

K9YA Telegraph

Robert F. Heytow Memorial Radio Club

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U.S. Antarctic Service Expedition

Amateur Radio at the South Pole, 1939-1941, Part II

Philip Cala-Lazar, K9PL

Aircraft

The expedition's aircraft included an Edo floats-equipped Curtiss-Wright Condor R4C-1, NR-12384. Supplied by the U.S. Marine Corps, it was first delivered in 1933. This large twin-engine transport biplane was one of

the early "super airliners." Powered by two Wright Cyclone GR-1820-F11 engines rated at 650-670 hp, it carried 15 passengers (170 lbs., each) and 605 lbs. of freight at a cruising speed of 145 mph with a range of "4 hours or 580 miles." NR-12384 was fitted with additional fuel tanks to extend its range.

Accompanying the expedition and transported aboard the *Bear*, was Byrd's personal seaplane, *The Explorer*, a Barkley-Grow T8P-1. With this 204 mph, monoplane powered by two Pratt & Whitney Wasp Junior SB radial engines of 400 hp; he charted 900 miles of coastline and 150,000 square miles of unexplored territory.

On loan from the Research Foundation of the Armour Institute of Technology was the 350 hp, Wright R-760-E2 engine-powered staggerwing Beechcraft D17A, S/N 357, NC20778 acquired to piggyback aboard *Penguin I*. "The ship had a full complement of blind flying instruments and radios as well as being equipped for aerial photography and scientific research such as cosmic ray surveys." Some early reports stated the piggybacked aircraft was a *pursuit* plane, perhaps as misinformation to any foreign entity planning to disrupt the expedition's aims.

Chicago Daily Tribune

November 14, 1939

Snow Cruiser Ready to Load on Ship

Antarctic Expedition May Get Underway Today.

The Snow Cruiser arrived at the Boston dock, November 17 following its cross-country trip on public roads from Chicago. Ready to load on *North Star*, it was found to be 10 feet too long to fit on the vessel's forward deck and would have hung over the bow. Acetylene torches were used to shorten the Cruiser. The excised rear deck portion was welded back on

upon *North Star's* arrival at the South Pole.

West Base, East Base

The expedition's 59 personnel, drawn from the U.S. Navy, Army, Marine Corps and civilian scientists and dog drivers, were detailed to West Base, aka Little America III, at the Bay of Whales and East Base located on "Stonington Island in Marguerite Bay off the Antarctic Peninsula."

The "two bases [were] located to achieve maximum coverage of the coastline and interior between the 72 degree and 142 degree meridians," an overland distance of about 1,600 miles and 2,200 miles by sea.

"Penguin I"

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Get the Most From Your Antenna

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Joseph Henry

Time after time I kept reading that getting maximum power from our transmitters to our antennas required impedance matching, but nobody ever took the trouble to explain what it was, nor the how or the why. So I took it upon myself to find the answer.

In one article after another the experts kept saying that, in transferring power from one circuit to another, power would be lost if the impedance at the input to the sec-

ond circuit did not equal the impedance at the output of the first circuit. And that was true not only for antennas but also for speakers and other circuits. I really wasn't even clear on just what impedance was. I had several questions that needed answers. So in true student tradition I "hit the books."

And this is what I learned.

IMPEDANCE is anything that obstructs or slows the movement of electrons. It is made of Ohmic Resistance and Reactance.

What is Ohmic Resistance? It is the ordinary resistance to electron flow in a conductor as the electrons move through the substance of the conductor. It dissipates power in the form of heat. Well, I knew that much.

But what is REACTANCE? Turns out that it's another kind of opposition to electron flow that comes in two flavors. One form is encountered when electric fields are formed around the plates and dielectrics (insulators) of a capacitor, or around anything that has an electric charge. It can even be between the wires and insulators in a circuit. They call that CAPACITIVE REACTANCE and give it a label, XC.

The other form is opposition to electron flow that occurs due to magnetic fields that develop around

conductors when electrons flow through them. That is called INDUCTIVE REACTANCE and is labeled XL.

