

TIGHAR TRACKS

THE JOURNAL OF THE INTERNATIONAL GROUP FOR HISTORIC AIRCRAFT RECOVERY





*... that they might escape the teeth of time and
the hands of mistaken zeal.*

— JOHN AUBREY
STONEHENGE MANUSCRIPTS
1660

ABOUT TIGHAR

TIGHAR (pronounced “tiger”) is the acronym for The International Group for Historic Aircraft Recovery, a non-profit foundation dedicated to promoting responsible aviation archeology and historic preservation. TIGHAR’s activities include:

- Compiling and verifying reports of rare and historic aircraft surviving in remote areas.
- Conducting investigations and recovery expeditions in co-operation with museums and collections worldwide.
- Serving as a voice for integrity, responsibility, and professionalism in the field of aviation historic preservation.

TIGHAR maintains no collection of its own, nor does it engage in the restoration or buying and selling of artifacts. The foundation devotes its resources to the saving of endangered historic aircraft wherever they may be found, and to the education of the international public in the need to preserve the relics of the history of flight.

TIGHAR Tracks is the official publication of The International Group for Historic Aircraft Recovery. A subscription to *TIGHAR Tracks* is included as part of membership in the foundation (minimum donation \$55.00 per year).

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ON THE COVER

The pen is mightier than the throttle. Amelia Earhart’s work as an advocate and consultant had a greater impact on the development of commercial aviation than did her record-setting flights. See page 54. Photo courtesy of the Minnesota Historical Society. Used by permission.

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A TIGHAR Selfie



In preparing for a direct mail membership campaign to boost our numbers, we commissioned a research company to do a demographic study of the current TIGHAR membership. We always knew that TIGHARs are a special bunch but what we learned about you knocked our stripes off.

To be clear, we do not have specific data on individual members beyond the basic contact information you have given us, but through the same data-mining techniques that enable retailers you've never heard of to send you advertisements for products you're actually interested in, the research company was able to tell us a great deal about what sort of person finds value in being a member of TIGHAR. We'll use that information to direct our mailing campaign toward more people like you.

So what did we learn? Briefly, as a group:

- Nearly all of you are between 34 and 74 years of age. Almost 40% of you are between 55 and 64. Only 8% of you are retired.
- Income-wise you're not in the legendary 1%, but you're in the top 2.5%.
- 65% of you have a four-year college degree. 30% of you completed graduate school.
- 90% of you are home owners
- Nearly half of you (46%) are professionals in a technical field.
- You're more interested in reading than in television.
- You're more interested in science, aviation/space, and history, and less interested in spectator sports than the average American.

In this, TIGHAR's thirtieth year, there are just over a thousand TIGHAR members in twenty-six countries worldwide. With five thousand members we could do much more and still provide the level of personal attention you have come to expect from your organization.

As the new member campaign comes together we'll be doing some test marketing before we commit to an expensive mass mailing. We'll let you know how that goes. We invite your input on how we can build a larger, stronger TIGHAR. Please send your suggestions to ric@tighar.org.





À Coeur Valliant



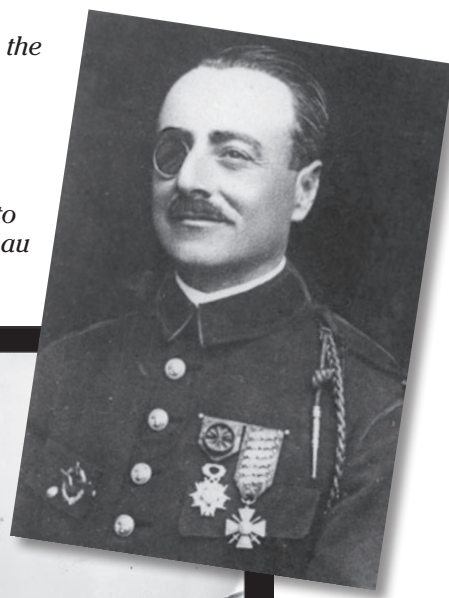
On May 8, 1927 two French World War One aces, Charles Nungesser and François Coli, lifted their giant white biplane l'Oiseau Blanc (the White Bird) from Le Bourget Field outside Paris and headed westward across the Atlantic, only to vanish, as Lindbergh later wrote, “like midnight ghosts.” If they had landed in New York, winning the \$25,000 Orteig

Prize – as everyone, including Lindbergh, expected – the Lone Eagle would not have flown to Paris a few days later. The tremendous boost to American aviation interest and innovation that resulted from his solo triumph would not have happened. The consequences, in the light of later events, can only be imagined.



Charles Nungesser, left, and François Coli, right, the crew of l'Oiseau Blanc.

Navigator François Coli stands in the cockpit to guide pilot Charles Nungesser as he taxis l'Oiseau Blanc across a field. TIGHAR collection.



