

Sierra Signals

Sierra Foothills Amateur Radio Club
Auburn, CA
An ARRL Special Service Club

September 2004

P.O. Box 1005, Newcastle, CA 95658

At the Key of S.F.A.R.C.



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Digital: Rob, WW6G

REPEATERS

145.430 (-0.6 MHz/PL 162.2)

440.575 (+5.0 MHz/PL 94.8)

223.860 (-1.6 MHz/PL 100.0)

CLUB NET

All welcome to check in
Thursdays, 7:30PM, K6ARR/R
145.430

CLUB MEETINGS

Second Friday of the month,
7:30PM at the Auburn
Library, 350 Nevada St,
Auburn

CLUB BREAKFAST

Last Sat of the month at
Susie's Café, Cirby at
Riverside, Roseville - 8:00 AM

NET CONTROL OPS

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2004 Calendar of Events

(Operating Events in Italics)

Sep 10	Regular Meeting
Sep 11	<i>NA Sprint (CW)</i>
Sep 18	<i>NA Sprint (SSB)</i>
Sep 25	Club Breakfast
Sep 25	<i>Texas QSO Party</i>
Oct 2-3	<i>Calif. QSO Party</i>
Oct 8	White Elephant Sale
Oct 10	<i>NA Sprint (RTTY)</i>
Oct 15-17	PACIFICON 2004
Oct 30	Club Breakfast
Nov 5-7	<i>ARRL Sweepstakes (CW)</i>
Nov 12	Regular Meeting
Nov 5-21	<i>ARRL Sweepstakes (SSB)</i>

IN THIS ISSUE

President's Report

Amateur Satellites

National Ham News

"Where In Blazes Am I"

President's Message



Well, August was a very busy month. We had a great presentation at our monthly meeting when Harry showed the new emergency communication vehicle. We had an ARES face to face meeting led by Joe, WB6AGR, and a real emergency situation with the fire in the Shasta region. Quite a month for ARES.

The VE team appears to have found a new home at the Bel-Air at Douglas and Folsom-Auburn Road in Granite Bay. The first exam date there will be September 3rd at 8AM.

Later, the club picnic was a success. The location at the Auburn Recreational Facility off Dry Creek Road proved a great spot again. Picnickers were treated to parts of the air show and a great time was had by all. Speaking of all, we had 22 members and family this year. If you did not make it, you should really try to come next year. It is a lot of fun.

This month fall begins and we move into a new phase of the year. Please do give some thought to nominating officers for next year - better yet, consider running yourself. If you can think of an officer or director candidate, please speak with Bob, KG6QWB. For October, we have our famous white elephant sale so begin to look through your shack for saleable items. It is always fun.

Our regular meeting will be on September 10th with the board meeting just before. See you there.

Forty Years Ago at the SFARC

Reported by Gary, KQ6RT

September 9, 1964

1. Meeting was called to order and the minutes approved as offered.
2. The president asked the secretary to write a letter to Mr. Jack Gardenas, sales manager for Handy Andy at 2620 Fulton Avenue in Sacramento, California.
3. Kenneth J. Weger made a motion to buy the Morrow Twins if possible from Elmo Griffith and seconded by Sage Otow. Motion failed since it was felt that perhaps a better buy might materialize at another time.
4. Jim Carman was given a ticket to attend as the clubs representative to the ARRL convention.
5. Secretary was directed to write a letter to Lin Hunter thanking him for the receiver donation to the club.

6. Bob Twaddell and Daly Ford were chosen to be next meetings refreshment committee.
7. Frank Carman won the Lombard's gift certificate.
8. Richard Ryan won the Cal TV gift certificate.
9. Ticket sales were going great and the report is that things are going swell on public approval.
10. Meeting was adjourned and refreshments served.

Respectfully submitted,

Kenneth J. Weger, WA6EMU
Secretary

Amateur Satellites

Reported by Greg, KO6TH

Space Station in FM Repeater Mode, with a twist!



The ARISS program (Amateur Radio on the International Space Station) announced that the amateur radio station on the ISS is now in FM Repeater mode. The station is receiving on 437.800 FM, and re-transmitting what it hears on the standard ISS downlink of 145.800, also in FM mode.

