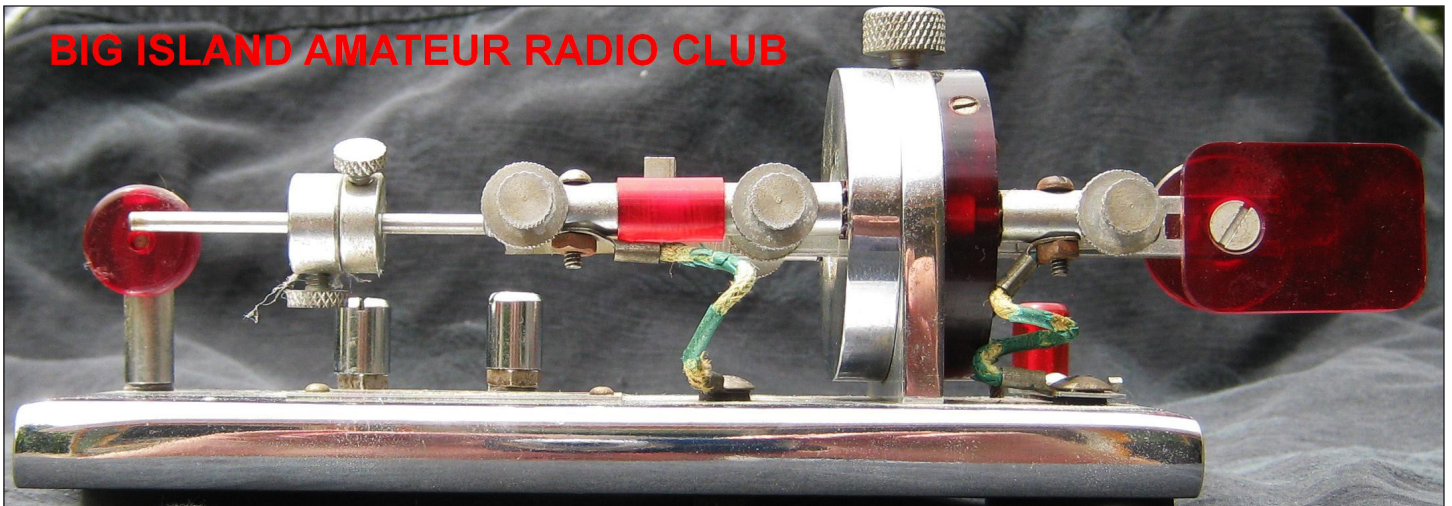


BIG ISLAND AMATEUR RADIO CLUB



The Big Island Amateur Radio Club Newsletter

Hawai'i Island
February 2014

2014 BIARC Members' Wish List

Aloha, BIARC members:

Late last year, as I contemplated running for BIARC president, one of the first questions I had was: What value do BIARC members get for their \$20 membership? Twenty dollars will get you 5 gallons of gasoline, or lunch at the Imiloa, for one, or maybe you can catch a movie for two, short of popcorn and soft drinks. Those are clear values for your money. But as a BIARC member, does your membership carry with it just as clear and tangible a value? The answer should be a resounding, hands-down "yes!" But is it?

At the January general membership meeting, on the wall were two large pieces of poster paper with the heading "2014 BIARC Members' Wish List," along with an invitation to all members present to write down their wishes as a member for the club in 2014.

Topping the list that day was addressing BIARC equipment. This topic is of importance to the club's board, as well. How important?

As of January 20, four BIARC equipment sites have been visited, inventoried, and equipment properly labeled. Expectation is to complete the remaining locations



HANSON



Milt Nodacker, AH6I, and Doug Wilson, KH7DQ, inventory BIARC equipment in the Shack on High, more than 8,000 feet above sea level. Despite the elevation, no report of high altitude sickness was tendered during this trek up Mauna Loa. (See additional photo from trip later in this edition.)

Bill Hanson, N0CAN, photo

President's message

within January. As the BIARC president, I apologize if this was of a concern to you, and hope the actions being taken will help ho'oponopono (make things right).

We sometimes need to examine the past and make things right before proceeding forward, and what is being done with equipment inventorying is just the start.

There are many more areas we can and should address as a club. In addition to addressing possible concerns, we should also revisit ideas that members felt made sense, and committees worked on, but for one reason or another have yet to be implemented. These may be great ideas that were well thought out, and that should be recognized and moved forward. That old cliché of "why reinvent the wheel?" comes to mind here. And, we shouldn't wait, but rather refill those flat tires so we can roll those ideas forward.

So far, we've covered: (1) Addressing outstanding concerns, I'll call "the basics," (2) Examining ideas that may have had traction, but have yet to be implemented, and finally, (3) ask for your mana'o in seeking new, fresh ideas that will promote and move BIARC into a new era.

These are the three categories of input that I would very much appreciate your taking time to talk to me about. I am asking for, and would truly like all BIARC members to be an essential part of this 2014 development and decision-making process of your club. I extend this invitation to write me at bill.biarc@gmail.com or call me at 989-4700 to discuss your concerns and ideas in developing this 2014 BIARC Members' Wish List.

With your kind input, I see the day when we will all look back and, without hesitation, agree that there is a clear and tangible value to being a member of BIARC.