Getting It Wrong

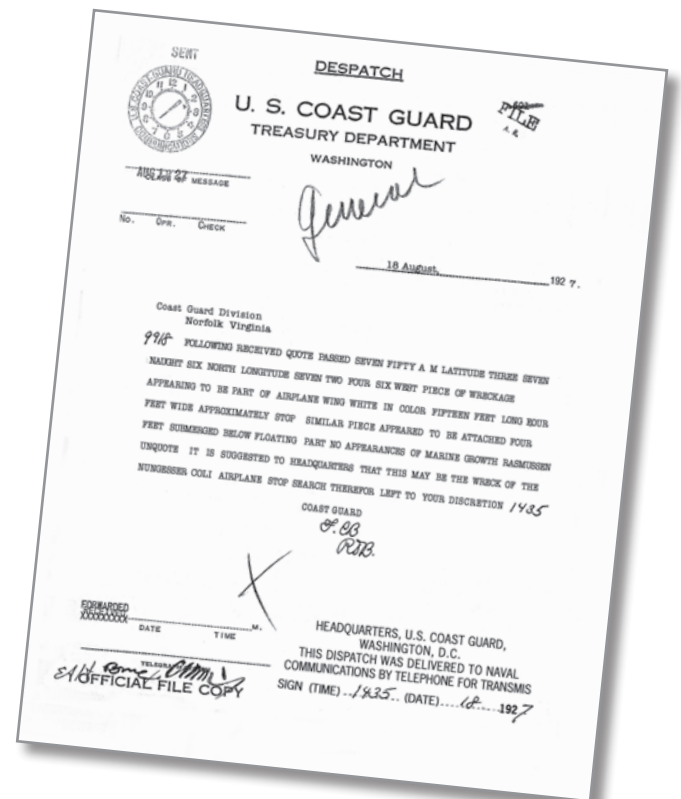
Today this hinge-pin of history, when it is remembered at all, is commonly misunderstood and misrepresented. On September 6, 2011, the front page of the *Wall Street Journal* carried an article headlined: “Charles Lindbergh Won the Prize, but Did His Rival Get There First?” The answer, of course, is no. The prize was for the first nonstop flight, in either direction, between Paris and New York. Wherever Nungesser and Coli ended up, it wasn’t New York. Lindbergh made it all the way to Paris. N’est ce pas?

The *Wall Street Journal* article described the research of French aviation enthusiast Bernard Decré who “is on his own quest—to rewrite history.” Decré is out to prove that l’Oiseau Blanc flew over Newfoundland before crashing off the coast of Canada. “Messrs. Nungesser and Coli would then have held the world flight distance record if only for 12 days and under tragic circumstances.” Wrong again. A record requires a successful flight. A trip that ends with the loss of the aircraft and the death of the crew is hardly successful.

There is a great deal of solid documentary evidence to suggest that l’Oiseau Blanc did get as far as Newfoundland, but M. Decré’s hypothesis that it crashed into the sea near the French-owned islands of St. Pierre and Miquelon is based on a sketchy story about fishermen hearing something crash into the sea in the fog. He considers his best supporting evidence to be a document he discovered in the U.S. National Archives. The *Wall Street Journal* describes it as “a 1927 telegram that reported sighting parts of the plane three months after the flight.” Specifically, “A Coast Guard officer said he had seen a pair of joined white wings floating several hundred miles off the coast.” M. Decré remembers, “My heart started pounding.”

On his blog M. Decré says:

- After having analysed 80 archives boxes, we have discovered texts confirming the presence of pieces of white aeroplane wings, floating from Saint Pierre & Miquelon, the French territory, to Portland!
- The most interesting piece is a telegramme, written by a Coast Guards ship captain on August 18th, 1927, to inform his superiors that two white wings, attached one on top of the other, were floating near his ship, and seem to be the wings of Nungesser & Coli’s aircraft. The analysis of sea current (Labrador) at those dates (from May to August 1927) match.



U.S. Coast Guard telegram dated August 18, 1927. National Archives.

A closer reading of the telegram might have stilled his pounding heart. Translating from telegraphese, it says:

Following received, “Passed at 07:50 AM, latitude 37° 06’ North, longitude 72° 46’ West, piece of wreckage appearing to be part of airplane wing, white in color, 15 feet long, 4 feet wide approximately. Similar piece appeared to be attached four feet submerged below floating part, no appearance of marine growth. Rasmussen.” It is suggested to headquarters that this may be the wreck of the Nungesser/Coli airplane. Search therefore left to your discretion.

M. Decré’s interpretation of the telegram is mistaken on several counts.

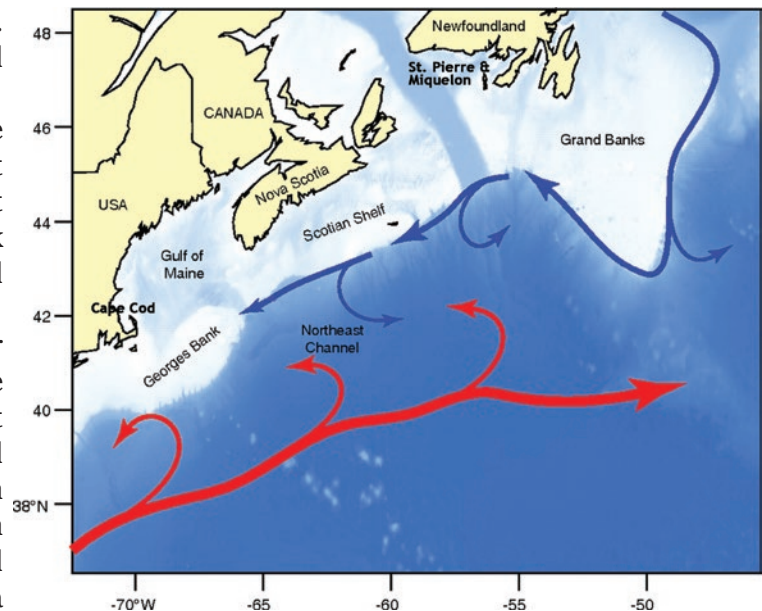
The latitude/longitude coordinates in the telegram do not describe a point near Portland, Maine. The position is 150 miles east of Norfolk, Virginia – fully one thousand miles from St. Pierre and Miquelon.

