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QST Issue: Feb 1970
Title: Long-Delayed Echo AR, A
Author: O.G. Villard, Jr., W6QYT

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There Is No Such Thing As

A Long-Delayed Echo AI

BY O. G. VILLARD, JR.,* W6QYT, C. R. GRAF,** W5LFM, AND J. M. LOMASNEY,*** WA6NIL

On September 22, 1969 (GMT), WB6VKV was in QSO with WA3KQA on 20-meter cw. At 0100 plus or minus one minute, he stood by. The frequency was QRM-less, and WA3KQA was unaccountably slow in coming back. When the receiver came alive, a signal could be heard in the background noise on WB6VKV's frequency, about S2 but clearly copiable. Although band conditions were normal for six o'clock on a California afternoon, and not much by way of DX could be heard, the signal sounded as if it had come a long way. It sent: "WA3KQA de WB6VKV K", *and was an exact repeat of WB6VKV's transmission.*

Sounds spooky? You bet. This was WB6VKV's initiation into a very exclusive club: those who have heard long-delayed echoes, or LDEs. The authors know of only about 50 other members in all, and they would very much like to add to the list, because LDEs are just possibly one of the world's "longest-delayed" radio mysteries, having first been discovered in 1927. It seems to be time that *somebody* tried to figure out what nature is trying to tell us in this way. (Of course, as in all similar situations nature's message may turn out to be trivially simple, but then it *might* be important. No one can tell until the particular Rosetta Stone gets deciphered.)

The "delays" are really impressive. For example, WB6VKV timed himself with a watch, as he simulated sending the above letters, and got a delay of 11 seconds. It takes only one-seventh of a second for a signal to travel all the way around the earth. Where had that signal been all that time, and why was only *one* echo heard? If the effect is not an illusion or a hoax, how in the world can nature "store" signals that long? Consider how difficult it is to build any purely electrical signal storage device capable of delays much in excess of milliseconds.

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Another curious feature of LDEs is that they are so phenomenally evanescent: WB6VKV estimates that his next standby would have come two or three minutes later; by that time all trace of the effect had disappeared.

The WB6VKV incident was chosen for mention because it happened fairly recently, because it has been investigated with some care, and because it is typical of a number of reports which have been received. LDEs are not just an anachronism from the 1930s; they still happen, and they still need to be explained.

The LDE Hunt — Where We Stand

In their article in the May, 1969 issue[1] the authors told the story of LDEs and solicited reports from initiates into the "club". The response was impressive; there are now over 40 "good" reports (i.e., reports in which time, date,

Fig. 1—WB6VKV, who heard the LDE on September 21, 1969 (California date). Charley's dedication to science may be surmised from the fact that he allowed his station to be thoroughly checked over by the senior author, and in addition submitted to a polygraph test at Stanford University. The test showed conclusively that his report was not a fabrication.

A report on long-delayed echoes (LDE's), by way of a sequel to the authors' article in the May, 1969 issue. The 40-plus reports received thus far have permitted encouraging progress in the search for an explanation, but the mystery is far from solved; additional observations are clearly needed.

Long-Delayed Echo $\overline{AR}$ . . .

or, The LDE Mystery Deepens . . .

frequency, etc., were logged), and it has been possible to begin some statistical studies. Following are the authors' present views:

(a) It appears that LDEs tend to be reported at times when magnetic activity is low.

(b) According to psychologists, there is a chance that one- or two-second "echoes" may be a trick of the imagination. But the longer ones don't seem to be readily explainable as "internally" generated.

(c) There appear to be two classes of unusual echoes. One is observable at 3.5 MHz over short distances, and involves one- or two-second delays. The other usually is characterized by longer delays and seems to be associated with long-distance propagation. It is observable at the higher frequencies, especially at times of band opening and closing.

(d) On balance, the evidence suggests that both effects are real and associated with the ionosphere.