Once again I was bugged by "why." Why should a magnetic or electric field affect the flow of current? I began to feel like a two-year-old constantly saying "why" until I remembered some old stuff I had read when I was curious about the early development of electronics. It concerns Michael Faraday in the early 1800s. He showed us that moving a magnetic field near a conductor induces a current in that conductor. He did this by moving a bar magnet in and out of a coil of wire. If the bar magnet was not moving, no current was induced, but the magnet's motion (and its associated magnetic field) did induce current in nearby wires.

Another experimenter, Joseph Henry, showed us that a rising or falling electromotive force (we call it voltage) produced a varying current in a conductor. He showed us that when electrons start to flow in a conductor, a magnetic field forms around it. As the current rises or falls the magnetic field moves and this moving magnetic field induces an electromotive force in that conductor. BUT, and this is important, the direction of that induced EMF is opposite to the first one. Henry called this phenomenon self-induction.

"I was bugged by 'why.'"

I'll say it again for emphasis. That induced EMF is OPPOSITE in direction to the first EMF. It is called BACK EMF. (Knowledgeable hams will recall Lenz's law.) Back EMF opposes the EMF that gave rise to the first current. As the first current continues to flow steadily (as it does in DC) things stabilize and, without a moving magnetic field, the induced current dies. That's the situation with DC until the current is turned off, when once again, the falling current induces a moving magnetic field and a forward EMF which, when added to the inherent EMF, may create a spark at the switch because the total voltage has increased.

With AC there is continuous changing of the direction of EMF and continuing changes in the magnetic



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field and continuing BACK and FORWARD EMF. That gives rise to changing current flow. The BACK EMF fights the forward flow of current. We call that INDUCTIVE IMPEDANCE.

If one looks, with the aid of an oscilloscope, at the changes in voltage and current in a circuit that has inductive impedance, one finds that changes in current lag behind changes in voltage. The reason current lags is the BACK EMF we just talked about. It opposes the oncoming EMF. Now we come to the question of how far back the current lags behind the voltage. Why is it 90 degrees and not 74 degrees or some other number of degrees?

To answer this question let us look at the pattern of an alternating voltage in an AC circuit that has inductive impedance. Look at Figure 1. This is a drawing of an oscilloscope image of AC in a circuit that has inductive impedance.

Voltage, "V" and current, "I" are indicated on the vertical axis and degrees of rotation (or time) on the horizontal axis. Think of how AC is generated and think of the rotation as the turning of the armature in an AC generator from zero, the starting point, completely around 360 degrees back to zero.

If you make a graph of the voltage and current values on the vertical (Y) axis and degrees of rotation of the armature on the horizontal (X) axis you'll get a picture similar to Figure 1.

As time goes on, the voltage, starting from zero, rises to a maximum positive and falls back to zero and then goes to a maximum negative. The most drastic change in voltage is where it goes from positive to negative or vice versa. That is where it crosses the zero voltage line and that is at 180 degrees. And that is also where the steepest part of the falling voltage is located. Remember, the strongest magnetic fields are generated by the most rapidly changing voltages.

That being where the most rapidly changing magnetic field is is also where the maximum induced current will be generated. Looking again at Fig.1, it is apparent that maximum current and maximum voltage are separated by 90 degrees. The maximum current occurs 90 degrees after the maximum voltage.

For those of you who remember calculus, that is where an inflection point on the voltage curve is located. Inflection points denote the most rapid rate of change.

Remembering that the induced current is in a direction opposing the initial current, we see what makes

the current lag the applied voltage and why it does so by 90 degrees.

Now let us turn our attention to a capacitive circuit. A capacitor accepts electrons until the plates that are connected to the source of electrons become fully charged. In the case of direct current, once that occurs, no further current can flow. In the case of alternating current those plates release electrons when the current reverses and the opposing plates in the capacitor become charged.

It takes time for the plates to charge up to the applied voltage. During this time current is still flowing but the capacitor hasn't yet reached the full value of the applied voltage. That is why we find that current leads voltage in a capacitive circuit.

So to review what we have been talking about with regard to AC:

1. Voltage (E) leads current in an inductive circuit.
2. Current (I) leads voltage in a capacitive circuit.

As noted above, we use the letter L for induction and C for capacitance.

A mnemonic to help remember this fact is "ELI the ICEman." The E stands for voltage. The I stands for current. The leading and lagging of current changes with respect to voltage changes is called PHASE SHIFT. And the time lag or number of degrees of those shifts is called PHASE ANGLE.