Mahalo,
Bill Hanson, N0CAN

Big Island Amateur Radio Club

P.O. Box 1938

Hilo, HI 96721

www.biarc.net

Officers for Calendar Year 2014

President: Bill Hanson, N0CAN, 989-4700
Vice President: Milt Nodacker, AH6I, 965-6471
Secretary: Leigh Critchlow, WH6DZX, 930-7330
Treasurer: George Bezilla, WH6EFN, 961-6323

Directors — 2014-2015

Toni Robert, N0INK, 937-2183
Barbara Darling, NH7FY, 982-9126

Directors — 2013-2014

Mary Brewer, WH6DYW, 985-9595
John Buck, KH7T, 885-9718
John Bush, KH6DLK/V63JB, 935-5500

(Club License Trustee: Paul Ducasse,
WH7BR, 985-9222)

Standing Committees

(as of December, 2013)

Service/Awards: vacant
Education & Testing: Milt Nodacker, AH6I
Emergency: Paul Ducasse, WH7BR
Equipment: Milt Nodacker, AH6I
Health & Welfare: Barbara Darling, NH7FY
Membership: Richard Darling, AH7G
Hospitality: Jean Nodacker, WH7WT, 965-6471
Newsletter: Leigh Critchlow, WH6DZX
Repeater: Bob Schneider, AH6J
Webmaster: Curt Knight, AH6RE

Special Committees

Field Day Chair: Robert Oliver, NH6AH (969-9993)
Hamfest Chair: Bob Schneider, AH6J
co-Chair: Doug Wilson, KH7DQ
QSL Bureau Chair: Barbara Darling, NH7FY

Meetings and Get-Togethers

Membership meetings: Second Saturday of each month at 2 p.m. at the Keaau Community Center
Friday Lunches: A group meets for lunch every Friday at 11:30 a.m. at Kow's Chinese Restaurant in Hilo at 87 W. Kawailani St., just above Kinoole Street behind the Shell station.



East Hawaii Net

The East Hawai'i Net meets on Monday, Wednesday and Friday mornings at 8AM HST on the 146.76 MHz repeater.

ARES Emergency Net

Meets Saturday evening at 1900 HST on the 146.76 repeater. Backup is 146.76 simplex. All are welcome to check in.

BIWARN Accessible Repeaters

Repeaters in bold font are BI WARN/MCDA linked. When operating over a link, remember to leave extra time in each transmission for the link to be established. The number in parentheses is the tone access frequency.

- 145.29- HOVE-Ka'u WH6FC (100)
- 146.66- HOVE (100)
- 146.68- Keaau limited area KH6EJ
- 146.76- Kulani KH6EJ
- 146.82- Mauna Loa ARES KH6EJ
- 146.88- Pepeekeo KH6EJ (may be linked)
- 146.92- Ka'u PD KH6EJ
- 146.94- Haleakala Maui KH6RS (110.9)
- 147.02+ Haleakala, Maui RACES KH6HPZ (103.5)
- 147.04+ Mauna Loa RACES KH6HPZ
- 147.16+ Kona (Hualalai) WH6DEW (100)
- 147.32+ Waimea Hospital NH7HI (100)
- 147.38+ Waimea-East KH7T experimental
- 442.35+ Kaanapali, Maui (136.5)
- 442.5+ Keaau KH6EJ
- 443.40+ Ocean View KH7MS (77.0)
- 443.40+ Kona KH7MS (100.0)
- 443.65+ Ocean View Hub
- 444.225+ Haleakala, Maui KH6RS (110.9)
- 444.45+ Parker Ranch KH6EJ (88.5)
- 444.9+ Hilo WH6FM WIN system (100)
- 444.775+ Hilo WH6FM XO system (123)

10-meter mission in 2014

Search is on for 52 in 10-10!



All Technician Class Licensees have 10-meter privileges, so try your hand on HF!

In this New Year 2014, the Anniversary QSO Party participants are looking for 10-10 numbers with 52 in them. It doesn't matter where in the 10-10 number it appears. For example, 5234, 15298, 46529 and 33652 all are correct.

You have 365 days to amass a log for submission. Meet the Volunteers QSO Party will likely have most of the same volunteer members. Contacts made in 2014 are valid entries for your log.

All Technician Class Licensees have 10-meter privileges, so try your hand on HF!

The Aloha Chapter of Ten-Ten International Net, Inc. meets on 28.490 MHz, with an alternate frequency of 28.487MHz, every Monday evening at 6:30 p.m. HST. If you don't hear me, don't just listen, call "CQ!" Help keep 10 meters in amateur radio hands. Thanks.

Aloha,
Irene Kubica, NH7PE

10-10 International Net

Winter Phone QSO Party Feb. 1

Members of the Ten-Ten International Net will hold their Winter Phone QSO Party Feb. 1 from 0001 UTC Saturday, to 2359 UTC Sunday, Feb. 2.

Everyone with 10-meter phone privileges is invited to participate.

Information on this — and all other parties and events — is always available on the 10-10 website, <http://www.ten-ten.org>.

The Aloha Chapter of

Ten-Ten is called every Monday evening at 6:30 p.m. HST — or Tuesday 0430 UTC — on 28.490MHz, with an alternate frequency of 28.487MHz.

Each year, the 10-10 International Net, through our nonprofit corporation, the 10-10 Scholarship Foundation, funds four \$1,500 scholarships.

