitute a quorum, the normally-scheduled September 3rd Board meeting was a social hour with no official Club business.

Prez Sez...

Hi everyone,

It's that time of the year that we take nominations for Club Officers. Nominations will be taken at the October and November meetings. You can nominate someone or put your name in for an office. Just let one of the Board Members know at either Club meeting. Again, nominations close at the November Club meeting.

Gene NØVRM "73"!

P.S. Mark Rude AKØZ became a Silent Key Friday, September 27th. Please keep his family in your prayers. He will be greatly missed!!

Silent Key

Mark Andrew Rude AKØZ, 80, passed on September 27, 2019. He leaves two sons: Patrick Rude (wife Tricia, children Olivia, Jamison, Jerrod) Stillwater, MN. Scott Rude (children Alexandra, Caleb) Rockford, IL. Predeceased by Grandson Samuel.



Mark Rude AKØZ

Born and raised in Duluth, he was the son of Samuel and Elaine Rude. He spent his early years commercial fishing on Isle Royale at Fisherman's Home. He split his adventurous life between Isle Royale, Duluth, and St. Charles, IL.

He was a member of the Isle Royale Boaters Association and Arrowhead Radio Amateurs Club. He leaves behind many life long friends.

Memorial Service is Friday, Oct. 4, at 3 PM at First Memorial Funeral Chapel, 4100 Grand Ave, Duluth, MN

ARAC Club Meeting Minutes

August 8, 2019

Present:

President Gene Ellefsen-N0VRM
Vice President Mike Lovold-N0PDG
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
Repeater Randy Wabik-KR0B
Testing Doug Nelson-AA0AW

Absent:

Treasurer / Membership Bruce Carlson-KE0NIT
Chaplain (Visiting) Rolland Bockbrader-KB0CK
Property / Picnic Scott Ahlgren-N0VYU
Newsletter / Historian Kim Waller-KE0NQS
Newsletter Steve Waller-KE0NQT
Web Site Thomas Dorr-KE0RHA
Repeater Derek McCorison-W0DNF
Repeater Randy Haglin-N0BZZ

Meeting called to order by President Gene-N0VRM at 7:01 pm

Minutes:

Minutes are posted on the web page and in the newsletter. Motion to approve by Bob-KD0YLN, seconded by Gary-KD9ABS, motion passed

Treasurer's Report:

Presented by Gene-N0VRM

Checking	2,815.96
Savings	1,371.01
Cash Subtotal	\$4,186.97
Outstanding Check (Repeater # 1414).....	-1,100.00
Subtotal.....	-\$1,100.00
Winter CD	1,707.19
Summer CD	1,700.00
CD Subtotal	\$3,407.19
Grand Total.....	\$6,494.16

Motion to approve by Bob-KC0NFB, seconded by Mike-N0PDG, motion approved

Question – what is the interest rate on CD? We don't know because Bruce-KE0NIT is absent. Gene-N0VRM will follow up to get the information

Committees:

Education:

Bob-KC0NFB was requested, again, to have a Technician's class, starting September 29, 2019, followed by testing on December 10, 2019. There will also be a study group for both General and Extra, led by Diane Saunders-K0DSL. Email Bob-KC0NFB if interested in attending the study group

Continued on Page 4

ARAC Club Meeting Minutes, Continued from Page 4

Time to start thinking about paying dues for the next year. We will take your dues money tonight

Committees:

Education:

First Tech Class, through Duluth Community Education, starts September 24, 2019, and people have already signed up to attend the class. General and Extra study sessions will also start that night. Demonstrations will be included as part of the class and the study groups. Bring your General or Extra book (by Gordon West to the study group

Newsletter:

We want to know your story, how you got into Ham Radio, want to hear stories, etc. Any materials you might have, we would like to see them to include them in our history

90th Anniversary for ARAC:

W0GKP was used for the 80th anniversary. We have to formalize plans quickly since December 3, 2019, is coming soon. First of the month prior to the month of the event, probably October 1, 2019, for information to be included in ARRL publications.