We said IMPEDANCE is composed of RESISTANCE and REACTANCE and that reactance comes in two forms, INDUCTIVE and CAPACITIVE. To figure out how to add up all of these we have to take into account the leading and lagging currents and their phase angles. Even if we did all that, there would still be many unknowns due to stray capacitances and inductances from the wiring, chassis and components of our radios.

To get around this problem we use a device called by various names: "TRANSMATCH" "TUNER" or "MATCHING NETWORK." This device contains

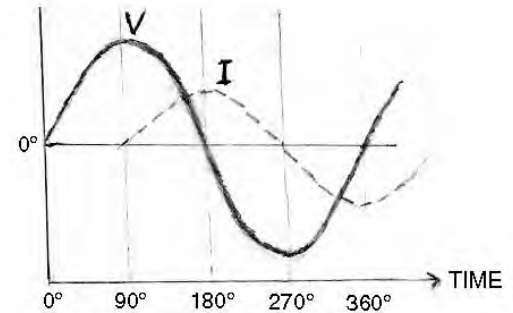


Figure 1

*"...let us
turn our
attention..."*



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CONTINUED - MOST FROM YOUR ANTENNA ON PAGE 6

Spastic Jack

Scott Laughlin, N7NET



It was February 1961 when I reached Beale AFB, California, and moved into the Armament and Electronic (A&E) Squadron barracks with the other single men. I found myself in the midst of many exceptionally intelligent people. Out of the lot, however, only one had bothered to earn his amateur license, and his name was Jack. His last name and call sign have both faded into the distant past. If his antics had not been so over the top I would have undoubtedly forgotten his first name as well.

Our barracks had originally been bachelor officers' quarters when Beale was an army post during World War II, hosting three to a room, hence, three wall lockers. By 1961, however, the dwelling had been handed down to enlisted personnel, two to a room, and the center locker remained padlocked. The word was that the first sergeant was the only individual possessing the master key for all center lockers. However, picking locks was another of Jack's many skills, and because radio stations were unauthorized, Jack kept his station, and a well-stocked junk box in the center locker, invisible to the critical eyes of white-glove inspectors. A dipole antenna was installed on the roof along with a length of coiled coax. Of course the antenna was unauthorized. I suppose he followed the theory that forgiveness was more easily obtained than permission. When he decided to operate he went on the roof, uncoiled his coax, tossed it over the side of the building and pulled it through his room window.

As a civilian, Jack might have been an all right neighbor, but maybe not. He dwelled in a world all his own. To look straight into his pale blue eyes, it seemed as though I could see the back of his skull. Not so. He could quote the formula for solving the ring time of a coil, or most other formulas, for that matter. He was a walking information booth. Unlike many, he was able to turn his theoretical knowledge into working electronic devices. He designed and built an automatic headlight-dimming switch for his

car before Heath offered it as a kit. He built other devices that served little purpose, but amused him—moisture and movement sensors. Most made noises, some more obnoxious than others. Perhaps the most annoying I witnessed was his stud finder that emitted a loud beep each time it found a nail head. Since the barracks was constructed largely of wood, there were more than a few nails to locate.

The Cold War was on and Vietnam was ramping up. We were launching and recovering two airborne alert bombers each day, every day, in addition to the normal flight crew training missions. As a result, the flight line was a beehive of activity that continued around the clock. In spite of the workload, the authorized number of personnel in our avionics shop was reduced from 34 to 19. Most of us worked twelve-hour shifts, oftentimes more. Being awakened by Jack's stud finder was no longer amusing. No amount of reasoning would cause him to turn his attention elsewhere. His antics eventually earned him the title of Spastic Jack. One evening the hall telephone rang. Someone identifying himself as Colonel Jones asked to speak to Jack.

*"...a world
all his own."*

Jack's device, the colonel claimed, was emitting a signal that was interfering with electronic equipment on the runway (Jack failed to consider that with the runway located eight miles from the barracks such a situation was most likely impossible, nor did he question how this colonel managed to learn about his stud finder). I never

asked who this Colonel Jones was, nor did I wish to know. Not to worry. The phone call netted positive results. Jack put his noisemakers away and turned his attention to home brewing and QRP. Propagation was exceptional and our barracks life returned to a state of relative normalcy. However, by this time the name Spastic Jack had migrated beyond the walls of our quarters.