The telegram is not a report of a sighting by a Coast Guard officer. Coast Guard Headquarters in Washington received a message from a source identified only as “Rasmussen.” Someone at headquarters typed up the telegram and telephoned it to Naval Communications for transmission to the Coast Guard’s Norfolk Division. Any Coast Guard officer in the Atlantic off Norfolk should have reported a wreckage

sighting to Norfolk Division, not Washington. The sighting was probably made and reported by a commercial vessel.

“Rasmussen” did not connect the wreckage with the White Bird. It was someone at Coast Guard headquarters, who came up with that idea. Apparently Norfolk Division didn’t think it was worth investigating further. It’s not hard to understand why.

The sighting did not occur in the Labrador current, which flows southwestward along the North American coast as far as Cape Cod, at which point it dives deep, carrying its cold water south in the never-ending circulation of the North Atlantic. The debris was seen in the Gulf Stream which flows northeastward at the surface. It’s difficult to imagine how a floating wing could travel a thousand miles southwestward in a northeasterly flowing current.

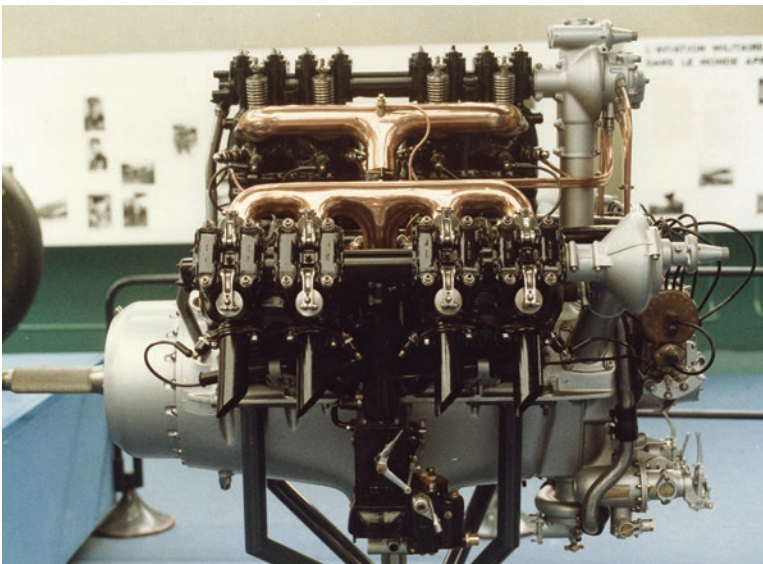


Getting It Right

The quest to find whatever remains of l’Oiseau Blanc is TIGHAR’s oldest, and in some ways dearest, project. Twenty search expeditions in the hills of eastern Maine and nine in Newfoundland have tracked the probable crash site of the White Bird to a few square miles of desolate muskeg on Newfoundland’s fog-shrouded Cape Shore peninsula. All that now likely remains of what was basically a biodegradable wood and fabric aircraft is its massive engine.

Finding it among the countless moss-covered boulders and shallow ponds is a matter of identifying and deploying the right technology. We’re currently investigating some new possibilities. If we can find the crash site we might also be able to find the gold, silver and platinum teeth, plates, and pins used to repair Nungesser’s numerous wartime injuries. One-eyed Coli’s trademark black monocle should also be there.

When valiant hearts vanish – whether their names are Amelia and Fred or Charles and François – they should be found. We’ll find them yet.



L’Oiseau Blanc was powered by a 450 hp 12-cylinder Lorraine Dietrich engine like this one on display at the Musée de l’Air. TIGHAR collection.



Explaining his macabre personal coat of arms, Nungesser is reported to have said, "À coeur vaillant rien d'impossible, même dans ses aspects terribles." (To the valiant heart nothing is impossible, even in its most terrible aspects). TIGHAR collection.



What We Know About 2-2-V-1

Mark Twain said, “History doesn’t repeat itself, but it does rhyme.” Or maybe he didn’t, but whoever said it, it does seem to be true. In 2015 a flaperon from the missing Malaysian Flight MH370 was discovered washed up on La Reunion Island, sixteen months after the Boeing 777 disappeared. In 1937 a tire and undercarriage leg from Lady Southern Cross

were found washed up on Aye Island in the Andaman Sea. The Lockheed Altair flown by Sir Charles Kingsford Smith had disappeared eighteen months earlier. In 1991 a section of aluminum aircraft skin was found washed up on Nikumaroro in the Central Pacific region where Amelia Earhart vanished fifty-four years before.



“You might want to look at this.”