New Business:

Next month is the Church's Annual Fall Roast Beef Dinner. We encourage support of the church. Please park on the west side of the church and the meeting will be upstairs in the sanctuary

Fall Fest:

In Carlton MN, 9 am to 1 pm, sign up with John-KC0AFE. Love to see everyone there. \$3.00 at the door, free coffee and donuts. Radio City will be there with a selection of different items. Four Seasons building, right under the water tower, in downtown Carlton

Testing:

December 10, 2019, is the next scheduled testing session. If you want to test before that, contact Doug-AA0AW

Repeater:

Received bill for the tower inspection. He is in town this week and will be working on the Mahtowa repeater this week

New Ham:

Stuart looking for a hobby to get into and thinks Ham Radio might be his pick. Welcome, Stuart!

Inline Marathon:

Saturday, September 14, 2019, starting 6:15 am, using the 94 Repeater, probably through 1:30 pm. Thanks to everybody that volunteered to help. Breakfast at McDonald's on 21st, 5:00 am

Wild Marathon:

October 19, 2019, more information to follow

Drawing for \$5.00 door prize won by Ryan Johnson-N0RMJ

Motion to adjourn by Jeff Maker-AD0TH, seconded by many, motion passed

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

Contest Calendar - October 2019

IQRP Quarterly Marathon	0800Z, Oct 1 to 2000Z, Oct 7
222 MHz Fall Sprint	1900 local - 2300 local, Oct 1
Phone Fray	0230Z-0300Z, Oct 2
CWops Mini-CWT Test	1300Z-1400Z, Oct 2 and 1900Z-2000Z, Oct 2 and 0300Z-0400Z, Oct 3
UKEICC 80m Contest	2000Z-2100Z, Oct 2
German Telegraphy Contest	0700Z-1000Z, Oct 3
NRAU 10m Activity Contest	1700Z-1800Z, Oct 3 (CW) and 1800Z-1900Z, Oct 3 (SSB) and 1900Z-2000Z, Oct 3 (FM) and 2000Z-2100Z, Oct 3 (Dig)
SARL 80m QSO Party	1700Z-2000Z, Oct 3
SKCC Sprint Europe	1900Z-2100Z, Oct 3
NCCC RTTY Sprint	0145Z-0215Z, Oct 4
NCCC Sprint	0230Z-0300Z, Oct 4
TRC DX Contest	0600Z, Oct 5 to 1800Z, Oct 6
Oceania DX Contest, Phone	0800Z, Oct 5 to 0800Z, Oct 6
Russian WW Digital Contest	1200Z, Oct 5 to 1159Z, Oct 6
YLRL DX/NA YL Anniversary Contest	1400Z, Oct 5 to 0200Z, Oct 7
IARU Region 1 UHF/Microwaves Contest	1400Z, Oct 5 to 1400Z, Oct 6
California QSO Party	1600Z, Oct 5 to 2200Z, Oct 6
International HELL-Contest	1600Z-1800Z, Oct 5 (80m) and 0900Z-1100Z, Oct 6 (40m)
FISTS Fall Slow Speed Sprint	1700Z-2100Z, Oct 5
SKCC QSO Party	1800Z, Oct 5 to 1800Z, Oct 6
RSGB DX Contest	2100Z-2259Z, Oct 5
UBA ON Contest, SSB	0500Z-2300Z, Oct 6
Peanut Power QRP Sprint	0600Z-0900Z, Oct 6
	2200Z-2359Z, Oct 6