The Spectrum of Effects Reported

In scientific work, one tries to operate "blind" as much as possible, because of a well-known tendency of the human mind to find whatever it is told to look for. For example, if observers are asked to walk through a grassy field and report the number of rabbits they flush, there is a high probability that some rabbits will be reported. However, the field may not have contained any rabbits at all: those brown furry fellows diving into their holes were actually woodchucks.

For this reason one hates to publish accounts of long-delayed echoes, because it may attract reports too closely matching the descriptions. But, on the other hand, if an observer doesn't know what to look for, he can scarcely be blamed for not finding anything, either. At the moment, in respect to LDEs, we can't even specify that the thing we are looking for has four legs and fur; this "field" we are investigating — to push the analogy further — might contain anything from a katydid to a kangaroo.

The diversity of reported effects is impressive. In longitude, the locations at which LDEs have been heard range from Africa to the Marshall Islands; in latitude, from Peru to Canada. The reported delays range from fractions of a second to over five minutes. The radio frequencies at which unusual echoes appear extend all the way from 810 kHz up through 144 MHz. A purpose of this article is to list what has been reported, in the hope that it may stir latent memories and/or stimulate future observations.

Are the Echoes Real or Imagined?

The first step in trying to understand LDEs is to ask whether they could be a trick of the imagination. The hearing of "voices" is a well-known feature of some psychological derangements — we all have our disoriented moments; why don't we hear occasionally our own voices or "fists" repeating themselves? The authors have consulted four psychologists on this question, including two specialists in "cognition", or the science of how the spoken or written word is perceived.[3] They indicate that the possibility of psychological origin for the shorter delays — one or two seconds — should not be ruled out. But at the moment a physical — rather than a psychological — explanation for the longer delays seems to them more plausible. (On the other hand, physicists seem to feel that short delays will be much easier to explain than the longer ones!)

"WATCH OUT FOR WOODCHUCKS; REPORT WHAT YOU HEAR, NOT WHAT YOU THINK YOU WERE SUPPOSED TO HAVE HEARD."