TIGHAR’s first expedition to Nikumaroro in 1989 included a visual and metal detector search of the beach in the vicinity of the landing channel, an inspection of the nearby Gardner Co-Op Store and a search of the abandoned village immediately inland. When we returned to the island two years later we discovered that the area inshore from the landing channel had been devastated by a storm surge. Beachfront vegetation had been ripped out and washed into piles against trees inland. A twenty-foot tall concrete beacon that had marked the landing channel was cleaned off at its base leaving only a few pieces of bent re-bar. The seaward-facing wall of the Gardner Co-Op Store was knocked down. While photographing the collapsed roof of the store TIGHAR president Pat Thrasher came upon a sheet of aluminum among the washed-up coconuts and palm fronds. She

shouted to her husband Ric Gillespie a few hundred feet away...and so it began.

For the past twenty-four years that battered scrap of aluminum sheet, now known as TIGHAR Artifact 2-2-V-1, has been one of the most puzzling, promising, contentious and controversial items in the pantheon of possible clues to Amelia Earhart’s fate. Despite years of research, forensic analysis, and consultation with experts of every description, conclusive identification of the artifact eludes us.

Identifying an artifact like this shouldn’t be that hard. You identify an unknown object by finding an exact match to a known object. We’ve done it a hundred times. There is no doubt that 2-2-V-1 was once part of an airplane. The materials tell us that it’s from a WWII or earlier type of all-metal aircraft. It was found on an island in the Central Pacific. The damage tells

us that it is a piece of wreckage from an aircraft that met a violent fate, and aircraft losses in the region are well documented. All of those factors greatly limit the possible airplanes the piece could have come from, and yet the artifact's "fingerprint" of material and rivet pattern doesn't match the standard construction of any of them, including the Lockheed Electra.

"... a high degree of certainty..."

On October 28, 2014, TIGHAR created something of a media firestorm when we announced that Artifact 2-2-V-1 has been identified to a high degree of certainty as being from Amelia Earhart's lost Lockheed Electra aircraft.

"According to researchers at The International Group for Historic Aircraft Recovery (TIGHAR), which has long been investigating the last, fateful flight taken by Earhart 77 years ago, the aluminum sheet is a patch of metal installed on the Electra during the aviator's eight-day stay in Miami, which was the fourth stop on her attempt to circumnavigate the globe."

—DiscoveryNews.com

The media often overstate our findings. Of course we did not say the sheet IS the patch. There's no way to make a conclusive

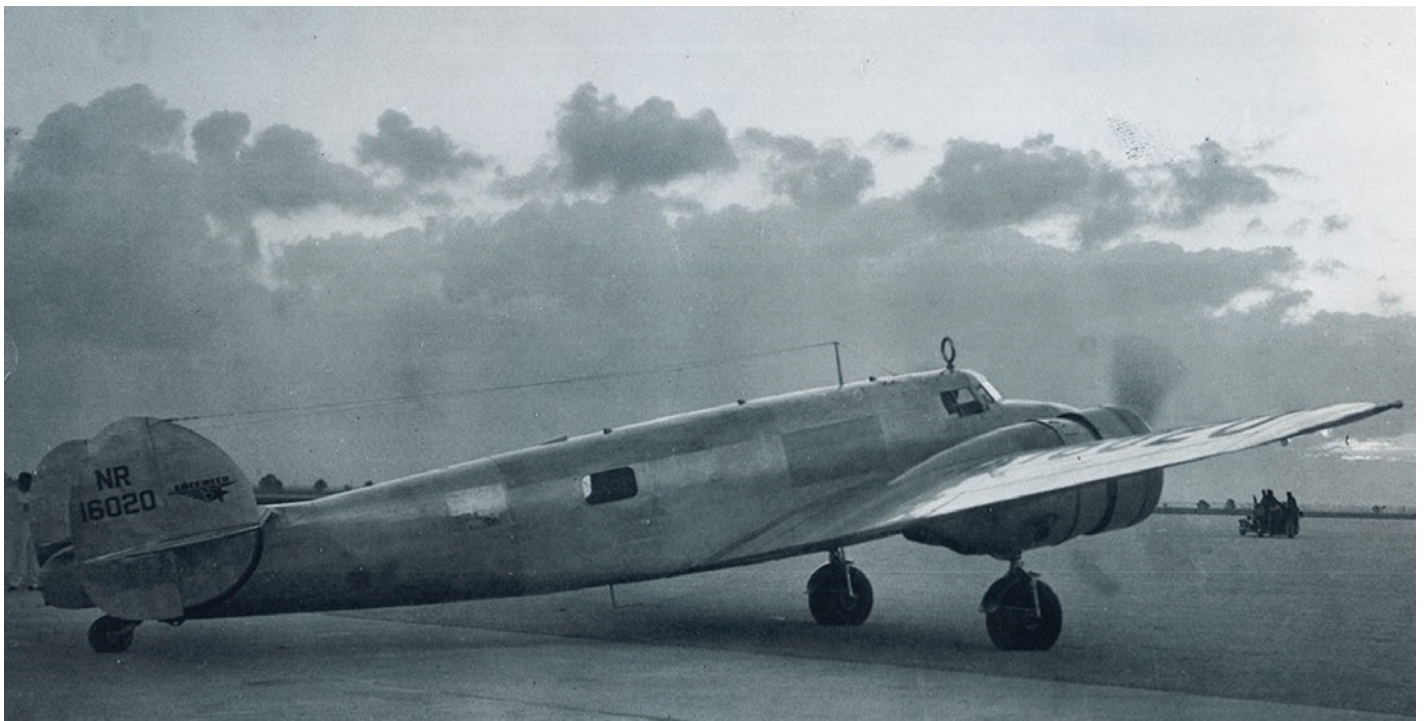
identification without finding the rest of the airplane which, as you may have noticed, is proving to be rather difficult. Disqualifying the artifact, however, is at least theoretically possible and that is what we, and others, have been trying to do. So far no one has succeeded and 2-2-V-1 remains a tantalizing but elusive puzzle.

