DEAD ZONE

As we continue to research and document the events of July 2, 1937 it becomes increasingly clear that the key to understanding what happened to Amelia Earhart and Fred Noonan, both before and after they were declared lost, is to be found in the only link they had to the world outside their airplane – radio. Except for one account (not written down until 1940) of an airplane said to have been heard high in the nighttime sky over the Gilbertese island of Tabituea, no one saw or heard the Electra after it left New Guinea. One hundred percent of what we know about the flight's progress from that moment on comes from what was heard, and not heard, over the radio receivers of those who were listening. The most obvious clues to the situation aboard the Electra are to be found in the words which make up the messages. Perhaps the most famous, also generally regarded as Amelia's last, was recorded in the USCG *Itasca's* radio log at 0844-46 local time:

> KHAQQ to Itasca. We are on the line 157 337. Will repeat message. We will repeat this on 6210 Kilocycles. Wait. *and then a few minutes later* We are running on north and south line.

Just what these words mean, if indeed they were recorded accurately, has been debated since the moment they were heard. But the information in the message is not limited to the words themselves. Because her voice was carried by radio, additional information is available from the known characteristics and limitations of those electromagnetic waves.

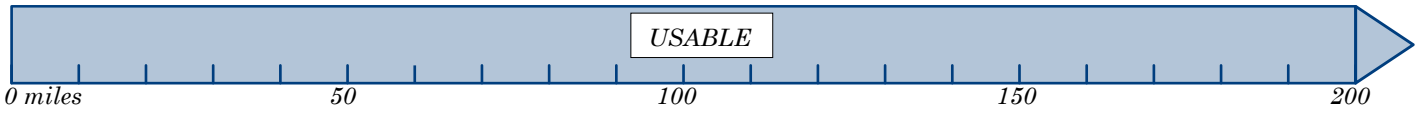
PLS STAY ON 3105 KCS;
DO NOT HR U ON 6210 …

The *Itasca* received the above transmission on a frequency of 3105 Kilocycles (today known as Kilohertz) at maximum strength (five on a scale of one to five). The Electra's Western Electric Type 13C transmitter had an output of only 50 watts, so the "S5" signal strength indicated to the captain of the *Itasca* that the aircraft was not more than 100 nautical miles from his ship. The frequency to which Amelia said she was changing, 6210 Kilocycles, was a standard aviation frequency. And yet, no further transmissions were heard by the *Itasca*. What happened? The abrupt silence has long been seen as clear evidence of fuel exhaustion and a crash at sea.

But there is another explanation for the loss of radio contact. TIGHAR's senior researcher for the Earhart Project, Randy Jacobson (#1364) has recently uncovered Fleet Communications Memorandum 2RM-37 dated 25 April 1937. This U.S. Navy document includes skip-distance diagrams which detail the performance to be expected from various radio frequencies during daytime and nighttime hours. Based upon these diagrams, Earhart's two frequencies could be expected to behave as shown in Figure 1 on page 4.

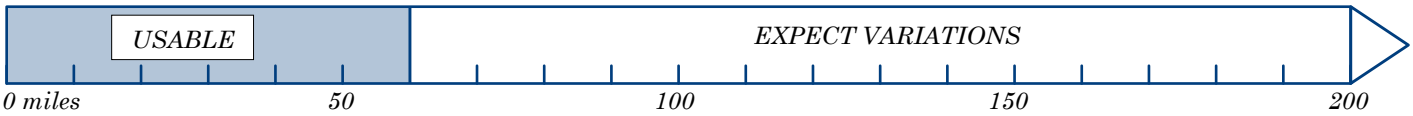
From these predictions it is easy to see why Earhart considered 3105 to be her "nighttime" and 6210 her "daytime" frequency. It also makes sense that, following her take-off, the radio operator at Lae heard several daytime position reports on 6210. The last one, received just before nightfall (17:18 New Guinea time), placed her 735 nm from Lae – within the usable daytime range

3105 KCS NIGHT



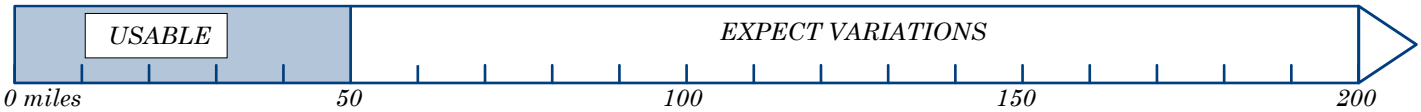
During hours of darkness, 3105 KCS is usable out to 1,000 miles.