The scholarships are administered on our behalf by the Foundation for

Amateur Radio (FAR). Applicants must be licensed amateur radio operators.

There is no restriction on course of study, but applicants must intend to seek at least an associate degree from a college or university.

Non-U.S. amateurs and those seeking graduate degrees are also eligible, as well as students who study outside the United States.

Completed applications must be received by FAR prior to April 15 of each year.

Download an application from FAR's website: <http://www.farweb.org>, or request an application from: FAR Scholarships, P.O. Box 911, Columbia, MD 21044-0911.

The band is open; don't just listen, call CQ!

Aloha,
Irene Kubica, NH7PE

~ BIARC Newsletter Free Classified Ads ~

Russ Darling, KH7S, from Pahoa, is going to be moving to the mainland in the future. He has a 33-foot compact US Tower TMM-433SS tower that retracts to 11 feet, making antenna work possible from a ladder. He also has a KLM four-element tribander. He is asking \$1,200 for the tower and \$300 for the beam. *Call him at 808-960-8236, or email admin@aloha1.net.*

Story/photo/ad submittal deadline
for March edition: Feb. 20
[email to 1critchlow@mac.com](mailto:emailto1critchlow@mac.com)

Shack on High

Hams make house call on Mauna Loa



Photo by Bill Hanson, N0CAN

With a breathtaking view of Mauna Kea in the background, BIARC members conduct equipment inventory control mission at the Mauna Loa radio site on Jan. 18. Pictured, from left, are Milt Nodacker, AH6I; Bob Schneider, AH6J, and Doug Wilson, KH7DQ.

Bylaws revision to be presented for vote at February meeting

By MILT NODACKER,
AH6I, vice president

The last revision of the BIARC By Laws was done in April 1996.

In the nearly eighteen years since then, we have changed many things by vote without properly incorporating them into the by laws.

A good example is that the bylaws only provide for two categories of member-

ship: full and associate.

Since then, we have enacted membership categories for family members, students, and the special half price for new members beginning at ARRL Field Day.

President Bill Hanson asked me to prepare a revision for consideration at the Board of Directors meeting on Feb. 4.

Following approval by the Board, the revised bylaws will

be voted on by the members at the February meeting.

Approval by two-thirds of the members present is required to approve the by-laws.

Please note that only members paid up for 2014 prior to the business portion of the meeting are qualified voters.

A correct copy of the 1996 bylaws is now posted on the BIARC website, www.biarc.com.

The proposed revised bylaws will also be posted there following approval by the Board of Directors.

Members are requested to review the proposed revised by laws prior to the meeting.

If you are aware of any changes that should be made to the bylaws, please send them to me at nodacker@gmail.com prior to Feb. 4.

Minutes

BIARC general membership meeting January 11, 2014 Keaau Community Center

President Bill Hanson, N0CAN, called the meeting to order shortly after 2 p.m., with 29 members, friends and visitors present.

Discussion topics were far-flung, ranging from meters to repeaters, gamma rays to Field Days, coronal mass ejections to QSL collections.

Bob Schneider, AH6J, discussed and passed around a copy of the ARRL Pacific Division Ham of the Year Award which had been presented to Ronald I. Hashiro, AH6RH, at Pacifcon 2013, in recognition of Hashiro's "outstanding contribution to amateur radio."

Bob is the American Radio Relay League Pacific Section manager. ARRL is the national association for amateur radio.

Gregg Datlof, WH7FC, Amateur Radio Emergency Service (ARES) district emergency coordinator, presented certificates to four BIARC members who have agreed to serve as ARES ECs for their respective areas: Doug Wilson, KH7DQ, Volcano to Mountain View; Kim Fendt, KD0QLR, Mountain View to Keaau; John Bush, KH6DLK/V63JB, for the Hilo area; and Rick Gardner, WH6LU, Pahoa to Kalapana.

Bill gave special kudos to BIARC members Richard Bowen, WH6ECR, and Ceri Sanders, WH6ECS, who were present at the meeting, for "stepping up" and assisting their Paauilo-area neighbors during the recent severe lightning, thunder, flooding and consequent road collapse which cut off access to a rural community.

Vice President Milt Nodacker, AH6I, said next month's speaker will be Lopaka Lee, WH6DYN, of the USGS Hawaiian Volcano Observatory, who will discuss "data collection networks at HVO."

The next VE testing for all



Photo by Linda Quarberg, WH6LQ

Vice President Milt Nodacker, AH6I, presented the monthly program — "Solar Flares and Electromagnetic Pulse." Here he demonstrates a homemade Faraday Cage he created using only a lidded cardboard box and some aluminum foil.

licenses will be Feb. 20 at the Hilo LDS church on Kilauea Avenue. The next Technician class will start March 6 at the Orchidland LDS church. And Milt noted that the class he just started this week includes a family of six: Mom, Dad and four kids.

Milt then presented this month's program on "Solar Flares and Electromagnetic Pulse."

We learned that Coronal Mass Ejections, aka CMEs or solar flares, and EMPs, or Electromagnetic Pulses, have similarities, but really are separate things. Confusing the two can even ruin a good book, Milt pointed out. No matter how good the writing, how exciting the plot, how solid the characters — a single sentence can do in an otherwise fine novel if the wrong

phenomenon is blamed for whatever disaster is afoot.