After several weeks, Jack received a post card from Reno. It bore no greeting, only a photo of an old codger panning gold and an address:

Spastic Jack
A&E Squadron
Beale AFB, California.

Even the postman knew Spastic Jack. ■

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Bob Cashdollar, NR8U

Recently, Fritz Tender, WD8E, introduced me to a person I will call “Jack.” Jack had been an amateur, but let his license lapse. He expressed interest in getting a license again and getting back into the hobby. As it turned out Jack was last licensed in 1969 and had no contact with anything concerning amateur radio since that time.

We got together with Jack for lunch in Columbus, Ohio, which is about 35-40 miles from where we live to try and answer any questions he had about what was current in amateur radio. It was a really eye-opening experience for all three of us.

Jack told us he was a dedicated CW operator up to the point his interests were directed elsewhere. Like most of us, at one time or another, life took precedence over hobbies and amateur radio slipped away from him. In the course of our conversation during lunch we covered a lot of topics about what had happened in amateur radio since he was last licensed.

Put yourself in Fritz’s and my place in trying to explain to someone about the things that have occurred in amateur radio in the last 40 years or so.

Such things as:

- No-Code
- Packet Radio
- Only three license classes
- All satellites since OSCAR 1
- MIR
- Amateur radio on the International Space Station
- PSK31 and other new digital modes
- Volunteer examiners
- D-Star
- Digital signal processing
- FM repeaters
- Software defined radios
- *CQ* and *QST* magazines are still around, *73* and *Ham Radio* are not.
- The rise of the computer in just about everything amateurs do in and out of the shack
- Log Book of the World
- And, a lot more I can’t remember.

(What would you have told Jack about the last 40 years of amateur radio?)

We, Fritz and I, had decided to take him to the local amateur radio store, Universal Radio in Reynoldsburg, Ohio, otherwise know as the “Candy Store” to look at some recent amateur equipment after finishing lunch. It was another interesting experience for we three.

Looking at all the new and recently used equipment, Jack had a lot of questions. The two comments that stuck with me most were a question and a comment about a new upper end radio sitting on the desk in the store.

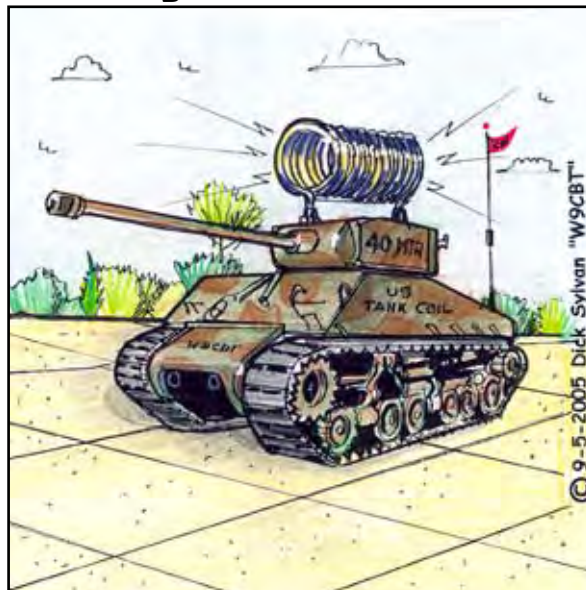
“Does everything come with digital readout now?” and “Everything is pushbuttons now instead of knobs and toggle switches.”

Apparently we must have gotten Jack enthused, as he was loaded down with magazines and a license manual plus some other literature when we left the store due to it being their Saturday closing time. We gave Jack our phone numbers and e-mail addresses as we finished talking in Universal’s parking lot and assured him we would be more than happy to help him with any questions that might come up. Hopefully Jack will use the license manual and take the exams and rejoin us as a “retread” amateur radio operator in the future. ■

Since this article was written Jack earned his Technician license and moved up to General. He also regained his original call sign.

Ham Lingo

DICK SYLVAN, W9CBT



THAT’S WHAT I CALL A “TANK COIL!”