Continued on Page 7

Contest Calendar - October 2019, Continued

RSGB FT4 Contest Series	1900Z-1959Z, Oct 7
ARS Spartan Sprint	0100Z-0300Z, Oct 8
NAQCC CW Sprint	0030Z-0230Z, Oct 9
Phone Fray	0230Z-0300Z, Oct 9
CWops Mini-CWT Test	1300Z-1400Z, Oct 9 and 1900Z-2000Z, Oct 9 and 0300Z-0400Z, Oct 10
432 MHz Fall Sprint	1900 local - 2300 local, Oct 9
10-10 Int. 10-10 Day Sprint	0001Z-2359Z, Oct 10
NCCC RTTY Sprint	0145Z-0215Z, Oct 11
NCCC Sprint	0230Z-0300Z, Oct 11
QRP ARCI Fall QSO Party	0000Z-2359Z, Oct 12
Makrothen RTTY Contest	0000Z-0800Z, Oct 12 and 1600Z-2400Z, Oct 12 and 0800Z-1600Z, Oct 13
Nevada QSO Party	0300Z, Oct 12 to 2100Z, Oct 13
Oceania DX Contest, CW	0800Z, Oct 12 to 0800Z, Oct 13
Microwave Fall Sprint	0800 local - 1400 local, Oct 12
Scandinavian Activity Contest, SSB	1200Z, Oct 12 to 1200Z, Oct 13
SKCC Weekend Sprintathon	1200Z, Oct 12 to 2400Z, Oct 13
Arizona QSO Party	1600Z, Oct 12 to 0600Z, Oct 13 and 1400Z to 2400Z, Oct 13
Pennsylvania QSO Party	1600Z, Oct 12 to 0500Z, Oct 13 and 1300Z-2200Z, Oct 13
FISTS Fall Unlimited Sprint	1700Z-2100Z, Oct 12
4 States QRP Group Second Sunday Sprint	0000Z-0200Z, Oct 14
RSGB 80m Autumn Series, CW	1900Z-2030Z, Oct 14
Phone Fray	0230Z-0300Z, Oct 16
CWops Mini-CWT Test	1300Z-1400Z, Oct 16 and 1900Z-2000Z, Oct 16 and 0300Z-0400Z, Oct 17
AGCW Semi-Automatic Key Evening	1900Z-2030Z, Oct 17
NCCC RTTY Sprint	0145Z-0215Z, Oct 18
NCCC Sprint	0230Z-0300Z, Oct 18
Zombie Shuffle	1600-2400 local, Oct 18
Araucaria World Wide VHF Contest	0000Z, Oct 19 to 1600Z, Oct 20

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Contest Calendar - October 2019, Continued

ARRL EME Contest	0000Z, Oct 19 to 2359Z, Oct 20
JARTS WW RTTY Contest	0000Z, Oct 19 to 2400Z, Oct 20
10-10 Int. Fall Contest, CW	0001Z, Oct 19 to 2359Z, Oct 20
New York QSO Party	1400Z, Oct 19 to 0200Z, Oct 20
Stew Perry Topband Challenge	1500Z, Oct 19 to 1500Z, Oct 20
Worked All Germany Contest	1500Z, Oct 19 to 1459Z, Oct 20
Feld Hell Sprint	2000Z-2359Z, Oct 19
Argentina National 7 MHz Contest	2130Z-2230Z, Oct 19
Asia-Pacific Fall Sprint, CW	0000Z-0200Z, Oct 20
UBA ON Contest, 2m	0700Z-1000Z, Oct 20
Illinois QSO Party	1700Z, Oct 20 to 0100Z, Oct 21
RSGB RoLo CW	1900Z-2030Z, Oct 20
Run for the Bacon QRP Contest	0100Z-0300Z, Oct 21
ARRL School Club Roundup	1300Z, Oct 21 to 2359Z, Oct 25
Telephone Pioneers QSO Party	1800Z-1900Z, Oct 21 (Digital Only) and 1900Z, Oct 21 to 0300Z, Oct 22 (All Modes)
SKCC Sprint	0000Z-0200Z, Oct 23
Phone Fray	0230Z-0300Z, Oct 23
CWops Mini-CWT Test	1300Z-1400Z, Oct 23 and 1900Z-2000Z, Oct 23 and 0300Z-0400Z, Oct 24
RSGB 80m Autumn Series, Data	1900Z-2030Z, Oct 23
NCCC RTTY Sprint	0145Z-0215Z, Oct 25
NCCC Sprint	0230Z-0300Z, Oct 25
CQ Worldwide DX Contest, SSB	0000Z, Oct 26 to 2359Z, Oct 27
Phone Fray	0230Z-0300Z, Oct 30
CWops Mini-CWT Test	1300Z-1400Z, Oct 30 and 1900Z-2000Z, Oct 30 and 0300Z-0400Z, Oct 31
UKEICC 80m Contest	2000Z-2100Z, Oct 30
RSGB 80m Autumn Series, SSB	1900Z-2030Z, Oct 31