We learned about neutrinos, gamma rays and cosmic rays, the arrival of plasma and what it does to the magnetic field. And that the magnetic North Pole is moving faster than it shifted in prior decades, steadily moving toward a pole reversal. But, not to worry: Unlike some of the current doom-and-gloom predictions of imminent pole-reversal, such an occurrence would take 25,000 to 50,000 years.

We learned how to make an efficient Faraday Cage from aluminum foil and a lidded cardboard box. When it comes to designing a metal shield, silver works best, Milt said, but when you add affordability to the equation, aluminum or copper is a smarter choice.

Aluminum wire mesh, or

screening, also works to guard against an E-1 (a very brief, but intense, electromagnetic field that's generated when gamma radiation knocks electrons from their atoms in the atmosphere. This creates a very strong electrostatic charge that can cause over-voltage breakdowns of insulation and semiconductors, resulting in short-circuit damage to equipment components.) in a Faraday Cage setup. So would a nonworking microwave oven, or chest freezer, or the like.

After Milt's talk, Hospitality Chair Jean Nodacker, WH7WT, treated the group to a delicious dessert buffet complete with the official club favorite: ice cream!

Thus fortified, the membership returned to the seating zone for the business portion of the meeting.

President Bill gave a brief overview of the Jan. 2 board meeting, at which all but two officers and directors were present. He noted that past President Barbara Darling has resigned as a director after many years of service. "We do recognize all of the hard work and labor she put into making BIARC what it is today," he said.

At the January board meeting, Bill said, the group assessed where the club is at, and looked toward the future. Proposed revision of the club bylaws is in the works, to streamline and update the document, which last was revised close to two decades ago. Perhaps changes need to be made to our list of standing and special committees, he said, and the BIARC website needs to be updated, along with the membership roll.

The next BIARC board meeting will be at 5 p.m. Feb. 4 at Civil Defense in Hilo.

QSL Bureau: No official report on numbers this month, but Milt distributed several cards sent to members by their overseas contacts.

Secretary's minutes: The minutes from the Nov. 9 general membership meeting were approved as circulated, with one correction: Regarding the listing of 2014 officers and directors, it should be

noted that directorship terms have expired for Richard Darling, Paul Ducasse, Steve Jacquier and Daryl Koon. There are no minutes from last month, because our annual Christmas party takes the place of our December meeting.

Field Day: Robert Oliver, NH6AH, will chair the annual event, which likely will be held again at Wailoa Center, since the facility is situated in a good central location and has worked well in previous years.

The 24-hour event is held on the fourth weekend of June of each year, with more than 35,000 radio amateurs gathering across the U.S. and Canada with clubs, groups or simply with friends to operate from remote locations.

ARRL officials describe Field Day as “a picnic, a campout, practice for emergencies, an informal contest and, most of all, FUN!” Robert invites any and all suggestions for this year’s Hilo program, and welcomes volunteers to help in planning and participating.

Bill asked for input on a BIARC wish list for 2014 and hung big pieces of paper on two walls to allow folks to write down their ideas. Doug Wilson, KH7DQ, suggested an email be sent to all members to solicit their suggestions.

Bill asked members to provide input by the end of each month, if they’d like to put a topic on the following month’s meeting agenda. Please email him at bill.biarc@gmail.com.

Repeater health was a main point of discussion at that point. Glenn Kadota, AH6IO, asked for clarifications relating to 146.760 and 146.720.

What factors determine priorities of usage and maintenance?

What is the process

for reporting and dealing with problems?

What priority level is there for 146.760 and its links to get fixed? Parts of the system go down for months, and repairs are done piece-by-piece, when, perhaps, the complete system should be replaced.

If 146.760 is “THE emergency repeater for East Hawaii,” then it should have high priority, said Glenn.

Bill said he will bring it to the BIARC Repeater Committee. Bob Schneider, AH6J, chair of that committee, said Paul Ducasse, WH7BR, chair of the BIARC Emergency Committee, and Paul Agamata, WH6FM, have been doing a lot of the maintenance. Bill asked Bob to convene a Repeater Committee meeting. John Buck, KH7T, asked that representatives from other Big Island repeater areas also be included at the meeting, because this all involves the BIWARN system.

Bill agreed that the club take a look at the repeater system, at-large. Doug asked for an inventory of everything BIARC owns. Bill said the board is working on that.

Education & Testing: Chair Milt reported that the last testing on Dec. 12 had good success, with six Technicians upgrading to General, and one former ham acing test after test, going in one sitting from being unlicensed, to being an Extra.

Bill said Civil Defense Administrator Daryl Oliveira supports training for the community and is trying to build up the number of licensed amateur radio operators on this island. Oliveira views ham radio as a viable, and valuable, resource.

Bob, the American Radio Relay League Pa-

cific Section manager, noted that the ARES net manned by volunteers during the recent lightning storms and severe flooding was reasonably successful, with volunteers on the air in case they were needed.

Bill noted that primary communications weren’t compromised.

Bob said that’s the way we want it: since no one was sure quite what was going on, the net came on, and was standing by to help, if needed.

Kim Fendt, KD0QLR, said with road closures, flooding and people without power, “we’re lucky it didn’t turn out to be a big disaster.”

John noted that, as Chief Oliveira has stated, the self-activation element of ham radio is a strength in times of emergency. Self-actualization is necessary, for it to happen.

Bill said his only concern is that with one repeater, and multiple organizations, how do you determine usage of this limited resource?