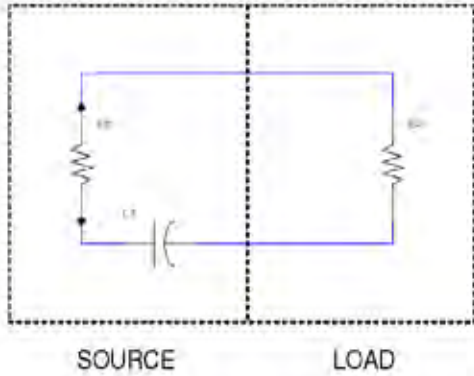


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sources of variable resistance, inductance and capacitance that can be adjusted to counteract the net reactance of our transceiver, connecting cables and antenna.

Having done that, we can match the impedance of our transceiver to the impedance of our cables and antenna. This will allow maximum transfer of power to our antenna.



Now, to show you the benefit of matching impedances I will use a very simplified illustration considering only resistive impedances. In the illustration below, the side labeled "source" represents the transceiver and the "load" represents everything beyond the output of the transceiver, i.e., coax and antenna.

The intrinsic impedance of the transceiver, the source, is going to stay constant at 50 Ohms. The battery is our voltage source E and we will assume it has no resistance and give it a fixed value of 100 Volts.

I advise against trying to construct this circuit. It has not been tested and is shown here only to illustrate the theory.

For this illustration assume that:

1. The battery (E) supplies 100 Volts and that its internal resistance is zero.
2. The intrinsic impedance in the transceiver is 50 Ohms. That stays constant.
3. In the table below we will vary the impedance of the load (the antenna and its supply wiring) to see which impedance gives the best power transfer from our source (the transceiver) to the load.
4. Impedances and Resistances are expressed in Ohms.
5. Power is expressed in Watts.
6. Current is derived (100V divided by Total R of circuit) (E/R) and is expressed as Amperes.
7. Total Power in the circuit is derived as the product of the square of the current times total resistance of the circuit.
8. 8. Power to the antenna is expressed as the square of the current x antenna impedance

Please refer to the Table below.

Look in the column farthest to the right and find the largest value of Power going to the antenna (4th row down with asterisk). Now look to the leftmost column showing the impedance of the load (the antenna) and you will see that it is the same as the fixed impedance of the source (the transceiver) that we specified in number 2 above.

Antenna

Impedance Total R Current I

Total Power

Power to Antenna

2521.9291.77.45551.82182.216.625751.33132.74
4.2*501001.00100.0*50.01001500.6767.344.9125
1750.5756.940.61502000.5050.037.51752250.444
3.633.92002500.4040.032.0

Antenna Impedance	Total R	Current I	Total Power	Power to Antenna
2	52	1.92	91.7	7.4
5	55	1.82	182.2	16.6
25	75	1.33	132.7	44.2
*50	100	1.00	100.0	*50.0
100	150	0.67	67.3	44.9
125	175	0.57	56.9	40.6
150	200	0.50	50.0	37.5
175	225	0.44	43.6	33.9
200	250	0.40	40.0	32.0

Thus we have demonstrated that for maximum transfer of power between a source and a load, matching impedances gives best results. ■

Sanford A. Franzblau, KA9BBV, Retired M.D., Ph.D. University of Illinois alumnus. Thesis on effects of altitude stress on cardiovascular system. Age 96. WWII veteran. Served overseas in U.S. Army Medical Corps.

Widowed two years ago. Four kids and five grandchildren. Wife was RN and taught nursing arts at the old St. Lukes Hospital on Michigan Avenue in Chicago.

What's Your Story?

Every ham has a story and we want to read yours! The *K9YA Telegraph* is always looking for content from its readers. Have an idea for a story you'd like to share—tell us about it. We'll help you get your story in print.

http://www.k9ya.org/write_for_us.htm



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Richard B. Black, Department of Interior representative and a member of Byrd's second Antarctic expedition, was named West Base leader. (For DXers, Black led the 1938 American party that claimed Canton and Enderbury Islands [chronologically: KC6, KB6 and KH1 prefixes] for the U.S.)

East Base leader Dr. Paul A. Siple was a geographer and research associate at the Clark University graduate school of geography. Among his many achievements, he and the Service Expedition's geologist Charles F. Passel devised the wind chill index. "Siple served as scientific leader of the US station at the South Pole during the IGY." (*K9YA Telegraph*, March, April 2013)

Radio Equipment

Aboard *Bear*: Two 500-watt, crystal-controlled transmitters and a 100-watt "non-crystal control set." The 500-watt set—16,720 kc—100-watt-set was "standard issue by the Navy." Receivers included two Hammarlunds and a National.