Table I

Name	*Call*	*Date*	*GMT*	*Band MHz*	*Emission*	*Delay, Sec*	*Duration, Sec*	*Own/Other*	*Location*	*Interval Audible*	*What Was Heard*
Barton, A. J.	K4OHK	5/21/60	≈2300	21	cw	4–5	4–5	both	Tripoli, Libya	4 min	Complete contest call and signal exchange at 30 wpm.
Bates, H. S.	WA4FIU	March, 1934	morning (local)	28	a-m	1–2	1–2	own	Rome, New York	few min	Repeat of call letters "W8GWZ".
Beck, K. H.	W3VDX	1950	late night (local)	7	cw	10–15	10–15	own	Newtown, Pa.	at least once	Call letters of called station plus "de W3VDX".
Birks, D.W.	K9IUI	2/3/68	1753	7	ssb	30	20	own	Minneapolis, Minn.	once only	After 30-second delay, heard "W9IOG, W9IOG, Peoria, Illinois, this is K9IUI portable ø Minneapolis, Minn."
Bock, A.	W1DNT	5/20/68	1230	14	ssb	2	2	own	Southwick, Mass.	once	"Thank you very very much."
Burr, A. F.	W5QNQ	10/8/68	2000	28	ssb	5	5	other	Las Cruces, N. M.	once	Delayed replica of a W2 transmission.
Butler, J. A.	K6CAZ	2/17/69	1445	14	ssb	1–2	1–2	own	Pacifica, Cal.	5 min approx	Heard own words repeated.
Carroll, R. E.	W8DZD	7/26/66	0218	21	ssb	½	½	other	Ann Arbor, Mich.	at least 3 min	Words of WA8LUI repeated.
Clark, C.	W7FFV	fall 1938	dusk, (local)	.850	a-m	½–2	½–2	other	Logan, Utah	20–30 sec	Heard distinct words, not just syllables. Koah Denver. Believed not to be a recording artifact.
Clark, V.	WN4NZK	7/20/69	0447	3.5	cw	1	1	own	Cullowhee, N. C.	once	Heard repeat of "K" after standing by.
Clement, A. J. F.	W6KPC	12/18/68	2000	28	ssb	1	1	other	Northridge, Cal.	2 min	Short whole words, like "power", "name", etc. Station was a W8.
Ernst, A.	W2EXX	winter, 1968–9	?	21	ssb	5	5	own	Buffalo, N. Y.	—	Heard repeat of signoff (one sequence of call letters); was weak but clear.
Feld, H. L.	OA4C	June or July, 1952	evening (local)	21	cw	5(?)	3	own	Lima, Peru	30 min	After standby, repeat of last three letters of own call, wavery.
Graf, C.	W5LFM	1/27/68	1400–1430	10.002 MHz	Time Ticks	½	½	other	San Antonio, Texas	30 min	Delay of seconds ticks on U.S.S.R. Station RID, relative to WWV.
Grandgent, C. M.	WA1FNJ	8/8/69	0013	3.5	cw	½	½	other	Granby, Conn.	once	Heard distinct echo of BTs on W1EO transmission.
Hall, W. R.	W3UVT	5/2/69	2345	14	ssb	15–18	12–15	own	Milford, Del.	1 min (?)	Entire directional CQ plus signature. Repeated call and heard echo a second time.
Hallock, D. B.	KØAZJ	11/20/61	0520	3.5	cw	½–1	½–1	own	Marion, Iowa	1 min	Echo of own signal.
Hill, E. R.	W3FEG	3/1/41	1612	14	a-m	22	22	other	Rehoboth, Del.	once	Weak repeat of a transmission of W5EBB in New Orleans, La.
Hollings, M. T.	OA4ED	March, 1954	late night (local)	21	cw	—	—	own	Lima, Peru	10 min	Heard one or two letters of own call repeated.
Horton, C.	WN3JET	1920's	?	7	cw	—	—	other	New England	—	Heard part of transmission of W1BFQ repeated.
Jenkins, D. S.	WA6OGH	June, 1965	0230	3.5	a-m	1.2–1.6	1.2–1.6	own	Tarzana, Cal.	once only	Heard words "off and clear, goodnight".
Jones, D. L.	W9WKU	3/7/59	0416	14	a-m	10	10	own	Deerfield, Ill.	few min	Heard "his and my calls" after two different standbys.
Kattan, G.	HK5BQW	12/30/68	0400	14	ssb	300	210	other	Cali, Colombia	once only	Repetition of several transmissions from VU2CT after contact had been completed.