This is similar to the "Bent Pipe" repeater modes that several other satellites use, including the newly-launched AO-51, but with the bands swapped. This mode on the ISS has the uplink on UHF, and the downlink on VHF. SO-35, now silent, was the only other FM satellite to operate this way.

As expected, this new mode of operation has generated a spike in interest in working the ISS. With a single FM channel to use, congestion has been a bit of a problem. Operators are encouraged to be patient and to keep their transmissions short. Also, with an uplink on UHF, Doppler tracking on the uplink is required on most passes. This is because the range of UHF Doppler shift is larger than the ability of the receiver to capture the signal.

Many hams adjust for the Doppler shift by programming their rigs with several pairs of up- and downlink combinations. For Low Earth Orbit satellites such as the ISS, a UHF signal can shift plus or minus up to about 10 KHz. VHF signals only move about 3 KHz, as the amount of Doppler shift is directly related to the frequency being used. (Consider the Doppler shift during AO-51's Experimenter Day on August 25th, where they were using the 2.4 GHz transmitter!) So, for the ISS, you could set up one pair of memories with the uplink on 437.810 and the downlink on 145.795. Another pair with 437.805 / 145.800. The next would be for the unshifted frequencies,

which correspond to the peak or middle of the pass, or 437.800 / 145.800. Then the last two would complete the set with 437.795 / 145.800 and 435.790 / 145.805. Notice that these frequencies are rounded to the nearest 5 KHz increment, as most FM rigs can only tune that way.

So, what's the twist?

Glad you asked. The unique difference between the ISS repeater, and SO-35 and the rest of the LEO FM satellite fleet, is that the ISS is inhabited! The current crew, astronaut Mike Fincke, KE5AIT, and cosmonaut Gennady Padalka, RN3DT, have been known to join in on the conversation. So, next time you work someone on the ISS, don't be too surprised if one of the crew joins in. (The crew's day runs on UTC, so late morning passes Pacific time are the best bet.) Emily Clarke, W0EEC discovered this recently while in a 3-way with VE7WFG and VE7EGN; it suddenly became a 4-way conversation when Mike joined in as NA1SS.

73,

Greg KO6TH



Oct 15 - 17, 2004

San Ramon Marriott Hotel

San Ramon, CA

Mark your calendars for Pacificon 2004! The ARRL Pacific Division Annual convention will return to the really great venue at the San Ramon Marriott. Presented by the Mt. Diablo ARC, it promises to surpass the incredible 2003 production.

Information at www.pacificon.org and you can purchase tickets to all of the forums and activities on-line via PayPal. The NorCal QRP Club will be hosting the 10th annual QRP Forum concurrently. Antenna Seminar (Fri), the Swapmeet (moved to Sun AM), and multiple tracks of seminars for the entire weekend.

ARES Report

Thanks Kevin (K6KWD) for jumping in and being a net control, great job. I think it was KO6IF that didn't get the Sunday phone call. (Actually, I didn't get it either) All seems to be pretty quiet right now, except maybe the Republican convention and the baseball games.

I have come up with a little addition to K6SOJs ARCT system. I have added ARCT 7 which will be a home station for those who can't leave home or prefer to work at home, this will be a VHF/UHF station. The ARCT 8 will be a home station with VHF/UHF and HF, with preferably a packet or digital capability. I believe that Shawn, KG6GMV, was considered an ARCT 5 Unit. On his trip up to the Redding area.

Here it is September already, start thinking about the SET (Simulated Emergency Test) October 2 & 3. Looks like Amador County and El Dorado County might do the SET late Oct. or early Nov. due to conflict with a contest, Pacificon, and the annual Hospital drill which might be in Nov.

I will be out of town for a week, from Sept. 17th thru 24th, this time I will be on the Island of Maui, and will not be taking any radio gear with me. Last time I was there was 1972 and I am sure that much has changed. That trip was the first time I had been back to Hawaii since I was stationed there as a Radio Operator in 1957. They still had pineapple fields and Sugar cane and even empty beaches then. (They still do, Joe!)

Last week, I introduced our new member, K6WWH as "Bob," when actually his name is Bill Hooper. He corrected me on the net Sunday night.