**For upcoming contests in Nov/Dec 2019
visit www.contestcalendar.com/contestcal.html**

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

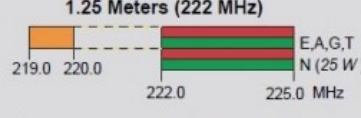
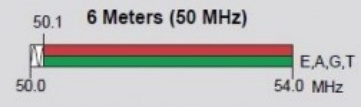
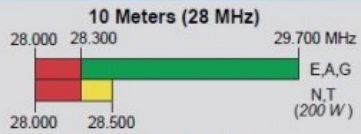
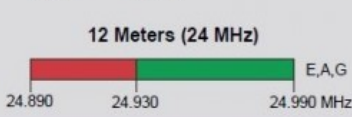
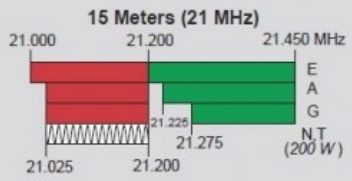
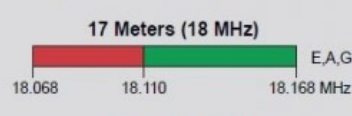
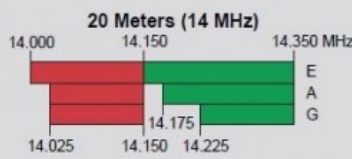
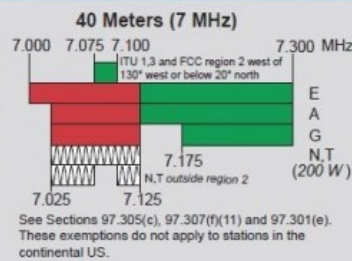
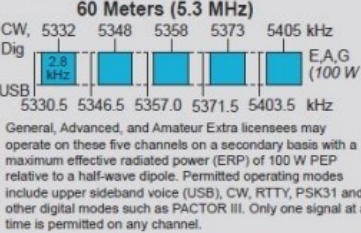
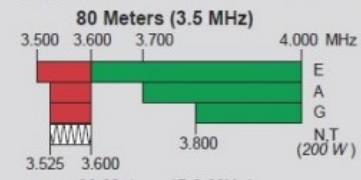
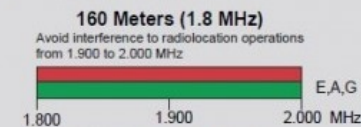
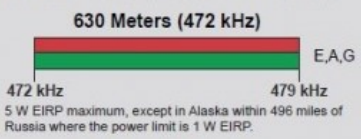
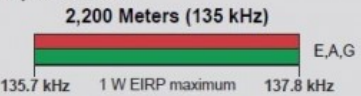
FCC 97.313 An amateur station must use the minimum transmitter power necessary to carry out the desired communications. (b) No station may transmit with a transmitter power exceeding 1.5 kW PEP.

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

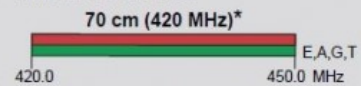


The national association for
ARRL AMATEUR RADIO

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 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 for detailed band plans.

ARRL
We're At Your Service

ARRL Headquarters:
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email: membership@arrl.org

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Toll-Free 1-800-326-3942 (860-594-0355)
email: nowham@arrl.org

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

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:** 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
- 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/glmmnet/>
- 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 KEØNQS.mn@gmail.com

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.

Contest Calendar at www.contestcalendar.com

National Contest Journal at 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
VHF Propagation site at 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 ARRL's web site at arrl.org.

CLUB REPEATER
WØGKP
146.94 (-)
CTCSS TONE
103.5

Next ARAC Board Meeting
Tuesday, Oct. 1, 2019
@ 1830
Sammy's West Duluth

Next ARAC Club Meeting
Thursday, October 10, 2019
6 p.m. Roast Beef Dinner
Adults \$12, Kids \$6
7 p.m. Club Meeting Upstairs
Copper Top Church

October 10th
Club Meeting Program

David Gerth
Founder & Director - ROCK OF AGES
LIGHTHOUSE PRESERVATION SOCIETY

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

Amateur Radio Technician Class

Instructors: Bob Schulz KCØNFB & Paul Dallavia KCØWDQ

- **Sept 24—Dec 10 7pm—9 pm**
House of Refuge
115 West Myrtle, Duluth, MN

Space is still available to jump into this Tuesday night weekly class. Cost is \$25.
Contact Bob KCØNFB at kc0nfb@charter.net

General & Expert License Study Group

- With Diane Saunders KØDSL
- **Tuesdays 7pm—9 pm**
House of Refuge

2019 HOLIDAYS

November 11 **Veteran's Day**
November 28 **Thanksgiving**
December 25 **Christmas Day**

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-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.