Name	*Call*	*Date*	*GMT*	*Band MHz*	*Emission*	*Delay, Sec*	*Duration, Sec*	*Own/ Other*	*Location*	*Interval Audible*	*What Was Heard*
King, J. D.	W5LUU	winter, 1950–51	0300	7	cw	5	5	own	Baton Rouge, La.	few min	Heard own call letters repeated twice, after standby.
Liebmann, J. G.	W5ORH	1967	0320	144	a-m	2–2.5	2–2.5	own	Oklahoma City, Oklahoma	20 min	Repetition of own signals — believes delay 2–2.5 secs.
Lotze, A. W.	W6RQ	winter, 1932–33	0200–0400	7	cw	—	—	own	Indiana	—	Heard tail end of own CQ — believed that someone was calling him.
Lundstrom, R. A.	W9FUR	March, 1952	0400	14	cw	2–3	2–3	own	Sterling, Ill.	5 min	Heard own signals after 2–3 sec delay; believed another station was calling him. Repeated test several times.
MacKinnon, J. C.	KX6CG	5/31/57	1600–1800	14	cw	3–4	3–4	own	Eniwetok, M. I.	one half hour	Heard repetition of own signals; two other persons also heard the echoes.
Mattes, M. F.	WA2LOR	9/21/60	0045	14	a-m	6	6	own	East Williston, N. Y.	once only	Heard about nineteen words, part of the last transmission of a QSO.
Means, G. H.	W6ADP	10/16/32	≈1800	28	cw	18	18	own	Hollywood, Cal.	once only	Heard "ON4AU de W6ADP".
Miller, C. N.	WB6VKV	9/22/69	0100	14	cw	11	11	own	Alpine, Cal.	once only	Heard "WA3KQA de WB6VKV K".
Mix, D.	W1TS	6/24/59	0430	3.5	cw	—	—	other (W1CEG)	Falmouth, Mass.	several min	Echoes on New Britain, Connecticut station so severe that had to QRS to 5 wpm.
Montague, J. E.	KH6DVG	April, 1961	0400	14	cw	12–15	12–15	own	Honolulu, Hawaii	10 min	Heard "—Q CQ de KH6DVG K". Effect repeatable.
Myers, W. H.	W6OL	1/21/60	1536–1538	14	cw	6–10	6–10	other	San Jose, Cal.	once only	Heard echo on U.S.S.R. station (UT5).
Neal, J.	WA8ZNO	7/9/69	1633	7	cw	3–4	3–4	own	Clinton, Ohio	once only	Heard "VV de WA8ZNO".
Nold, D. E.	W9HFX	7/14/69	0413	14	ssb	20	15	own	Fort Wayne, Ind.	once only	Heard "CQ calling CQ this is W9HFX . . . etc." Carefully tried to duplicate, without success.
Noyes, G., Jr.	WA1DYU	early summer, 1966	≈0000	50	a-m	3–10	3–10	own & other	West Bridgewater, Mass.	5 min	Heard echoes on K1TZC and self.
Patterson, J. C.	W5VY	12/2/67	1328	28	ssb	4–5	4–5	own	San Antonio, Texas	only once	Heard "W5VY, W5VY, W5VY"
Prewitt, S. J.	W9TUT	2/3/60	2215–2218	.850	a-m	¼–½	¼–½	other	Hayden, Colo.	once only	Heard echo on KOA, Denver, local (i.e., non-network) broadcast.
Pulitzer, S. M.	W5JYK	4/26/69	afternoon (local)	14 may-be 21	cw	7	5	other	New Orleans, La.	once only	Echo sent "GB OM SK;" may have had *some* Doppler shift. Station probably in U. S.
Simpson, A. A.	VE4AS	2/25/69	0118	14	ssb	1	1	other	St. Boniface, Manitoba	10 min	YN1GLB had echo repeating words; by DF-ing source found to be to the north of both stations.
St. John, Ed	K6EV	November, 1965	0600–0700	14	ssb	3–4	3–4	own	Los Angeles, Cal.	observed echo twice	Heard "standing by for any DX call".
Thompson, J. H.	W1BIH	9/7/58	0345	14	cw	300	20(?)	own	Torrington, Conn.	once only	Heard complete repeat of his call to DX station, five minutes after standby.
Von Dielingen, D.	WAØKMD	winter, 1966	≈1600	21	a-m	4–5	4–5	other	Winfield, Kansas	5 min	Heard echoes on SW broadcast from East Coast station — N.Y.C.?
Wellman, H. J.	W8H8I	7/13/69	1341	14	ssb	1	1	other	Wyoming, Ohio	once only	Heard repeat of standby transmission of WA2YKU.
Wiggins, B. A.	W6ONY	12/1/61	0500	3.5	ssb	⅛–¼	⅛–½	own & other	Los Angeles, Cal.	½ hour	Echo heard by various stations in LA area, but not outside. Tape recording made.

Observations on Long-Delay Radio Echoes

An Opportunity for Amateur Cooperation

By J. H. Dellinger*

SPECIAL signals are being transmitted from two European stations for the study of long-delay echoes. The signals and the whole undertaking are adapted to the participation of persons all over the world who have high-frequency receiving sets, no technical training being required.