The month of September is National Preparedness Month according to Homeland Security. Of course we are always Prepared !!

If anyone is interested, they are going to hold a weekend training session on the Red Cross Communication Van in Sacramento on Oct 22 thru 24th. contact me, and I will give you more details, requirements, and expectations.

Joe, WB6AGR
EC - Placer Co. ARES

(Just in case the word has not made it all around the Section, Dave Thorne, K6SOJ, who is the Sacramento Valley Section Emergency Coordinator) publishes a monthly email newsletter chock full of the latest happenings in the ARES/EMCOMM arena. It is available by contacting lazyt@cot.net and asking to be put on the email list. Way more information that we have room for here in Sierra Signals.)



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It's Just 'His' Opinion

Casey McPartland, W7IB

(as channeled from Hiram Percy Maxim, IAW)

(Disclaimer: The thoughts and ideas put forth in this article come to me from out of the ether. I sometimes intersperse my thoughts in an effort to maintain continuity, but for the most part it's just his opinion!)

Conspiracy Theory!

It's been awhile and I've had a little peace in my life, but the Old Man suddenly made an appearance and wants control of the keyboard. So here we go, again!...

Well, some time has passed and it doesn't feel like 'IB has been paying much attention to what's *really* going on in Amateur Radio! Well, I say there's allot going on and some of it needs to be analyzed and held up to the light, just to see how it fits with everything else. What more appropriate time to do so than at the time of my 135th "life anniversary."

So, time has passed and much has taken place, both behind the scenes, and right under our noses. There are about a million proposals for the restructuring of Amateur Radio...why there's "drop this" and "grandfather" that, and "everybody do ham radio via email and the Internet" (radio?) here, and "VHF/UHF is the only medium for emergency communication," there. If you read, you know what I'm talking about! The one thing that appears to be missing, and is not reflected in even one proposal that I've seen, is the need for an effort to pull the nearly 750,000 licensed Amateurs together into a cohesive, and flowing multi-dimensional structure with at least one single goal. In my humble opinion each and every one of the proposals seems to further the goals of a specific person, or persons, to accomplish what they want, and to heck with everyone else!

For this column the Old Man would like take a quick look at some small pieces of emergency communications (EMCOMM). This area results from one of the driving principles of the rules surrounding Amateur Radio (I won't go into much about Part 97, because we did that before, and because every ham has a recent copy of the "rules." Right?) It's my observation that since 9/11/2001 the government operating as Homeland Security, among others has been using money to play free and loose with the "rules."

They have encouraged a large number of people to get licensed, and yet no reason or motivation, beyond getting a license has been provided. There is no real guidance for the newly licensed hams and the levels of unrest among the "newbies" becomes apparent. Many of us who've been around for a while, joined ham radio as a hobby, while many of these new "hams" do so to fulfill some job requirement or function. Additionally, many "mandates" in the form of money have come down from the Washington, DC crowd, and with the dollars come demands from our served agencies; these often look and sound like suggestions ("We'd really like to have a group of ARES members totally dedicated to us in the event of an emergency or a disaster" – totally against the basic purpose of ARES, I think!)

One of the more recent occurrences that sticks in my craw is the excitement(?) being fostered by the ARRL (which, btw I

founded) for something called WinLink. I believe that this is basically email via radio, passed through a series of relays (sounds a great deal like the National Traffic System, doesn't it?) This effort is largely funded and, I think, promoted by, whom else, Homeland Security...so we have one government agency promoting the use of an Amateur Radio service, which is "managed" by another government agency, for the purpose of providing "better" communication during disasters and emergencies. Sound good doesn't it?

But doesn't this start to look like amateur operators providing a business critical service for a government agency that already has its own communication system? Not to mention the excruciating cost of high speed HF radio modems, the need for rules changes to allow for those high speeds on HF, and the fact that traffic could/would be passed without benefit of control operator knowledge, and on and on... Just questions and suppositions, of course, but when you tie them together with the continuously failing BPL effort, faithfully backed by the FCC and the Executive branch, both of which would, it appears, like to sell off any spectrum they can for a buck, makes me think – what's up here?