Over the past year, further research has revealed more about the patch and about the artifact. Some of what we've learned supports the hypothesis that it is the Miami Patch, while other research casts doubt on that possibility. Barring new information that conclusively eliminates 2-2-V-1 as part of the Earhart Electra we're left with balancing the pros and cons.

The Mysterious Miami Patch

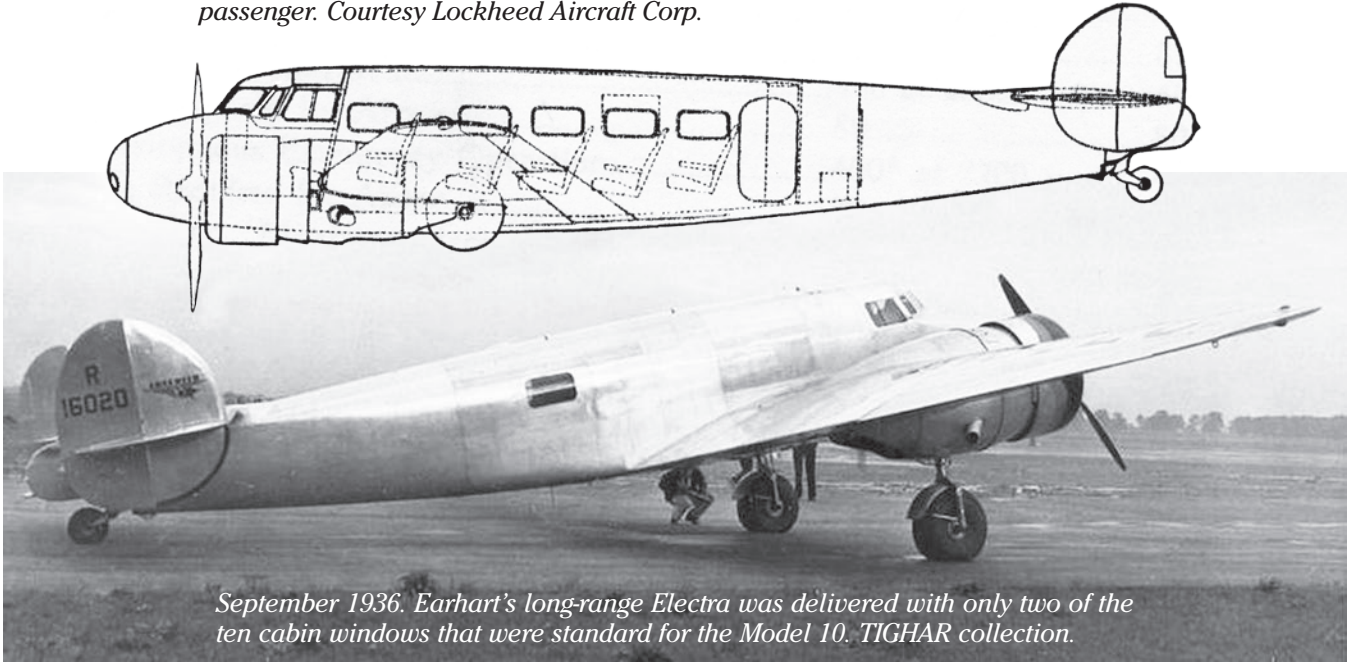
Whether or not Artifact 2-2-V-1 is part of Earhart's aircraft, the abrupt and unexplained replacement of a special window on the Electra with a plain aluminum patch is a puzzle within the larger Earhart mystery that had previously gone completely unnoticed by researchers.

The riddle begins in late 1936/early 1937. During preparations for the globe-circling flight scheduled to begin in mid-March, a window was installed in the cabin door, and a large window was cut into the starboard side of the lavatory compartment.



Sunrise, June 1, 1937. ©Miami Herald. Used by exclusive permission.

The standard Electra had five windows on each side of the cabin, one for each passenger. Courtesy Lockheed Aircraft Corp.



September 1936. Earhart's long-range Electra was delivered with only two of the ten cabin windows that were standard for the Model 10. TIGHAR collection.

Earhart was highly secretive about the flight, only announcing her intention to fly around the world on February 12, 1937, so it is perhaps not surprising that nowhere in her writings or interviews with the press does Earhart mention the new windows or explain their purpose. The standard Electra cabin windows were curved Plexiglas™ and not suitable for taking celestial observations. Researchers have generally assumed that the special windows were added to provide the navigator with an optically correct window on each



Mid-February 1937. Exactly when the door and lavatory windows were installed is not clear but they were already there when Earhart flew the Electra to New York to announce her intention to fly around the world. TIGHAR collection.

side of the aircraft. If that assumption is correct, it may be that Earhart's selected navigator for the first part of the world flight, Harry Manning, had a role in the decision to modify the airframe.