Long-delay echoes are a most surprising and baffling phenomenon. Mr. J. Huis was listening in Norway, one day in 1927, to telegraphic signals from station PCJJ in Holland on a frequency of about 9600 kc. Some of the signals were followed, after about 3 seconds, by a faint echo or reproduction. Echo signals occurring one-seventh of a second after an emitted signal had been well known, being due to the reception of waves that had travelled all the way around the earth. But the discovery of echoes after a materially greater interval than a seventh of a second immediately raised the puzzling question of where such an echo could come from.

The phenomenon has been verified in a few scattered observations by Dutch, British, and French engineers. Echoes have been heard from 1 to 30 seconds after the emitted signal. Not enough is known, however, to determine what causes the echo signals nor how they are propagated. Listeners with a high-frequency receiving set, listeners in all parts of the world have been enrolled in the endeavor, over 10,000 of them in Great Britain. It seems likely that information of unique value to science will result, and an orderly explanation of the curious phenomenon developed, when definite data are secured on the frequencies and the times of day and season at which these echoes occur, their intensities, the area over which a given echo is heard, their relation to magnetic storms, sunspots, etc.

THE SPECIAL TRANSMISSIONS

The stations transmitting the special signals are GSB, Daventry, England, and HBL, Geneva, Switzerland (the League of Nations station). The GSB signals are transmitted on 9510 kc., with a tone or modulation of 1000 cycles per second, each Sunday, Tuesday, and Thursday, from 3:25 to 3:55 a.m., Eastern Standard Time. The HBL signals are transmitted on 6675 kc., modulated continuous waves, each Sunday, Wednesday and Friday, from 6:30 to 6:50 a.m., E.S.T. Each transmission consists of a five-minute adjusting period (GSB using phonograph music, and HBL using its call letters in code repeated) followed by the letters of the alphabet in code, spaced a minute

Fig. 2—The first U.S. amateur search for LDE's! The article by the late J. H. Dellinger appeared in QST for August, 1934, and was drawn to the author's attention by Ray Rinaudo, W6ZO. It is not known whether any reports were received in response to this request. The special transmissions alluded to were in all likelihood far too infrequent.

Are the Echoes Hoaxes?

Unfortunately, the authors know of no way by which this can be ruled out in any given case. Extremely clever practical jokes have been pulled off in the past, and doubtless there will be more in the future. The number of hoaxes will probably grow with the number of people looking for LDEs, and with the amount of publicity the whole matter receives. Oddly enough, this fact is an important reason why *many* reports are needed: hoaxes often become obvious when a large number of observations are examined for internal consistency.

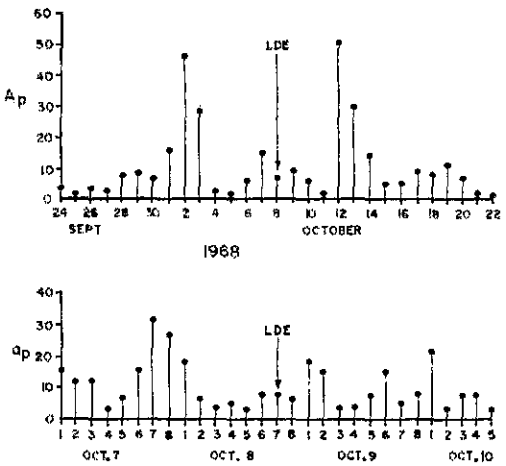

Fig. 3—Representative example (chosen at random) of the way in which LDEs seem to occur during dips in relative magnetic disturbance. The lower plot (ap) is an average of this quantity over three hours, plotted for each three-hour interval of the three-plus days centered on the LDE. The upper plot (Ap) is an average of the eight daily ap figures, plotted for each of the 30 days centered on the LDE.