There are many more examples, but then, you would think that I was fostering "conspiracy theory" and nothing could be further from the truth. The only conspiracy that I would like to theorize is one that has *hams* theorize ways that they can put aside their personal ambitions and desires long enough to think *and* act with the single purpose of keeping our hobby alive and well, for us all! Being a "herd of cats" may work really well in large scale, wide spread disasters or emergencies, but not when fighting for our collective lives!

I'll have more to say about this later, but for right now think *and* act as members of a singularly unique organization!

...Boy! I'm glad that's done. What a headache I have! I can't wait to read what the Old Dude pushed through me this time (btw, it's his 135th birthday celebration on September 2)! Maybe tomorrow, but for now, from the Old Man, W7IB and Oscar the 7 wpm Dachshund, 73 'til next time!

The Hiram Percy Maxim Birthday Celebration Event

Excerpts from The ARRL Letter

As Casey reports above, "TOM" would have been 135 on Sep 2nd this year. To celebrate, ARRL Officers, Appointees, Headquarters staff, elected volunteers such as our own SM, Jettie, W6RFF, and ARRL Life members will be signing "/135" from 0000Z 9/2/04 through 2400Z 9/12.

Work at least 25 of these stations and a newly designed certificate is ready for you. You can also get endorsements up to 100 QSO's. You can work any given station on any band and mode for credit, including repeaters.

"/135" stations will send RS(T), their appointment (position), and their name. Others send RS(T) and name.

The League is asking for \$5 along with your entry. See Sep QST pg 40 for more information.

National and International News

ARRL Seeks Comment on Draft "Bandwidth" Petition

ARRL Letter 23-34

(Ed. Note: This is a little long and a bit complex, however it deserves some thought and comment from rank and file amateurs since, if adopted by the FCC, it will establish policy and precedent that will affect our band-usage rules for a long time to come)

The ARRL wants members' comments on a planned petition to the FCC seeking to regulate amateur sub-bands by bandwidth rather than by mode. The ARRL Board of Directors adopted the petition's guiding principle--to create a regulatory environment more accommodating to newer technologies--two years ago, and it wrapped up its review of a draft petition in late July.

"The main objective is to make appropriate provision for digital modes in the HF amateur bands, while preserving amateurs' prerogatives to use the traditional modes," said ARRL CEO David Sumner, K1ZZ. "Regulation by

Bandwidth" is the title of Sumner's "It Seems to Us . . ." editorial in September QST.

The draft petition represents expert input from the ARRL Ad Hoc HF Digital Committee. ARRL staff also provided an interim report, and the Board reviewed a draft petition when it met last January. An ARRL Executive Committee review followed. The EC decided to make a synopsis and explanation of the petition available to ARRL members before it goes to the FCC.

"The regulation of emission modes in Amateur Radio Service allocations is a limiting factor with respect to Amateur Radio experimentation," the petition synopsis concludes. "It leads to attempts to put new technology into a regulatory framework that was designed only to deal with older analog emissions." To implement digital technologies, an underlying assumption of the League's draft petition is to provide for an intermediate bandwidth--between what's needed for the legacy CW and phone modes--in the middle of certain bands.

As drafted, the ARRL's bandwidth petition would preserve double-sideband AM unchanged, but it would stop short of opening the phone bands to digital and other modes of the same bandwidth.

FCC rules now permit RTTY and data emissions throughout the HF CW sub-bands, although informal agreements typically keep RTTY and data signals out of those parts of the CW band generally used for CW. The ARRL's petition proposes to limit bandwidth in the CW sub-bands to 200 Hz, which also will accommodate data modes such as PSK31.

In addition, the League's proposal would limit bandwidth in the existing "RTTY/data sub-bands" to either 500 Hz or 3 KHz, with phone emissions specifically prohibited in certain sub-bands where 3 KHz would be permitted. Under the proposal, these would include 3650-3725, 7100-7125, 14,100-14,150 and 21,150-21,200 KHz.

"The reason for this is to encourage the development of higher-speed data communications in these sub-bands by preventing

them from becoming de facto 'expanded phone bands.'" Sumner explained.

The new proposals take into account the ARRL's prior "Novice re-farming" petition to expand some HF phone bands, included in the FCC Notice of Proposed Rule Making in WT Docket 04-140.