<u>Name</u>	<u>Call</u>	<u>Expertise</u>
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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Contact Kim or Steve Waller to include your name in this list-

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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 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



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 LSAC & ARAC

OCTOBER

CLUB EVENTS

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 ARAC BOARD MEETING 1900 Sammy's West Duluth DC Net 2000 CC Net 2030	2 2100 - BWAR	3	4	5
6 CW 1930 AA0AW USB 2000 AA0AW ES 2100 N0VRM	7 WX 2000 KC0MKS	8 DC Net 2000 CC Net 2030	9 Lake County ARES/RACES Meeting 1800 Lake County Net 1900 2100 - BWAR	10 ARAC Club Meeting Coppertop Church 6 pm Roast Beef Dinner 7 pm Upstairs for club meeting	11	12
13 CW 1930 N0PDG USB 2000 W0LWU ES 2100 K0DSL	14 DC ARES/RACES Mtg 1900 DC EOC WX 2000 KC0MKS	15 DC Net 2000 CC Net 2030	16 St. Louis County ARES/RACES Mtg 1630 Pike Lake EOC 2100 - BWAR	17	18	19 Wild Duluth Race
20 CW 1930 AA0AW USB 2000 K9KDK ES 2100 AA0ME	21 WX 2000 KC0MKS	22 DC Net 2000 CC Net 2030	23 Lake County Net 1900 2100 - BWAR	24 Carlton County ARES/RACES Meeting 1900 CC EOC	25	26 Club Breakfast @ The Chalet 0730-0800
27 CW 1930 N0PDG USB 2000 W0DIO ES 2100 N9DMG	28 WX 2000 KC0MKS	29 DC Net 2000 CC Net 2030	30 2100 - BWAR	31		

Get this newsletter *faster*
via email!

Email Doug AAØAW at
aa0aw@chartermi.net

Next Meeting: Thursday,
Oct. 10, 2019 - 7 pm *upstairs, right*
after 6 pm *roast beef dinner!*

CONGRATULATIONS

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

Dave Schreyer WAØAWZ - New Club Member!

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:

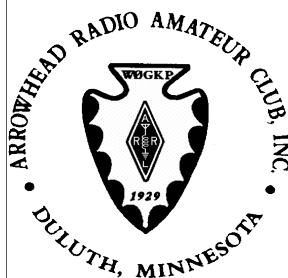
Dennis Anderson WØDIO

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.