Correlation with Magnetic Conditions

Dr. A. C. Fraser-Smith of Stanford University has correlated the level of magnetic activity on days when LDEs are reported with the average level for that month. He finds that "78 per cent of the LDEs occur on days which are quiet relative to the rest of the month". This finding needs further checking, but if it stands, it will be an important result because it tends to reduce the credibility of both the psychological origin theory and the "hoax" theory. There is little reason to believe that the tendency to hallucinate would be greater on days of low magnetic activity than on any other. Likewise, it seems unlikely that practical jokers would consult magnetograms before turning on their equipment.

Two Kinds of Echoes

A striking feature of several reports at 3.5 MHz is the fact that the echoes are heard on the signals of a particular station (usually one nearby) but not at the same time on other stations near to the same radio frequency but somewhat farther away. (This kind of observation is helped by the multiple-station netting usually practiced at the lower frequencies.) If the presence or absence of an echo is a sharp function of distance at the lower frequencies, a possible explanation is that the delay may be a consequence of slowed velocity of propagation accompanying deep penetration of the layers directly overhead.

At higher frequencies, such deep penetration of the layers is highly unlikely, and other explanations must be sought.

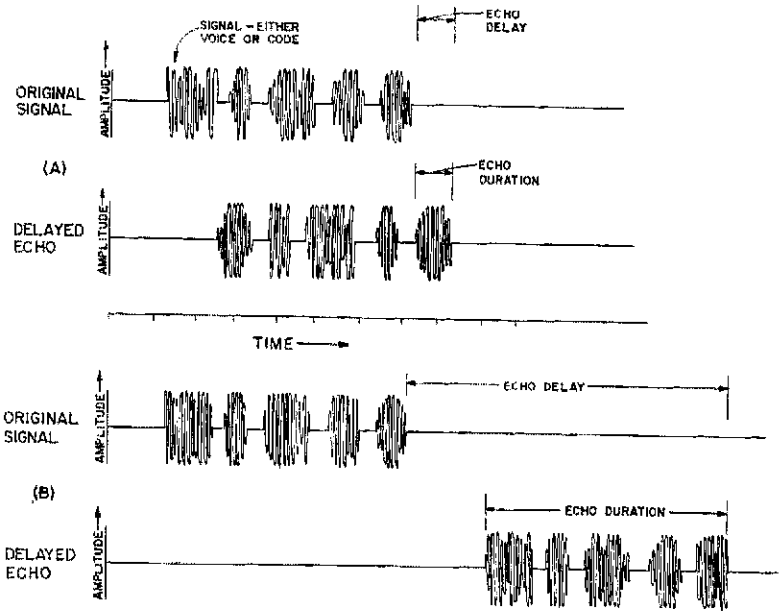

Fig. 4—Definition of "echo delay" and "echo duration." A—In this case echo delay equals echo duration. B—Here echo delay differs from echo duration.

One might imagine that if LDEs are in fact more likely to occur at times of magnetic calm, then more than one instance ought to be reported on the same day. But there are no such coincident reports thus far. One concludes from this that the chance of any given echo being heard must be very low. It is probable that a fairly large number of requirements must have to be satisfied in order for an echo to be observed. Some of these are not hard to visualize. For example:

1) The radio frequency may well have to be just right.
2) The frequency must be free of interference. The called station, or the other half of a QSO, or general QRM, must not drown out the echo.
3) The operator must be alert and aware that an echo of this sort is unusual and worth reporting.
4) Because the echoes are normally weak, the receiver must be sensitive and must be operating with sufficient gain so that antenna noise is audible, and
5) Any beam antenna should be pointing in roughly the right direction.

Of course, there may well be other requirements that cannot even be guessed at as yet!

