

Gary wrote:

I have written before:

"Paul, I for one never believed that Noonan made a navigational error. He was too experienced, too motivated (his life was on the line) and the techniques being used were well proven and of sufficient accuracy to have allowed them to find Howland."

There is a lot of evidence that he was careful and competent. I think all the stories that came out after the flight besmirching him personally and his abilities were for the purpose of exonerating the popular and well known American heroine celebrity AE from fault for the disappearance, Fred was made the fall guy since he was an unknown nobody.

I posted before that Fred would have been motivated to do a very competent job on this leg since it was the sole reason that he was brought along. Further proof of that was written by AE in "Last Flight", "Fred Noonan has been unable, because of radio difficulties, to set his chronometers. Any lack of knowledge of their fastness and slowness would defeat the accuracy of celestial navigation. Howland is such a small spot in the Pacific that every aid to locating it must be available."

They had to delay the flight for a day so that Fred could get a radio time signal (it was only broadcast once a day from Australia) so he could check his chronometers to determine how fast or slow they were. This would not have been necessary if they were just planning to use radio bearings to find Howland.

This necessity for very accurate time is probably not understood by most people on this forum. The earth turns at a rate of 900 knots (900 nautical miles per hour, or 1035 mph) at the equator which means that it turns one nautical mile every four seconds. Without getting into the details of how celestial navigation computations are done, it works out that if your chronometer (a very accurate clock) is slow by just four seconds then your celestial computations will place you one nautical mile further west than where you actually are. If it is fast then you will think you are east of where you actually are. It doesn't take too many seconds of unknown chronometer error to cause you to miss Howland.

If they were just going to use radio bearings then AE didn't need Fred, she could do that herself since the radio equipment was in the cockpit. It is obvious, then, that the entire world flight was planned around the need to use celestial to find Howland.

I had also posted that Fred would have pre computed the landfall procedure so that it could be easily accomplished after a long and tiring flight. I believe that he would have done this on the ground before takeoff either that morning or the day before or early in the flight before becoming fatigued. These computations would have only taken about one hour using Dreisonstok and plotting the altitude curve on graph paper for the sun's and moon's altitudes as calculated at Howland. With this pre computed he could take many shots with his sextant and compare the measured altitudes with those on the graph and know instantly if they were staying on the LOP to Howland. No further complex computations would need to be done in flight while approaching the island.

Even if they were planning to use a radio bearing to find Howland and celestial was planned only as a backup Fred would have known not to count on the radio working since it had failed them approaching Dakar. In fact he didn't have to think back that far. The day before the last flight they had had their radio repaired and had test flown the plane to check out its operation. They were unable to get a null which meant that the radio direction finder WAS NOT WORKING. For some inexplicable reason they ignored that blatant fact and decided that the problem was that they were too close to the station. Certainly Noonan appreciated this was at least a potential problem and would have redoubled his effort to make sure that he did everything possible to ensure that celestial would get them to Howland. If he hadn't been confident of this they would not have left with an unproven radio direction finder.

I don't know how many instrument rated pilots we have on this forum. I am an airline transport pilot for single

and multi-engine land planes and rated in some jets and I have also been an instrument flight instructor since 1972 so I have some knowledge of how radio direction finders work since they were common navigation equipment in airplanes used for flight in the clouds until the recent development of GPS. (I also have a radio amateur operators license, call sign KA9UHH.)

When flying on instruments you are inside the clouds and can't see any landmarks, obstructions or airports. In order to navigate without visual references you rely on different systems of radio navigation equipment which for many years included radio direction finders very similar to the one installed in NR16020. This equipment uses long wave radio signals in the band of 190 to 535 kilocycles (now kilohertz) just below the A.M. broadcast band and including 500 kcs the international calling and distress frequency. This was the frequency that Itasca was broadcasting on. AE's radio direction finder should have been able to get a null and and so determine the bearing to fly to get to Itasca.

Getting a null involves turning the loop antenna until it is lined up with the direction of the incoming signal which is shown by the received signal getting weaker and weaker until it disappears, this is the "null." If you turn the antenna past the null the signal starts to get louder very rapidly. The width of this null is very narrow so that the bearing can be determined very accurately.