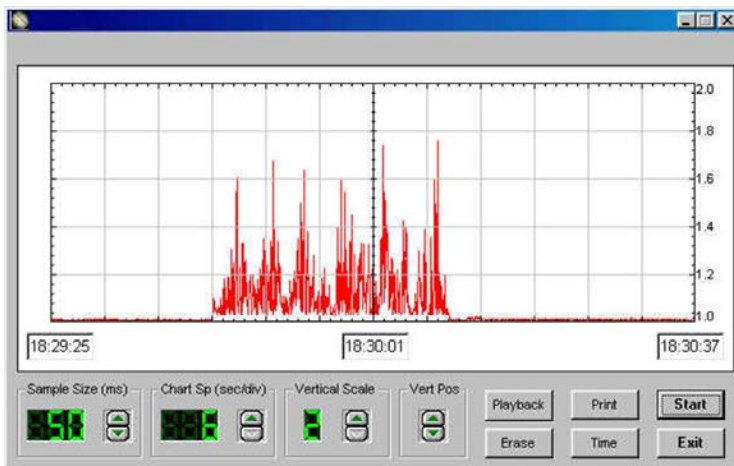


Observing Jupiter, Continued from Page 1

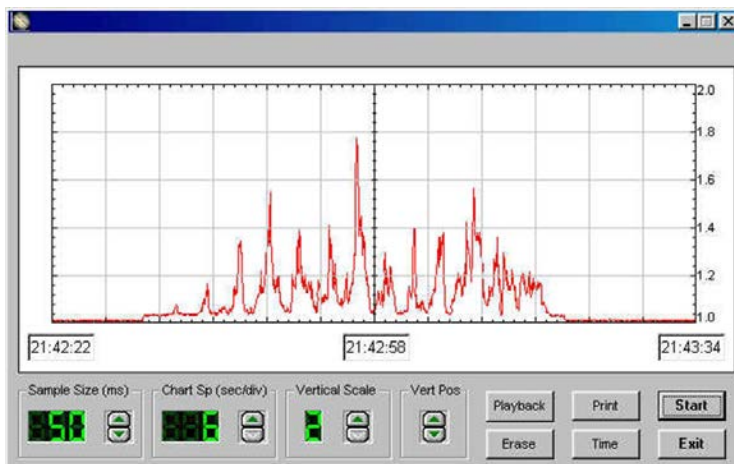
Indeed, that is the approximate temperature of Jupiter's cloud tops. Subsequent observations at lower frequencies began to point to extraordinarily high energies which could not be explained as thermal in nature. These high energy emissions, which occur below 40.5 Mhz, are the result of a phenomena called synchrotron radiation. This type of radio emission occurs when charged particles, usually electrons, are accelerated to extremely high velocities in a magnetic field. The electrons thus accelerated shed excess energy in the form of radio and sometimes even light frequency waves. In Jupiter's case the magnetic field is provided by the planet itself. The noise storms occur when the inner moon, Io, passes through major flux lines of magnetic field in such a way that the emissions are essentially beamed in our direction.

The Voyager space probe missions revealed Io to be an extremely active satellite, with large volcanic plumes rising above the icy surface. It is possible that these volcanic eruptions play a role in the radio storm phenomena. In any case, the storms are predictable in nature based on rotation of the magnetic field, the position of Io in its orbit, and the relative position of the Earth. Any experimenter wishing to provide a useful service to other amateur Jupiter observers could develop a computer algorithm to predict these storms.

For casual observing, all that is necessary in the form of equipment is a shortwave receiver of good sensitivity capable of receiving in the 18 to 30 Mhz range. The 21 Mhz ham band is an excellent place to listen for Jupiter. Some older shortwave receivers fall off in sensitivity at about this frequency. In such a case, a pre selective amplifier may be included between the antenna and the receiver.



SBurst Radio Noise from Jupiter
Images Courtesy Thrush Observatory



These preamps are available commercially or may be constructed from plans available in amateur radio web sites.

The antenna need not be anything special; a simple dipole will do. In fact, directional antennas may be a hindrance if they cannot be tracked as Jupiter changes position in the sky. A somewhat better antenna system would include two dipoles, switchable from the operating position. one dipole would oriented north-south and the other east-west. Suspending the dipoles approximately 1/4 wave above a wire poultry netting ground plane may help in reception when Jupiter is near the zenith. If a directional antenna such as a 3 or 4 element yagi is used, then it may be helpful to tilt the antenna upward, perhaps 30 degrees or so, to achieve a compromise in reception when Jupiter lies at higher elevations. Lowering the antenna to a few feet above ground can also increase the angle of reception.

Consult an astronomy site such as skyandtelescope.com or astronomy.com to determine when Jupiter is in view (remember, it need not be a night time observation). Several ephemeris programs are available

Continued on page 17

Observing Jupiter, Continued from Page 16

for a variety of computer formats. Many of these programs are public domain software. These programs provide sky coordinates (right ascension and declination), as well as the altitude and elevation of the planets for any time, date, or location.

Other factors which must be considered are the placement of Jupiter and the Earth in their orbits around the sun and the reflectivity of the ionosphere. The orbital placement may bear somewhat on the strength of the received signal, but perhaps not to the exclusion of hearing the storms. The earth's ionospheric conditions are on the other hand very important. If the frequency at which you are listening seems alive with terrestrial signals from distant points on the globe, then there will be little chance of hearing Jupiter as the ionosphere is so reflective that it will prevent the penetration of signals from space. In this case you can try listening on frequencies closer to 30 Mhz where the ionosphere may still be transparent. If this fails, then you are probably out of luck for the present. When you finally catch Jupiter, and you will if you are persistent, there are two types "noise" to listen for; the ocean wave type described earlier, which is called an L burst (L for long), and a short burst type static called an S burst. The S bursts often have a "rapid fire" characteristic and tend to drift upward in frequency. You can record these events on audio recorder or on a strip chart recorder.