On the Origin of the Longer LDE's

The longer LDEs are frequently reported when transmission in the higher-frequency bands is just opening up or shutting down. These are times of day when QRM is low, when long-distance propagation may be good, and when tilt-initiated ionosphere-to-ionosphere reflections often take place. Such reflections are now known to be an important feature of round-the-world (RTW) propagation,[3] but they have not as yet been studied in detail. With the aid of such propagation, the ionosphere can function as a giant echo box or "whispering gallery." Could LDEs be temporarily-lost whispers in the whispering-gallery? It's a possibility. For example, RTW propagation is also best at times of low magnetic activity.[4] In addition, only two of the reports thus far have mentioned any Doppler shift, although in many instances frequency changes as small as plus or minus 20 Hz ought to have been recognizable. This suggests that the "reflecting" regions — whatever they are — are relatively fixed in position, like the earth's ionosphere itself. On balance, it seems desirable — at least initially — to seek a relationship between LDEs and the quality of long-distance transmission.

A difficult thing to explain, however, is the fact that without exception — so far — only *one* echo is reported! Yet in the early days more than one repeat of a given test transmission was quite frequently noted. Is this entirely a threshold effect resulting from the lower powers of today?

It doesn't strain the imagination much to visualize that there might be times when the ionospheric echo box could achieve phenomenally high "*Q*", either due to fortuitous focussing or exceptionally low losses or both. In that event, however, one would expect to hear a jumble of decaying energy, rather like shouting at a piano with the damping of the strings removed. But no one has reported this type of behavior at all.

The authors will be grateful for further reports of echoes greater than one or two seconds in length. Shorter echoes can in general be explained by round-the-world propagation, and are of lesser interest. Address: W6QYT, Radioscience Laboratory, Stanford University, Stanford California 94305. All reports will be acknowledged and credit given.

Comments on the Reports

Table I is a summary of the principal features of the reports received thus far. Some reports which are inexact as to time, place, and other details, have been omitted. In cases where authors have submitted more than one report, the most complete one has been chosen for inclusion.

It can be seen that — strictly speaking — the list is not exclusively echoes of "long" delay, according to the classical definition of "long" which is 3–30 seconds. It is really a list of echoes which the observers felt to be unusual enough to report. The authors thought it wisest to be guided by the reporters' judgment in this respect. It is well known that the ability to estimate the passage of time depends strongly on the observer's mood. Hence, the estimates of echo duration in seconds must be treated with great caution except for those cases where there is memory of the exact words heard, and the rate of speaking or sending.

Of particular interest are the two reports of echoes heard in the broadcast band, the VHF reports, and the two reports of delays in the order of minutes.

Note that where an undesignated time appears, it is GMT and the date is GMT; where the time is designated as "local", the date is local. Also, please note the definition of "echo delay" and "echo duration," which is given in Fig. 4. "Audible interval" refers to the length of time during which the echoes could be heard.

Home station call letters are listed opposite reporters' names. The "location" column lists the locations (often different from home) at which the LDE's were actually heard.

References

[1] O. G. Villard, Jr., C. R. Graf and J. M. Lomasney, "Long-Delayed Echoes . . . Radio's 'Flying Saucer' Effect", *QST*, Vol. LIII, No. 5, May, 1969, pp. 38–43.

[2] Professors E. R. Hilgard and R. N. Shepard of Stanford University; Professor Colin Cherry of the Imperial College of Science of Technology, London, England and Dr. D. E. Broadbent of the Applied Psychology Research Unit Medical Research Council, Cambridge, England.

[3] R. B. Fenwick and O. G. Villard, Jr., "A Test of the Reality and Importance of Ionosphere-Ionosphere Reflections in Long Distance and Around-the-World High Frequency Propagation", *Journal of Geophysical Research*, Vol. 68, No. 20, October 15, 1963, pp. 5659–5666.

[4] R. B. Fenwick and O. G. Villard, Jr., "The Effect of Magnetic Storms on Around-the-World High-Frequency Propagation", *Journal of Geophysical Research*, Vol. 68, No. 16, August 15, 1963, pp. 4683-4688.