Amateurs typically won't have to be able to measure the bandwidth of their signals, Sumner says, since the bandwidths proposed are more than sufficient for "clean" signals using traditional HF modes.

The ARRL proposal would eliminate bandwidth restrictions in the 222-225 MHz band--beyond a requirement to keep signals confined within the band.

Sumner encouraged ARRL members to review the synopsis of the petition and the specific rule changes the League plans to propose www.arrl.org/announce/bandwidth.html. Direct questions or comments--favorable or otherwise--via e-mail bandwidth@arrl.org. ARRL staff members will respond to any questions, while comments will be forwarded to your ARRL division director. Members also are welcome to comment directly to their ARRL directors via www.arrl.org/divisions/, [and who are] also listed on page 15 in QST.

FCC No Longer Issuing Certain 2x3 Vanity Call Signs

From ARLB022

The FCC has ceased issuing 2x3-format Amateur Radio vanity call signs that begin with the prefixes WC, WR, WK and WT (eg, WR1AAA, WC4ZZZ). The Commission has acknowledged that it erroneously granted more than 150 WR and WC-prefix 2x3 vanity call signs from 1997 through September 2003, when it began rejecting such call sign requests.

In the late 1970s, the FCC announced a new Amateur Service call sign assignment system. It provided four standard call sign groups, designated Group A, B, C and D, delineated by license class and issued sequentially with no back-filling. The FCC's Bill Cross, W3TN, recently told the nation's volunteer examiner coordinators (VECs) that the FCC also had a "Group X." These included WC (RACES), WR (repeater), WK and WT-prefix 2x3-format call signs reportedly reserved for special-use licenses.

The FCC stopped issuing repeater call signs in 1983 and ceased renewing RACES licenses in 2000. After the current vanity program began in 1996, several ham clubs sought new and formerly held repeater and RACES-type call signs. When the Universal Licensing System came along in August 1999, however, the FCC encountered some licensing system programming shortcomings including the anomalous assignments of WC and WR-prefix 2x3 call signs as acceptable formats.

When the FCC implemented programming corrections that halted the issuance of Group X call signs in September 2003, it did not advise the amateur community. As a result, several amateurs who filed for 2x3 WC or WR-prefix call signs had their applications dismissed without any explanation beyond

saying that the applicant's call sign choice was unavailable. That remains the case. The FCC has not indicated whether it plans to address the WC and WR-prefix 2x3 call signs it's already issued.

In a related matter, the FCC's new Amateur Radio vanity call sign regulatory fee of \$20.80 for the 10-year license term [went] into effect Friday, August 10th. All applications received at the FCC on or after that date must be accompanied by the new, higher fee.

Phonetics

Editorial Musings

The phonetics hams use to clarify call signs and words when transmitted on voice have probably always been a bit of mystery to non-licensed folks. Sometimes, they are just funny, such as Des Stovall, now SK, who would occasionally identify on 75 meters as "Watching Six Elephants Chewing Yardsticks." Sometimes they are downright confusing (I actually heard a 4 using "Drinking Marqueses Rum" ... I wasn't aware they had rum there), and do little to enhance communications, and sometimes, such as in the heat of a contest and when used at high speed by a DX station for whom English is an acquired language, they don't work at all.

Urban Legend #1: The "International Phonetic Alphabet" begins with ALPHA, FOXTROT through LIMA, QUEBEC, and the SIERRA, and ends with a pas de deux by a ZULU.

There have been many "approved" lists of phonetic words, some National, some International, and some were used primarily in one occupation. All have been less than crashing successes.

The Joint Army/Navy Phonetic Alphabet came on the scene around WW II, and became the ham standard for a number of years. It began, ABLE, BAKER, CHARLIE ... used ITEM for the 'I' ... included MIKE (it seems like 'mike' and 'x-ray' are the only universally accepted phonetic words) ... and ended with a ZEBRA. In the 40's and early 50's, it was solemnly declared to be The Approved Phonetic Alphabet in the ARRL Handbook and other operating guides and handbooks.

Quite a few variants of this alphabet grew up, such as in law enforcement, where some substitutions were made (e.g. ADAM for ABLE), and which, with the advent of television in every home and numerous cop shows, became very familiar to the public. MIKE and XRAY stood fast, however.