The window in the door had no effect on the aircraft's structural integrity, but cutting the longitudinal stringers to install the starboard-side window weakened the fuselage on that side. The aircraft was

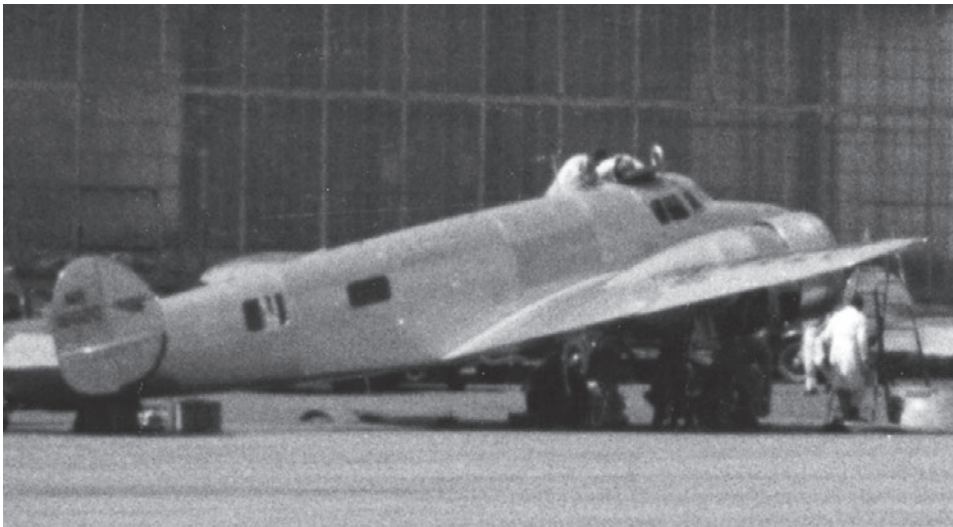
based at Burbank's Union Air Terminal which was home to Lockheed Aircraft and also Paul Mantz Air Service. Hollywood stunt pilot Paul Mantz was Earhart's technical advisor. Who it was that installed the windows is not known, but there are no drawings or engineering orders for the windows in the surviving Bureau of Air Commerce records for the aircraft. By contrast, the engineering orders for Lockheed's repair of NR16020 following the Hawai'i crash are in the Bureau of Air Commerce file for the aircraft. The lack of paperwork on the windows, the absence of any public discussion of them, and the questionable structural wisdom of their installation suggest that they were something that Earhart/Manning/Mantz did without involving Lockheed engineers or government inspectors.



Harry Manning, Amelia Earhart, and Paul Mantz in front of NR16020 in early March 1937. Larry C. Inman "Remember Amelia" collection, used by permission.

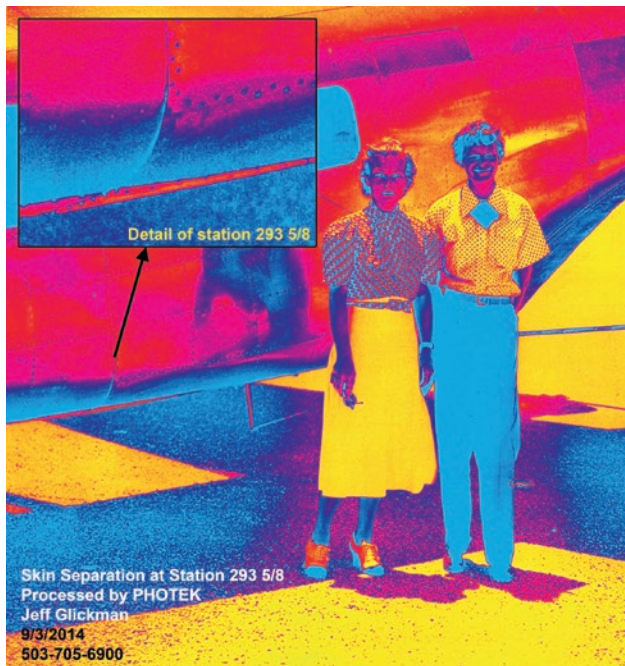


March 1937. The large window installed on the starboard side of the aircraft was in the lavatory compartment at the rear of the cabin. TIGHAR collection.



May 21, 1937. The special windows were undamaged in the Hawaii accident. A photo taken in Burbank on the day Earhart departed for Miami shows the starboard-side window in place. TIGHAR photo, Carter/Johnson collection.

Earhart, with her husband George Putnam, navigator Fred Noonan, and mechanic Ruckins "Bo" McKneeley aboard, arrived in Miami on May 23, 1937 having flown from Burbank via Tucson and New Orleans. That this was the start of the second world flight attempt was kept strictly secret. Earhart assured the press that the flight from California was merely a test flight. Only after she was sure that any discrepancies were fixed did she announce that she had reversed her route and the world flight had actually begun.



False-color analysis of this photo taken in Miami reveals apparent separation between fuselage skins in the area weakened by the window installation. It may be damage caused by the fuselage flexing in the hard landing. Original photo © Miami Herald. Used by exclusive permission.

Why the patch?