This type of equipment is good for a very long distance mainly determined by the power of the transmitting station. For enroute navigation, airways, like "highways in the sky" were created with radio transmitters placed on the ground at each end of each leg of the airway. The signals have to be strong enough so that you can receive them at the halfway point of each airway leg. You track outbound from one station until halfway to the next station then start following the signal to the second station. As an example, a route I flew many times was "A17" from Bimini, Bahamas to Puerto Rico. You take off from Miami or Ft. Lauderdale and tune in the radio station on Bimini which transmits on 396 kcs with a morse code identification of "ZBB." You use the radio direction finder to head for Bimini which is 55 NM from Ft. Lauderdale. After passing over Bimini you turn to a heading of 121° magnetic and track outbound until halfway to the next radio station located on the island of Grand Turk at the very southeast end of the Bahamas chain. Grand Turk transmits on a freq. of 232 kcs with the ident of "GT." After passing GT the next station is located on the north shore of Puerto Rico about 60 miles west of San Juan transmitting on the frequency of 391 kcs, ident "DDP." Now here is the important part, the leg from ZBB to GT is 516 NM (593 miles). This means that you can receive the signal 258 NM at least from each station. It is reasonable to believe that had AE's radio direction finder been working she would have been able to hear Itasca at a similar distance. This is born out by the fact that Itasca heard AE's much less powerful transmitter several hundred NM out.

Since the leg from Lae to Howland is 2222 NM and the common estimate of DR accuracy is 10% of the distance flown then one could expect to fly the distance from Lae to Howland solely by dead reckoning and still be confident of coming within in 222 NM of Itasca and so be close enough to pick up the radio signal and track inbound to Howland. So if AE was willing to rely only on radio she didn't need Fred. But obviously they wouldn't just rely on radio.

It is hard for young people today who have grown up with cell phones, the internet, TV, satellite dishes and IPODs to have any gut feeling for the unreliability of radio equipment in the 1930s. Modern equipment and systems are so reliable people don't even think about it anymore. But in the '30s comparing the reliability and trust in complicated pieces of electronic equipment with resistors, capacitors, and tubes that burned out without warning in your own equipment and in the transmitting equipment that was not under your control with the proven reliability of a simple sextant, a book of tables and a clock (or two clocks for redundancy) and celestial won hands down. That was why AE hauled Fred all the way around the world.

Back to the use of radio direction finders. When flying on instruments you eventually have to descend to land at an airport that you can't see while you are in the clouds that might be in a valley surrounded by mountains. You fly to the approach radio station on a specified course and altitude and then after you pass over the transmitter's antenna you know it is safe to descend down to the minimum decent altitude that has been established by the FAA for the approach to that airport which takes into account the height of surrounding obstacles and the altitude

of the airport and the distance from the transmitter to the runway. When you pass over the antenna and start your final decent you start a stop watch. Your approach chart tells how many minutes and seconds it will take you to fly from the station to the runway at various ground speeds. After you descend to the minimum decent altitude you maintain it until you see the runway or until the time runs out by which you know you have passed over the runway without seeing it so you must climb and go to your alternate.

The reason I went through this long winded explanation is so everyone will understand that the radio direction finder works right over the transmitting antenna, you can't get closer than that. AE dismissing the failure of her radio direction finder because she thought she was too close to the transmitter shows either she didn't understand its operation or she was satisfied that celestial alone was sufficient to get them to Howland. I think the latter explanation makes the most sense since they could have (and probably did) check the radio direction finder operation as they flew farther away from Lae and continued on even though it is apparent that it wasn't working. Again, this would have made Fred work real hard on his celestial since he knew, actually KNEW, that he couldn't depend on the radio.

Based on all this I believe Fred knew he had to do an exemplary job of celestial navigation and if the radio did per chance work when they got to Howland then "no harm, no foul." He had confidence in celestial and knew it had sufficient accuracy to locate Howland or he wouldn't have gotten in the plane.