Unfortunately, many of the phonetic words in these alphabets derived from things and experiences that were culturally American, and didn't really stir up quick recognition around the world or even in other English-speaking nations. So, in the mid-50's, NATO, being at the forefront of international interoperability, developed and published the "NATO Phonetic Alphabet," supposedly pronounceable by everyone (let's see, is it QUEE-BEK or K-BEK? ... PAH-PAH or pah-PAH?). MIKE and XRAY held on, however, and it was adopted by the ICAO for aircraft usage world wide, and most of us know it by heart.

It begins with ALPHA, FOXTROT through LIMA, QUEBEC, and the SIERRA, and ends with a pas de deux by a ZULU. "Oh, and that became the 'International Phonetic Alphabet,'" I hear you cry! Well, no ... it became the "NATO Phonetic Alphabet" and stayed that way. The International Phonetic Alphabet actually arose in the latter part of the 19th century in the arcane field of linguistics and is still alive and well. If you're interested, try www2.arts.gla.ac.uk/IPA/ipachart.html

Urban Legend #2: When NATO figures something out, it is probably the best we have.

Well ... let's give NATO a big hand for a really good try. In many international communications situations, it works extremely well, but then QRM is not common for them either. For ham usage, it still comes up a bit lacking. Take the pronunciation problem, alluded to above. Spanish speakers tend to pronounce WHISKEY more as WIKEEE -- not surprising since it follows the rules of their language. SIERRA means "saw" or "mountain range" in Spanish, I have no idea what it means, if anything, in German, or Serbo-Croatian. I'm a KILO SIX, but is it KEE-LOW, or KIH-LO? Of course, MIKE and XRAY still seem to work.

Hams have, over the years, always had a second affinity to place names as phonetics. LIMA is okay, but everyone in the world know where LONDON is. We Americans tend to think that everyone also knows where WASHINGTON is, and indeed, when DELTA GOLF WHISKEY doesn't seem to do it, DENMARK GERMANY WASHINGTON nearly always does. In fact, in the NATO alphabet, GOLF has to stand as the worst choice. MIKE and XRAY still hang in, but then MONTEVIDEO poses some real problems and MONTREAL isn't all that much better, although you do hear it.

Allegedly the result of an extensive survey, which I doubt, there is a ham phonetic alphabet that does seem to work, most of the time:

AMERICA	NORWAY
BOSTON	ONTARIO
CANADA	PORTUGAL
DENMARK	QUEBEC
ENGLAND	RADIO
FRANCE	SANTIAGO
GERMANY	TOKYO
HONOLULU	UNITED
ITALY	VICTORIA
JAPAN	WASHINGTON
KILOWATT	XRAY
LONDON	YOKAHAMA
MEXICO	ZANZIBAR

QUEE-BEK is still there (rats!), and MIKE has finally bitten the dust, but KILOWATT is something we all know, and it doesn't matter if its KEEE-low-WATT or KIH-LO-WATT. And XRAY remains. I guess it beats XYLOPHONE, BOSTON maybe works because most of the world drinks tea.

Where In Blazes Am I?

Hyperbolic Navigation - "The Real Stuff"

Last issue, we ground through the basics of hyperbolic navigation systems. Like all other systems employing some form of radio that provide an actual position (including GPS), such systems reduce to a triangulation process where you establish two "lines of position" with two stations (or sets of stations), and your position is where they intersect. The real differences are in how you establish the LOPs.

Real systems using hyperbolic techniques were explored by both the British government and several private companies in the mid to late 30's. These efforts proceeded in parallel, so it is pretty much impossible to establish an exact parental lineage for them. As WW2 loomed in Europe, the British began experimenting with a secret system they called "GEE."

GEE was developed as an air navigation system to enhance the capability of the RAF in bombing on the Continent. It originally operated in the 30 MHz range (later extended upward to 75 - 80 MHz), and was intended as a shorter range, near-line of sight system. Expecting the signals to be jammed by Germany over the Continent, it was intended to provide the bomber fleets with a means to compute winds prior to arrival at the coastline. Thereafter they would navigate via dead reckoning.