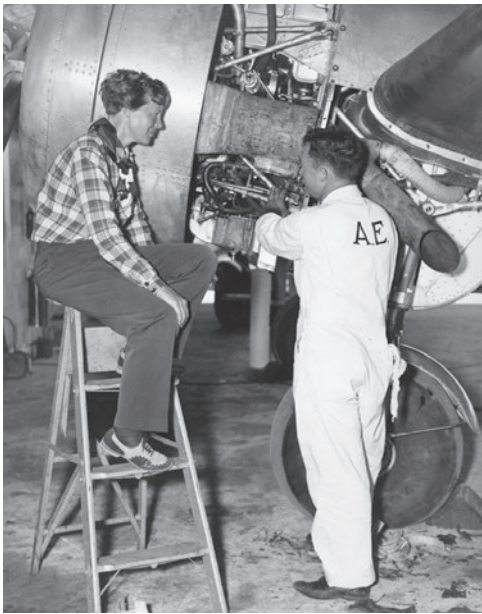
Upon her arrival she mistakenly landed at the Thirty-sixth Street Airport (now part of Miami International). Realizing her error, she immediately took off and proceeded to her intended destination, nearby Miami Municipal Airport. Perhaps flustered by her mistake, she botched the landing, dropping the Electra in so hard that a waiting newspaper reporter wrote that "the screech of metal could be heard all over the airport." The next day

McKneeley put the ship in the hangar to inspect the landing gear for damage.

It is not hard to imagine flexing of the fuselage causing the large starboard-side window to crack. With no time to special-order another window they may have decided to replace it with a simple patch. Noonan may not have considered the window essential for navigation. He is said to have been dismissive of the elaborate navigation modifications his predecessor Manning had installed in the cabin, preferring to make his celestial observations from the cockpit. If the hard landing damaged the window, Earhart might not have been eager to answer questions about the change. Whatever the motivation for the modification there is no doubt that it was made and that nobody talked about it publicly.

Who did the work?

No one knows. While at Miami Municipal the Electra was hangared at "Karl Voelter Inc. Sales - Service - School." Pan American technicians from the company's Dinner Key seaplane terminal about half an hour away came to Miami Municipal to work on the autopilot and radios, but fabricating the patch required different materials and expertise. It seems likely that Bo McKneeely, perhaps with help from Voelter mechanics, built and installed the patch. According to regulations, an engineering drawing of the proposed patch should have been approved by the local Bureau of Air Commerce office and the finished installation



This undated photo of AE watching her mechanic "Bo" McKneeley may have been taken in Miami. TIGHAR collection.

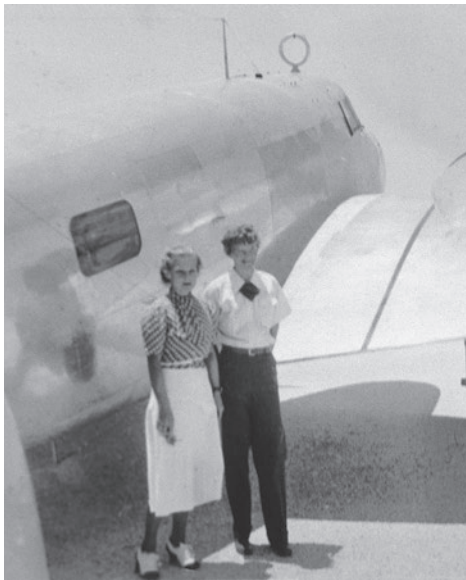
signed off by a BAC inspector but, as with the original installation of the window, no record or mention of such compliance has been found.

When Was the Patch Installed?

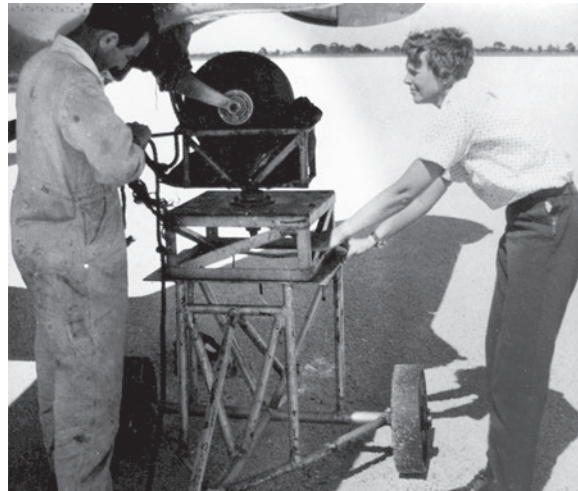
Photos taken while Earhart was in Miami make it possible to determine a probable date.



A photograph taken by a Miami Herald reporter shows Amelia standing beside the Electra with a well-dressed woman. The large special window is still present but neither the date nor the identity of the woman is noted on the photo. © Miami Herald, used by exclusive permission.