Gregg Datlof, WH7FC, the East Hawaii Amateur Radio Emergency Service district emergency coordinator, explained that ARES is an organization that operates from the ground up. It self-mobilizes. Utilization of a repeater is determined by the memorandums of understanding governing the hierarchy of use. “Whoever is the stakeholder who needs it the most” gets it, Gregg said.

The Amateur Radio Emergency Service (ARES) consists of trained radio amateurs who provide public service communications support. These licensed amateurs have voluntarily registered their qualifications and equipment, with their local ARES leader-



Photo by Linda Quarberg, WH6LQ

Hospitality Chair Jean Nodacker, WH7WT, treats the group to a delicious dessert buffet complete with the official club favorite: ice cream!

ship, for communications duty in the public service when disaster strikes. Every licensed amateur, regardless of membership in ARRL or any other local or national organization, is eligible to apply for membership in ARES.

Milt noted that in 2013 the club budgeted \$1,000 for repeater maintenance, and all but \$40 was spent.

Kim reported on volunteer signups for the March 16 Big Island International Marathon. At our November meeting, race Director Bob Wedeman had put out a call for hams to help with communications that day along the Hilo route of four race events. It’s a chance for individual hams to join in a “really great training opportunity.”

She is coordinating the ham communica-

tions contingent for the races, and invites anyone interested to email her at Kd0qlr@gmail.com. There also will be ways non-hams can assist, and everyone is welcome.

Doug, who is the assistant communications coordinator for the event, said “we’d like more people, rather than fewer. It’s a great way to show what ham radio can do for the community, and it’s a great training opportunity for us.”

Bill then discussed the organization forming this year called the Hawaii County Auxiliary Communications Service. Using \$100,000 in grant money from the federal government, the county will be establishing repeaters in good locations around the Big Island. Civil Defense is looking at erecting a

minimum of 7, and a maximum of 9-10, strategically situated around the Big Isle, with maybe even a repeater on another island.

It will be commercial-grade equipment, and should result in robust VHF communications all around the island. County also is looking at HF setups. He asked if BIARC would like to go on record as being supportive of this endeavor. The consensus was a big "yes." Bill said he will report back to ICS at Civil Defense that BIARC members support the new effort. Gregg noted the grassroots-level work done by ARES and said it's good to have all stakeholders work together.

John said "ARES IS the umbrella organization, and, therefore, the infrastructure exists. Most hams are aware of ARES and will participate." He noted that the basis of the FCC charter for the existence of ham radio is the use of amateur radio licensees' private equipment for emergency comms during times of emergency.

Under old business, it was moved by Paul Lakin, WH6DYX, and seconded by Milt, that a status report "as complete as possible" on the repeater situation be provided by the BIARC Repeater Committee at next month's membership meeting.

Bill adjourned the meeting at 4:52 p.m.

Respectfully submitted,
Leigh Critchlow,
WH6DZX, secretary

Note: The next general membership meeting will be at 2 p.m. Saturday, Feb. 8, at the Koaau Community Center. Please email Bill Hanson at bill.biarc@gmail.com by the end of the month, if you'd like to add a topic to the Feb. 8 agenda.

More Thoughts on the Faraday Shield

By MILT NODACKER,
AH6I, vice president

Following my presentation at the January meeting, there were some questions on the Faraday Shield that I didn't feel I knew enough to adequately answer.

The following is from the Wikipedia article.

I especially like the description of the cage as a "hollow conductor."

Since there is virtually no voltage difference between the different parts of the conductor (shield), no current flows through the space inside the conductor.

This also explains why the contents of the cage need to be insulated from the material of the cage for maximum effectiveness.

Besides this Wikipedia article, there are also some other good articles online that can be found by googling "Faraday Cage."

A Faraday cage, or Faraday shield, is an enclosure formed by conducting material or by a mesh of such material. Such an enclosure blocks external static and non-static electric fields by channeling electricity through the mesh, providing constant voltage on all sides of the enclosure.

Since the difference in voltage is the measure of electrical potential [in this case, no difference – or zero voltage difference], no current flows through the space.

Faraday cages are named after the English scientist Michael Faraday, who invented them in 1836. [Emphasis added.]

A Faraday cage is best understood as an approximation to an ideal hollow conductor.

Externally or internally applied electromagnetic fields produce forces on the charge carriers (usually electrons) within the conductor; the charges are redistributed accordingly (that is, electric currents are generated).

Once the charges have rearranged so as to cancel the applied field inside, the cur-

rents stop. [Emphasis added.]

If a charge is placed inside an ungrounded Faraday cage, the internal face of the cage becomes charged (in the same manner described for an external charge) to prevent the existence of a field inside the body of the cage.

However, this charging of the inner face re-distributes the charges in the body of the cage. This charges the outer face of the cage with a charge equal in sign and magnitude to the one placed inside the cage.

Since the internal charge and the inner face cancel each other out, the spread of charges on the outer face is not affected by the position of the internal charge inside the cage.

So, for all intents and purposes, the cage generates the same DC electric field that it would generate if it were simply affected by the charge placed inside.

The same is not true for electromagnetic waves.