GEE worked pretty much as we discussed last month. Stations (pairs and triples) transmitted pulses in carefully timed sequences. The navigator measured the difference in arrival times using the then new cathode ray oscilloscope, and computed his position. Knowing his real position and the heading and speed of the aircraft, he could then compute the winds. A fairly comprehensive description of Gee can be found at webhome.idirect.com/~jproc/hyperbolic/gee.html.

When it became clear that the US was going to enter the war in Europe, and, after Dec 7, 1941 that it was going to have to defend itself in the vast Pacific Ocean, R&D was cranked up to full blast with early development of a system remarkably similar to GEE, also operating in what was then regarded as the VHF bands. The Americans knew nothing about GEE at that time. Development proceeded at MIT, and soon, the restricted range of 30 MHz and up was realized, and the system was moved to lower frequencies, initially in the 3 to 8 MHz area. Useable ranges increased dramatically, however some difficulties suggested still lower frequencies, and the ultimate choice was in the 1.7 to 2.0 MHz range. There were plans to use a second frequency band around 40m for daytime use, however it was never implemented.

LORAN-A pulses were 40 microseconds long, and recurred at fixed intervals in the 30 to 40 millisecond range. The peak pulse power was over 200 KW, however this resulted in an average power of only a few hundred watts because of the short duty cycle.

Four frequencies between 1750 and 1950 KHz were assigned. These channels were reused many times, and to separate the stations, each chain used a different repetition rate. On the receiver scope, adjusted to the repetition rate of the desired

chain, the desired signals stood still and the others drifted past and were ignored.

The frequency range is of course familiar to us ... LORAN-A was placed in our 160m amateur band. The system was deployed up and down both coasts of the US and Canada, and at multiple places in the Pacific as our forces moved west. Initially, this was no problem since all amateur activity ceased with Pearl Harbor. When the war ended and hams were allowed to transmit again, we finally got 160 back, but on a non-interference basis with severe power restrictions. It didn't matter much, however, because the racket put out by LORAN-A made 160 pretty much useless, at least along the coasts. However, if you've ever wondered why linear amplifiers from that period don't cover 160 (such as the Heath SB-200 and SB-220), that's the reason. A good description of LORAN-A is at webhome.idirect.com/~jproc/hyperbolic/loran_a.html

LORAN-A continued up to about 1980 in North America, when it was replaced with LORAN-C. (LORAN-B never really made it off the drawing boards). All LORAN-C stations operate on 100 KHz. We have a station here in Northern CA over in Middletown near Clear Lake. As LORAN-C developed, it was slaved to the NBS time standards at WWV, and was used to distribute precise time around the world as well as provide navigation. LORAN-C is still operated by the USCG, however it is likely it will be phased out in favor of GPS in the next few years.

Beginning in the 50's, and becoming operational in the 60's, the Omega system was a very long range system that could be used by submerged submarines. It operated at between 10 and 14 KHz (the ELF range), and was a CW system rather than pulse. Stations had extremely stable oscillators that maintained a precise phase relationship between their carriers. The navigator obtained the time difference by comparing the relative phases of the station carriers.

Omega is really a modified hyperbolic system. While the LOP's are hyperbolas, there is an ambiguity problem. You could measure the phase difference between the station carriers, but you had no idea how many full cycles were also included in that difference since one cycle of the carrier looks like all the others. The net result is that an Omega chart was divided into "lanes", where each lane represented some integer number of cycles difference. If you had a rough idea of your position enough to tell you which lane you were in, you could then refine the position to 3 - 4 nm or so. As long as Omega stayed on the air and your receiver did too, you could continue to plot your position, noting when you changed to the next lane. The US Omega station was in North Dakota.

Much earlier, the Decca Navigation Company had proposed (and patented) a similar system called DELRAC which was never implemented. Decca sued the US Government for infringement of the Omega system and won an award of \$44M. They also sued over LORAN-C ... and won that one too. However, the US Government claimed that LORAN-C was a military system essential to national security, and never paid Decca anything.

Omega was decommissioned at 0300Z on 30 Sep 97. A good description by VE3FAB can be found on the web at webhome.idirect.com/~jproc/hyperbolic/omega.html

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