3105 KCS DAY



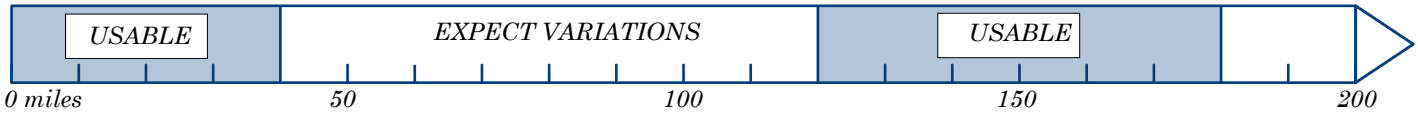
During daylight hours, 3105 KCS is not reliable at distances greater than 60 miles.

6210 KCS NIGHT



During hours of darkness, 6210 becomes usable again from 350 to 750 miles, is unreliable from 750 to 850 miles, then is usable all the way out to 4,000 miles.

6210 KCS DAY



During daylight hours , 6210 becomes usable again from 250 to 400 miles, is unreliable from 400 to 500 miles, then is usable out to 800 miles.

Figure 1.

for that frequency. Likewise, *Itasca* heard its first faint transmission from the airplane on 3105 at 02:45 local time when it was probably about 650 nm away. Gradually the signal got stronger as the Electra drew closer until, as dawn broke over Howland Island at 06:15 local time, Earhart's estimate that she was "about 200 miles out" was received at strength 3. Half an hour later, at 06:46 local time, she was coming in at strength 4 and announcing that she was "about 100 miles out." Because the 200 knot groundspeed implied by these two position estimates is not consistent with the Electra's 130 knot cruising speed, there has been much speculation as to which, if either, was correct. Noting the severe degradation in range to be expected on 3105 after sunrise, and knowing that Noonan could not establish his Line Of Position until after the sun was up, it now appears likely that the latter estimate was the more accurate.

By 07:42 local time the *Itasca* was hearing Earhart's voice at maximum strength (S5) in broad daylight on 3105 KCS and her signals remained strong through her final message an hour later. Based on the known output of her transmitter, the Coast Guard felt that she had to be within 100 miles. The Navy's skip-distance diagrams, however, indicate that she was even closer – within 60 miles – and, indeed, the Army Air Corps representative aboard the *Itasca*, Lieutenant Daniel Cooper, thought she was "probably within 50 miles." The loss of signal experienced by *Itasca* when Earhart switched to 6210 KCS was most logically the natural result of her being in a dead zone for that frequency.

Understanding that the boundaries indicated on the Navy's skip-distance diagrams are not absolute, we can, nonetheless, draw some general conclusions about where Earhart had to be when contact was lost at 08:46 local time and in what direction the Electra was most likely travelling. Because *Itasca* was hearing her in daylight on 3105, she was within roughly 60 miles of Howland Island. But because *Itasca* did not hear her when she switched to 6210, she was not