Radio Equipment Needed to Monitor the Decametric Synchrotron Emissions

Jovian (another name for things relating to Jupiter) Receiving System

The equipment required to receive Jovian originated electromagnetic storms is quite reasonable to assemble:

ANTENNA

Dipole Antenna

The antenna required to observe Jupiter may be as simple as a half wave dipole antenna. The gain from this antenna will be quite low there for requiring a RF preamp to be used. A half wave dipole antenna can be constructed with a two pieces of wire, 11 feet, 8.4 inches in length connected to a 50 ohm coax cable. One length of wire is connected to the inner conductor, and the second piece of wire is connected to the coax shield. The antenna is laid out on a East-West line. The antenna should be raised above the ground by poles or some other means to a height of at least seven feet.

DDRR Antenna

The Directional Discontinuity Ring Radiator (DDRR) antenna is a good compromise between the 1/2 wave dipole and a large beam antenna. DDRR is a loop antenna made from soft aluminum or copper tubing, 1/2 inch in diameter and is cut to 125.5 inches (21MHz). A reflector made of metallic window screen and mounted on a wood, metal or PVC tube frame which is placed 5 inches behind the loop antenna. The loop is supported by a minimum of 4 insulating wood or PVC stand-offs attached to the reflectors frame. The coax cable inner conductor is connected to the antenna element and the outer conductor is connected to the wire screen reflector. A good pre-amp should be located very close to the loop antenna element. The antenna assembly is then located on a East/West line and will be used in a drift scan mode.

Preamp

If the receiver and/or the antenna system lack the necessary sensitivity to detect Jovian noise then an antenna pre-amp will be required. Radio Shack offers a 10 db gain pre-amp which can be located at the antenna. They also offer a tuned pre-amp which can be placed next to the receiver. The external pre-amp is preferred. Several other manufactures produce pre-amps in the range of 18 to 23 MHz. Ham radio sites offer various pre-amp choices as well online resellers.

Continued on page 18

Observing Jupiter, Continued from Page 17

Receiver

Any good quality communications receiver capable of receiving in the 18 MHz to 23 MHz range will work. The receiver's selectivity is very important in reducing the effect of nearby radio emissions. The frequencies that the Jovian noise is detected on is also used by many services. Since there is no protected frequency for the reception of Jovian radio emissions, care must be taken in finding a clear channel at your location.

Note: If at all possible the receiver should have the ability to shut off the AGC. This may reduce the sensitivity of the receiver, however it will increase the ability of the receiver to detect the slight signal changes emanating from a Jovian storm.

Receiver Modifications

Modifying the receiver to defeat the AGC will aid in the detection of Jovian storms. The AGC tries to keep the volume constant by biasing the RF or IF amplifiers in such a way as to hold the audio output at a constant level.

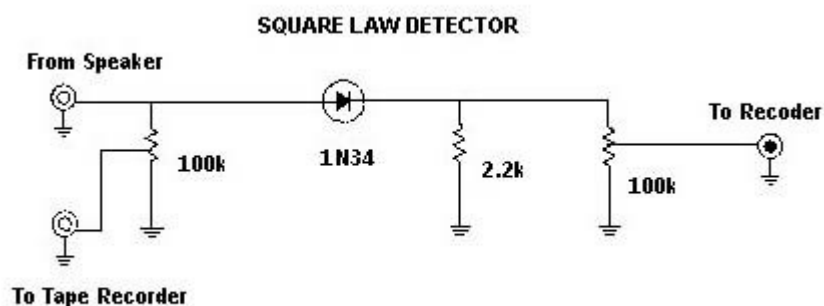
Audio Recorder

An audio recorder capable of turning on from a signal level increase (voice actuated) or can be controlled by the communications receiver is necessary to verify the received noise is from Jupiter.

An excellent way to monitor Jovian noise is with an old stereo cassette tape deck. The left channel is connected to the audio output of the SW receiver, while the right channel is connected to another receiver monitoring WWV or the Canadian time station. This setup will allow you to time stamp Jovian storms. The time stamp will allow the observer to accurately determine when a Jovian storm has occurred. Once the time is known then the Jovian predictive data can be utilized to determine the type of storm.

Square Law Detector

The Square Law Detector is an interface from the receiver to the recording device. A easy to build detector is shown below. Component placement is not critical. All resistors are 1/4 watt.



Recording Devices

Old Rustrak 288 Strip Recorder or equivalent computer program

The Rustrak 288 is no longer made, but still available on ebay or other used goods sellers ★