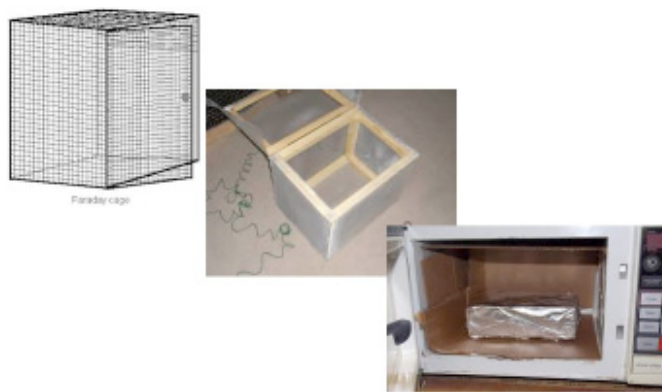
If the cage is grounded, the excess charges will go to the ground instead of the outer face, so the inner face and the inner charge will cancel each other out and the rest of the cage will retain a neutral charge.

Examples

- A microwave oven is an example of a Faraday cage applied [in the] inverse of the usual case: keeping the RF energy within the cage rather than keeping it out.

- Elevators and other rooms with metallic conducting frames famously simulate a Faraday cage effect, leading to a loss of signal and "dead

Faraday Cage



zones" for users of cellular phones, radios, and other electronic devices that require electromagnetic external signals.

Small, physical Faraday cages are used by electronics engineers during testing to simulate such an environment to make sure that the device gracefully handles these conditions.

- The shield of a screened cable, such as USB cables or the coaxial cable used for cable television, protects the internal conductors from external electrical noise and prevents the RF signals from leaking out.

- A booster bag (shopping bag lined with aluminium foil) acts as a Faraday cage. It is often used by shoplifters to steal RFID-tagged items.

- Plastic bags that are impregnated with metal are used to enclose electronic toll collection devices during shipment to the customer, so that a toll charge is not registered if the delivery truck carrying the item passes through a toll booth.

- Some electrical linemen wear Faraday suits, which allow them to work on live, high voltage power lines without risk of electrocution. The suit prevents electrical current from flowing through the body, and has no theoretical voltage limit. Linemen have successfully worked even the highest voltage (Kazakhstan's Ekibastuz-Kokshetau line 1150 kV) lines safely.

Wikipedia contributors.

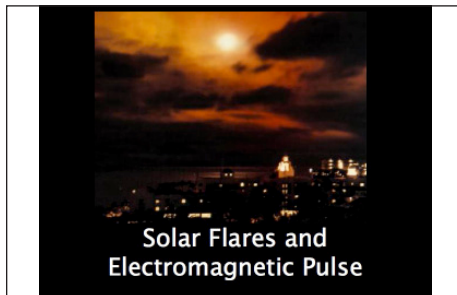
"Faraday cage."

Wikipedia, The Free Encyclopedia.

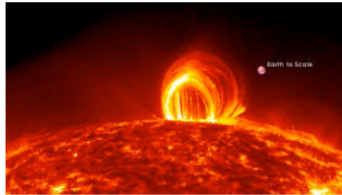
4 Jan. 2014; 17 Jan. 2014

'Solar Flares and Electromagnetic Pulse'

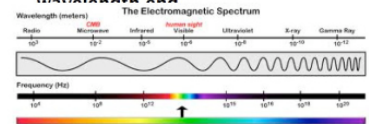
Editor's note: These are the slides from Milt's program, placed on the pages in chronological order, from left to right. Not all translated from the PowerPoint program to print in their entirety, but they do provide a bunch of interesting facts, explanations and graphics.



- A solar flare occurs when magnetic energy that has built up in the sun's atmosphere is suddenly released.



- Radiation is emitted across virtually the entire electromagnetic spectrum, from radio waves at the long wavelength end, through optical emission to x-rays and gamma rays at the short wavelength end.



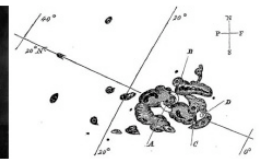
- The amount of energy released is the equivalent of millions of 100-megaton hydrogen bombs exploding at the same time!



- The first solar flare recorded in astronomical literature was on September 1, 1859. Two scientists, Richard C. Carrington and Richard Hodgson were independently observing sunspots at the time, when they viewed a large flare in white light.

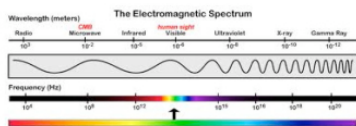


Richard Carrington



Electromagnetic Radiation

- The electromagnetic radiation from a solar flare travels at the speed of light and reaches the Earth in about 8 minutes.



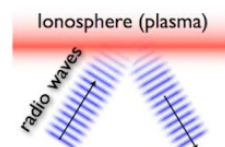
Ionization

- Energetic ultraviolet and x-rays knock an electron off from an oxygen atom, creating a charged oxygen ion and a free electron.



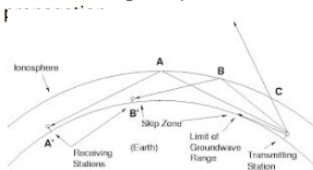
Skywave reflection / refraction

- Ionized gas atoms and free electrons reflect and refract some radio waves.