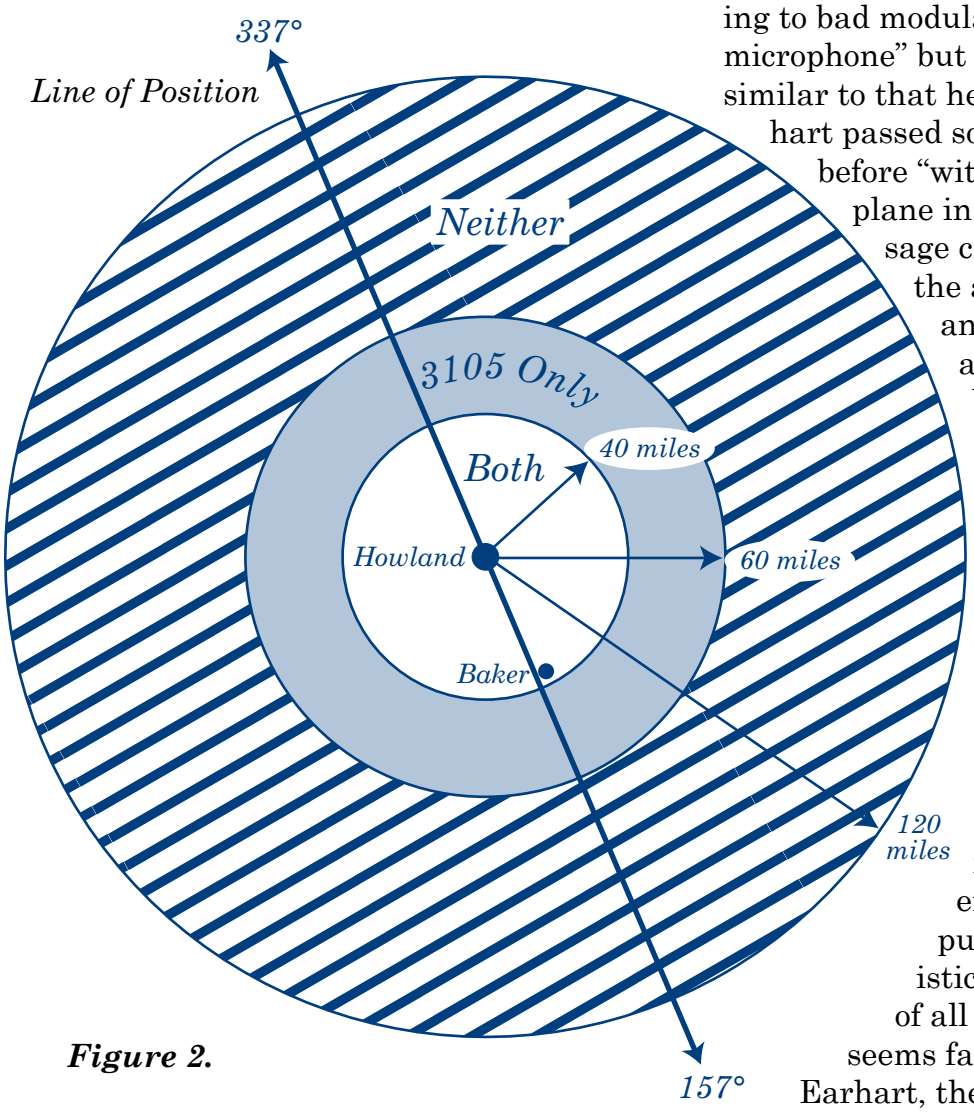


Figure 2.

within approximately 40 miles of the island. That puts the airplane somewhere within the 20 mile band shown above and, as she said, following her described Line Of Position. Had she been travelling toward Howland, the *Itasca* should have soon been able to pick up her transmissions on either frequency. But that didn't happen. It therefore appears that she was travelling away from the island and, within a few miles, into a dead zone common to both frequencies (see Figure 2).

Whether she was north of Howland and headed northwestward or south of the island and headed southeastward is impossible to determine from the skip-distance diagrams alone. However, a transmission on 6210 heard by the radio operator on the island of Nauru late that same night seems to provide a clue. The words were unintelligible "owing to bad modulation or speaker shouting in microphone" but the signal was described as similar to that heard by Nauru when Earhart passed south of that island the night before "with exception of no hum of plane in background." If the message came from the Lockheed then the airplane had to be down on an island. (If the Electra were afloat the radios would have been underwater.) There is no land northwest of Howland within the airplane's remaining 500 nm range. (The closest of the Japanese mandated Marshall Islands is some 800 nm away.) Three hundred fifty nautical miles southeast of Howland is Nikumaroro, then known as Gardner Island. The atoll's 1200 mile distance from Nauru is entirely consistent with the published nighttime characteristics of 6210 KCS. In the light of all the available evidence it seems fair to say that if Nauru heard Earhart, then Earhart was at Gardner. Fleet Communications Memorandum 2RM-37 does not prove that the Earhart flight ended at Nikumaroro. It does, however, offer the first documented explanation of why the *Itasca's* reception of messages from Earhart stopped abruptly when she changed frequencies.