The original antenna supplied was "found insufficient for good communications" and replaced by a doublet quarter wave" hung between two of the ship's mast's." This antenna was cut for "Navy frequencies... 4235 series and 4205 series."

The bases' 500-watt transmitters were used for "long-distance duty." Base antennas comprised "rhombics and vee's" expected to "push a thumping signal" on "7075, 14,150 and 28,300 kc."

West Base: Two Class 1 Harvey transmitters running 813 finals while providing 500 watts CW and 400 watts, Class B, on 'phone. Frequency agility provided via five front panel-switched crystals and "optional master oscillator."

East Base and the *Bear*: One each Harvey transmitter as described above.

Snow Cruiser, two Condors and U.S.M.S. *North Star*: Class 2, 125-watt Harvey transmitters with 814 finals and master oscillator.

Twenty-five Class 3 outpost sets were 30-watt 'phone and CW, master oscillator controlled. 12-volt batteries "powered by windchargers" fed them. Outpost receivers were the ubiquitous, but modified, National SW3-type, tuning from 4 to 7.5 Mc and equipped with five-inch speakers. The sets were modified to use 1.4-volt tubes "operating from b.c.l.-type [broadcast listener] combination portable batteries" and provided with two sets of coils to "permit reception of time signals and weather data."

*"rhombics
and vee's"*

One each of these sets was installed in Byrd's Barkley-Grow seaplane and the Beechcraft.

Small trail sets augmented the above gear. They comprised 12-watt transmitters ("Hartley 801") powered by "Signal Corps hand-cranking generators" at 400 volts, 70 mA. These sets were supplied with "a collapsible 13-foot vertical rod" and "a 35-foot horizontal wire."

Expedition bases received 2 ½-meter transceivers "to be used in lieu of telephone wires during unloading operations and for local exploratory work." This was an innovation unique to the Service Expedition; no telephone circuits were "taken along by the expedition, and all communication [was] by radio."

The receiver complement included the National SW3, Hammarlund Super-Pro and HQ-120. The bases and Snow Cruiser received one of each, Condors the HQ-120 and various combinations installed aboard the ships.

Conditions at the South Pole dictated no mercury-vapor rectifiers since they were "slow to vaporize in cold temperatures." In their place high-vacuum rectifiers were used. In addition, "no electrolytic condensers [were installed] in any part of the equipment." Chief Radioman Bailey asserted, "that at temperatures below zero you might as well use a block of wood." Crystals were mounted in "heated... individual oven holders of the miniature plug-in type."

During Byrd's Second Antarctic Expedition, 1934, where "the presence of ice made it impossible to obtain a ground in the ordinary sense of the word. A 340-ft. counterpoise stretched on the ice in an inverted-vee served as a combination aerial and ground, and permitted reception up to 12,000 miles." That may have also been the grounding solution for the Service Expedition.

Witte Diesel Systems supplied base power needs. Two generators, 7.5 kW and 3 kW at 110 volts, 60-cycle, single phase 24, hours a day. (<http://www.youtube.com/watch?v=SyRkq4x6Yok>)



Elmer M. Lamplugh, W1LWD



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Stations and Operators

Antarctic stations and their operators: KC4USA, West Base, operators, Elmer M. Lamplugh, W1LWD; B. Perce; and Howard T. Odom; KC4USB, East Base, operators, Bailey, J.A. Reese, ex-W4CTA, and W.R. Giles; and KC4USC, Snow Cruiser, operator, Felix L. Ferranto, W6NDH.

Non-amateur call signs assigned the expedition were: Commercial and broadcast (CBS and NBC): KRTK, West Base; KRTC, East Base; and KRTA, Snow Cruiser. U.S. Navy call signs: NUW, West Base; NPQ, East Base; NLC, Snow Cruiser; and NKG, Pacific Coast Base. Aircraft call signs: NUW/1, West Base; NPQ/1, East Base; and NLC/1, Snow Cruiser. Base outposts: NUW/9 and NPQ/9.