Skywave propagation

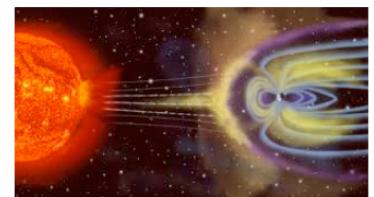
- Increased ionization with increased radiation changes skywave



Coronal Mass Ejection (CME)

- In addition to electromagnetic radiation, massive solar flares can eject a tremendous burst of plasma, a physical chunk of the sun's outer atmosphere that can race through space and slam into the Earth a day or so later.

Coronal Mass Ejection (CME)



CME Hazard

- The hazard posed by these CMEs is not heat, but electromagnetism: the particles carry an electrical charge like the solar equivalent of a lightning bolt.

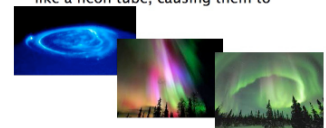
Lights in the Sky

- Major CMEs are powerful enough to challenge the Earth's magnetic field, which normally deflects charged particles toward the poles, causing Northern (and Southern) Lights.



Lights in the sky

- The incoming charged particles agitate atoms in Earth's upper atmosphere like a neon tube, causing them to



the night after the Carrington Flare, Northern Lights were seen as far south as Rome, Cuba, and Hawaii. Southern Lights were seen as far North as northern Australia and Indonesia. The lights were reportedly so bright that a newspaper could



Electrical Effects

- In 1859, the only widespread electrical system was the telegraph. Telegraph wires burst into flame, telegraph machines scorched papers, operators received shocks, telegraphs transmitted gibberish, and telegraphs continued to operate for hours after being disconnected from the batteries that norm .. am.



Since 1859

- The Solar Storm of 1859 is the strongest such event in recorded history.
- November, 1882 – A massive flare lit lamps, disrupted telegraph communications and touched off several fires in the Chicago telegraph switchboard and melted equipment.
- November, 1903 – Disrupted telegraphs and the transatlantic cable and shut down Swiss streetcars.

Since 1859

- March 1940 – Burned out fuses and damaged hundreds of miles of telegraph and telephone networks.
- March 1989 – Auroras were seen as far south as Cuba. Quebec power grid shorted out. Circuits overloaded in New York, Virginia, Great Britain. Space Shuttle instruments were affected and the mission was nearly aborted.

March 1989 (continued)

- Geomagnetic induced currents melted the internal windings of a 500kV transformer at a nuclear plant in New Jersey. The plant was unable to operate until the transformer was replaced. Fortunately a transformer was available from a cancelled nuclear plant, and they were able to resume operation in 40 days. Without the "spare" they could have been down for years.

Since 1859

- November 2003 – Temporarily disabled several satellites; killed one permanently. Burned out an instrument on the Mars Orbiter. ISS crew took shelter and reported elevated radiation readings and seeing "shooting stars" within their eyes.
- September 2005 – A series of flares disrupted power grids and took the GPS system down for about 10 minutes.

Before 1859

- Astrophysicists suggest that a sharp increase in carbon 14 found in tree rings for 774–775 AD could have been caused by a massive CME.
- The event would have had to be 10 to 20 times as energetic as the Carrington Event of 1859.

Why hasn't it happened?

Why hasn't there been a Carrington-class CME event since 1859?

- Large flares are fairly common, but to affect Earth they must be pointed toward us.
- Some of the flare events we have noted have been "grazing hits" or near misses.
- CMEs are 15 times less common during lows in the 11 year sunspot cycle than at solar maximum.

What about now?

- The Carrington Event of 1859 has had by far the strongest effect on Earth of any solar event in recorded history. What would another like it do now?



What about now?

- The greatest threat of a present day CME of Carrington magnitude is to the electrical power grid.
- We have already seen blackouts and grid damage from lesser events.



Electrical system damage

- Major damage to electrical transmission lines and especially to large transformers could take months to years to repair. There are no on-hand replacements for many of these



Replacements unavailable

- Manufacturers currently have a lead time of about 3 years for Extra High Voltage (EHV) transformers (230 kV and up).
- Only one US plant is capable of manufacturing transformers up to 345 kV.
- No US plants are capable of manufacturing 500 and 765 kV transformers – the largest at-risk

Dependence on Electricity

- Our dependence on electrical power for virtually all of modern life makes us much more vulnerable than we were in 1859.
- Electricity is needed to process and preserve our food, heat and cool homes and businesses, pump water and waste, operate medical facilities.
- You can't even buy gasoline to run your generator if the station has no electricity.

Dependence on Electricity

We are fortunate here in Hawai'i in several respects:

- Our distance from the magnetic poles reduces the intensity of the effects of CMEs.
- We are not part of a huge, continental power grid which can have a cascade failure.
- We are not as dependent on electricity for space heating as other parts of the country.

Solar Flares and Amateur Radio

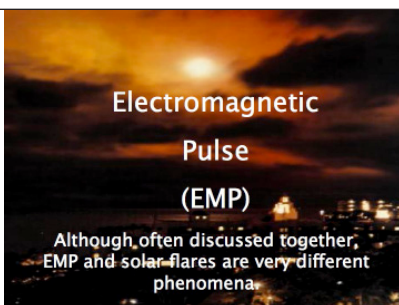
- Solar activity makes some of our most enjoyable amateur activity possible – skywave propagation via the ionosphere provides our long range DX operation.
- Strong aurora make auroral operation possible.
- Geomagnetic storms caused by solar flares can disrupt normal propagation patterns.