Acknowledgements

In addition to the reporters included in the list, the authors wish to thank the many others who have taken the trouble to write, and regret that space does not permit all the names to be included.

The report by W3FEG was referred to us by O. P. Ferrell.

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A.R.R.L. QSL Bureau

The function of the ARRL QSL Bureau System is to facilitate delivery to amateurs in the United States, its possessions and Canada of those QSL cards which arrive from amateur stations in other parts of the world. All you have to do is send your QSL manager (see list below) a stamped self-addressed envelope, about 4¼ by 9½ inches in size, with your name and address in the usual place on the front of the envelope and your call printed in capital letters in the upper left-hand corner.

Cards for stations in the United States and Canada should be sent to the proper call area bureau listed below.

W1, K1, WA1, WN1[1] — Hampden County Radio Association, Box 216 Forest Park Station, Springfield, Massachusetts 01108.

W2, K2, WA2, WB2, WN2 — North Jersey DX Assn., P.O. Box 505 Ridgewood, New Jersey 07451.

W3, K3, WA3, WN3 — Jesse Bieberman, W3KT, RD 1, Valley Hill Rd., Malvern, Pennsylvania 19355

W4, K4 — H. L. Parrish, K4HXF, RFD 5, Box 804, Hickory, North Carolina 28601.

WA4, WB4, WN4[1] — J. R. Baker, W4LR, 1402 Orange St., Melbourne Beach, Florida 32951.

W5, K5, WA5, WN5 — Hurley O. Saxon, K5QVH, P.O. Box 31367, El Paso, Texas 79931.

W6, K6, WA6, WB6, WN6 — No. California DX Club, Box 11, Los Altos, California 94022.

W7, K7, WA7, WN7 — Willamette Valley DX Club, Inc., P.O. Box 555, Portland, Oregon 97207.

W8, K8, WA8, WN8 — Paul R. Hubbard, WA8CXY, 921 Market St., Zanesville, Ohio 43701.

W9, K9, WA9, WN9 — Ray P. Birren, W9MSG, Box 519, Elmhurst, Illinois 60126.

WØ, KØ, WAØ, WNØ — Des Moines Radio Amateur Association, P.O. Box 88, Des Moines, Iowa 50301.

KP4 — Alicia Rodriguez, KP4CL, P.O. Box 1061, San Juan, P.R. 00902.

KZ5 — Gloria M. Spears, KZ5GS, Box 407, Balboa, Canal Zone.

KH6, WH6 — John H. Oka, KH6DQ, P.O. Box 101, Aiea, Oahu, Hawaii 96701.

KL7, WL7 — Alaska QSL Bureau, Star Route C, Wasilla, Alaska 99687.

VE1 — L. J. Fader, VE1FQ, P.O. Box 663, Halifax, N.S.

VE2 — John Ravenscroft, VE2NV, 353 Thorncrest Ave., Montreal 780, Quebec.

VE3 — R. H. Buckley, VE3UW, 20 Almont Road, Downview, Ontario.

VE4 — D. E. McVittie, VE4OX, 647 Academy Road, Winnipeg 9, Manitoba.

VE5[1] — A. Lloyd Jones, VE5JI, 2328 Grant Rd., Regina, Saskatchewan.

VE6 — Karel Tettelaar, VE6AAV, Sub. P.O. 55, N. Edmonton, Alberta.

VE7 — H. R. Hough, VE7HR, 1291 Simon Road, Victoria, British Columbia.

VE8 — George T. Kondo, VE8 ARRL QSL Bureau of Department of Transport, Norman Wells, N.W.T.

VO1 — Ernest Ash, VO1AA, P.O. Box 6, St. John's Newf.

VO2 — Goose Bay Amateur Radio Club, P.O. Box 232, Goose Bay, Labrador.

SWL — Leroy Waite, 39 Hannum St., Ballston Spa, New York 12020.

[1] *These bureaus prefer 5 × 8 inch or #50 manila envelopes.*