Commercial mobile marine band frequencies were employed for KRTK, KRTC and KRTA. KRTK, KRTC and KRTA commercial broadcasting frequencies: 6424, 9135, 11060, 12862.5, 17310 and 23100 kc.

Communications between the bases and the Snow Cruiser: NLC: 4385, 6355, 7455, 10255 and 11390 kc; NUW: 4435, 6230, 7595 and 11060 kc; NPQ: 4265 series, 6120, 7305, 10035 and 11240 kc. Various Navy frequencies used for official traffic with the U.S.

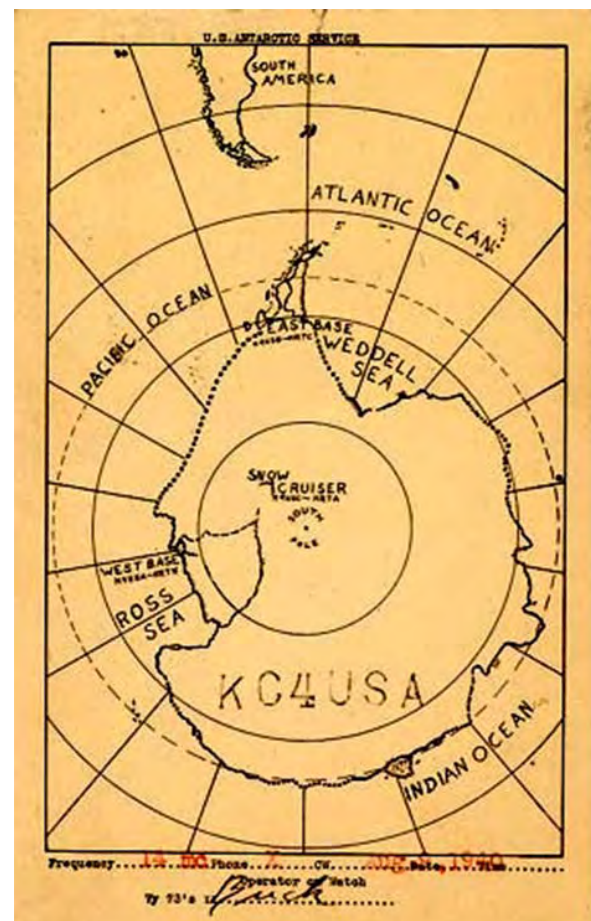
Amateur Radio Operations

Prior to the expedition's arrival in Antarctica, Clay Bailey, Chief Radioman in charge of communications, was asked about amateur operations, specifically, scheduling. He dismissed scheduling, stating, "We won't know until we get down there whom we can work. And then we'll take the best and most dependable signals, and concentrate on them for our schedules and our important traffic."

It was thought West Base, KC4USA, would enjoy an advantage in working "Pacific Coast" stations. East Base's KC4USB was positioned to better work "W4's and East Coast stations."

Most amateur operation was planned for the winter months (summer in the northern hemisphere) because during the Antarctic summer "personnel will be too busy working with exploring parties, making hourly observations and carrying out their other duties, for much hamming."

The May 1940 issue of *QST* noted that "KC4USB, East Base station... is now actively on the air." Their first contact was with Johnnie Griggs, W6KW, at 2



KC4USA QSL Card (1940)

Image courtesy of: <http://www.hamgallery.com/>

am PST on March 26 with W1LWD at KC4USB. Famed DXer Don Wallace, W6AM, accomplished QSO number two.

W6KW held a twice-weekly sked with KC4USB, Tuesdays and Saturdays at 1:30 am PST. They worked split, KC4USB on 7075 kc and W6KW on 7104 kc. Like today's DXpeditions, KC4 stations would not reply to stations calling on their frequency or the stations they were working. Another similarity to today's operations, it was reported that QSL cards might be delayed as long as a year. A central office in the United States fulfilled confirmation requests.

Snow Cruiser station KC4USC was nightly on the air at 8 pm on 14248 kc with W4DSY handling traffic. W2AIW scored a double-header, working KC4USC on March 6 and KC4USB on March 29. KC4USB was reported as running "150 watts to [sic] a Harvey 1000-watt rig."

Operator Lamplugh noted that since expedition members were currently housed in tents and would not be moved to houses for six weeks, ham radio operations would necessarily be limited. ■



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