Hazards to Amateur Radio

- The greatest hazard to amateurs and their equipment would be during a major CME event. High currents induced in antennas could damage equipment and cause electrical shock.
- Long wire antennas are most at risk for these induced currents. Antennas should be disconnected from equipment during CME events.

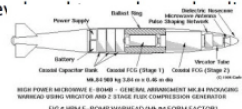
Electromagnetic Pulse (EMP)

Although often discussed together, EMP and solar flares are very different phenomena.



Producing an EMP

- Nuclear electromagnetic pulse is produced by the detonation of a nuclear device above the Earth's atmosphere.
- Non-nuclear devices have also been developed to produce EMP.



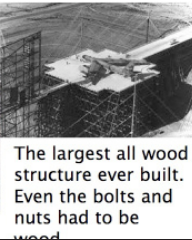
EMP Testing

- The EMP device hanging in the foreground is being used to test an E-4 at Kirtland AFB in New Mexico.



EMP Testing

The trestle at Kirtland AFB



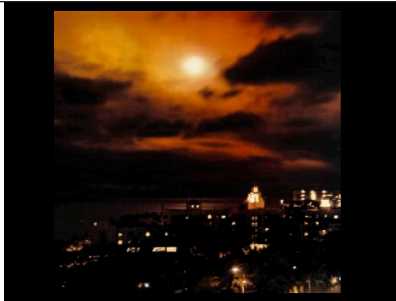
The largest all wood structure ever built. Even the bolts and nuts had to be wood.

EMP History

- EMP has been known since nuclear weapon testing began in 1945.
- Weapons detonated at or near ground level (lower than 10 km altitude) suppress EMP effects.
- US and USSR conducted EMP testing in 1962.

US Testing

- Starfish Prime at Johnston Island on 8 July 1962 was a 1.4 Mt device detonated at 400 km altitude.
- Effects in Hawai'i about 900 miles distant included knocking out about 300 street lights, setting off burglar alarms, and damage to a telephone company microwave link.



USSR Testing

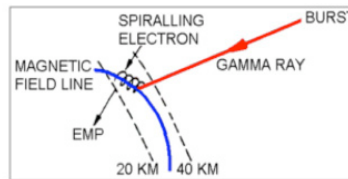
- USSR conducted three tests over Kazakhstan.
- Tests over populated area.



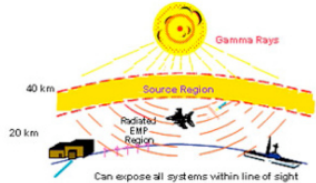
USSR Test 184

- 22 October 1962 -- 300 kt at 290 km altitude
- On a 570 km instrumented telephone line, blew all fuses and overvoltage protectors and produced measured currents of 1500 to 3400 amperes.
- Burned down Karaganda power plant and shut down 1000 km of shallow buried power cables.
- Power line insulators were damaged causing short circuits and wires falling to the ground.

How EMP is generated



The bigger picture



EMP intensity does not diminish as the square of the distance from the weapon burst.



Three components

Nuclear EMP has three components:

- E-1 pulse is very fast. Rises to peak in about 5 nanoseconds (ns). Decays to half of peak at about 200 ns.
- The E-1 pulse ends (by definition) at 1000 ns (1 microsecond).

E-1 Pulse

- Causes most of its damage by causing electrical breakdown voltages to be exceeded. Typically 50,000 V/m.
- Can destroy communications equipment and computers and compromise insulation in all kinds of wiring and devices.
- Too fast for ordinary lightning protectors to provide protection.

E-2 Pulse

- Intermediate speed pulse from 1μs to 1s.
- Similar to pulse from a nearby lightning strike.
- Would be easiest to protect against, except that protective equipment has probably been compromised by E-1 pulse.

E-3 Pulse

- Much slower than E-1 and E-2. Lasts from tens to hundreds of seconds.
- Caused by the heaving of Earth's magnetic field out of the way by the detonation, then its reformation.
- Similar in effects to a geomagnetic storm caused by a severe solar CME.
- Causes high induced currents in long electrical conductors which can damage power line components, such as transformers.

Weapon Design

- In general, the simpler the weapon, the more effective it is at producing EMP.
- Even very low yield weapons can produce damaging EMP.
- Weapons can easily be optimized for EMP production.
- A thermonuclear (fusion) weapon produces less E-1 pulse, but the E-3 pulse would be proportional to the total weapon yield.

EMP Threat

- Probably our greatest current nuclear threat.
- Weapon does not need to be targeted, just launched above the target country. It could even be detonated in a LEO satellite.
- Produces no injuries or fallout on the ground (except possible eye damage), but can reduce target country to pre-electrical economy.
- The most technologically advanced countries are the most vulnerable.

How Likely?

- The best way for a rogue nation (N. Korea, Iran) to attack the US.
- Could be launched from off shore with relatively crude missile.
- It would be difficult to determine what country was responsible for the launch.
- Little to no warning.
- There are missile systems that fit cargo containers. Open top and shoot.
- Iran tests it's missiles from ships.

How Likely - Hawaii?

- It would be easy. You could get a device high enough with a balloon to EMP the islands. Lots of ocean to launch from.
- Not much of a target. There would not be as much payoff here as on the mainland.
- Less intense. The Earth's magnetic lines are farther apart this close to the equator.
- My guess: Pretty low threat here.