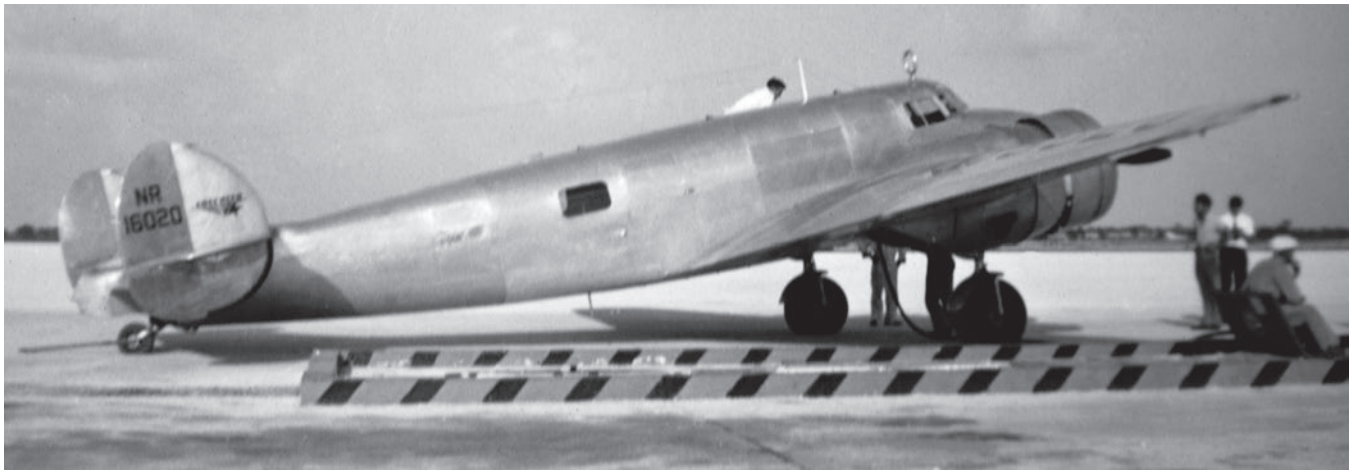
A second photo taken at the same time was found by TIGHAR researcher Arthur Carty in the Elgen Long Collection archived by David Jourdan of Nauticos. A notation on the photo identifies the woman as Nilla Putnam, wife of George Putnam's son David. David and Nilla Putnam are known to have visited AE and GP in Miami from their home in Ft. Pierce, Florida but the exact date has not been documented. Elgen Long Collection, courtesy of Nauticos.



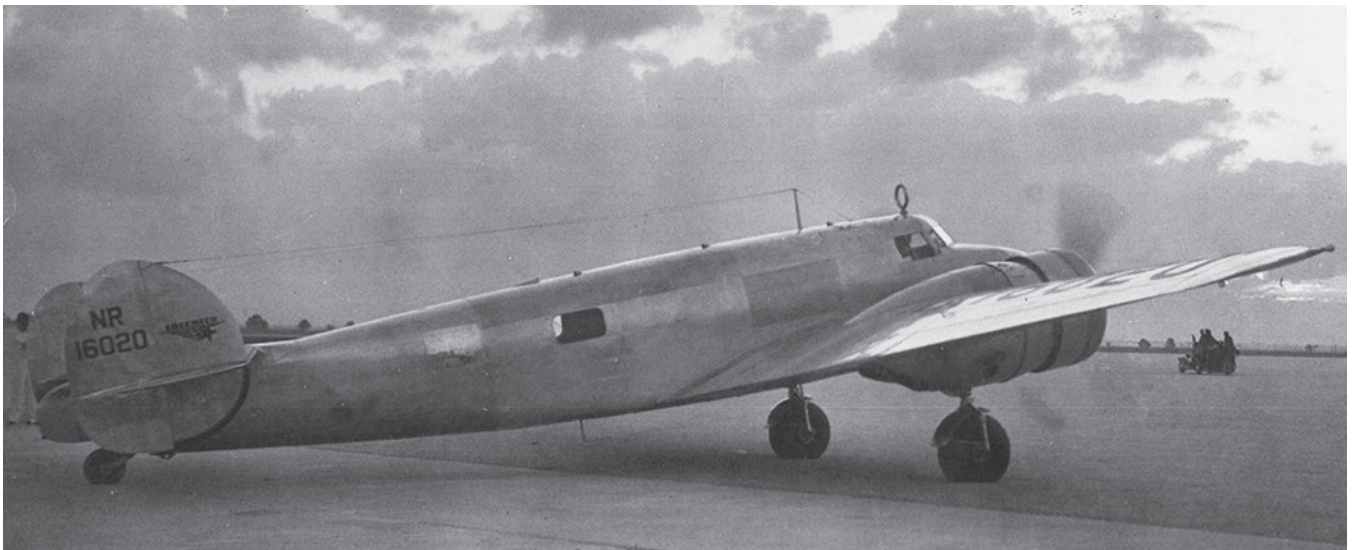
In this undated photo taken in Miami, AE is dressed in the same clothes she is wearing in the photos with Nilla Putnam. The tailwheel of the Electra has been raised up to put the aircraft in flight attitude for checking the accuracy of the compass, known as swinging the compass. Press reports establish that the compass was swung on Saturday, May 29. That was also the day that Amelia revealed to the press that her flight from California had not been merely a test flight as she had previously insisted. She had decided to reverse her direction of circumnavigation to west-to-east and the flight to Miami had been the beginning of her second attempt to fly around the world. TIGHAR collection.

An hour and a half test flight on the morning of Sunday, May 30, revealed that there were still issues with the radio and autopilot. While Pan American technicians addressed the problems Earhart and Putnam accepted an invitation from Miami businessman Bruce McIntosh to go deep sea fishing on his yacht *Brownie*.

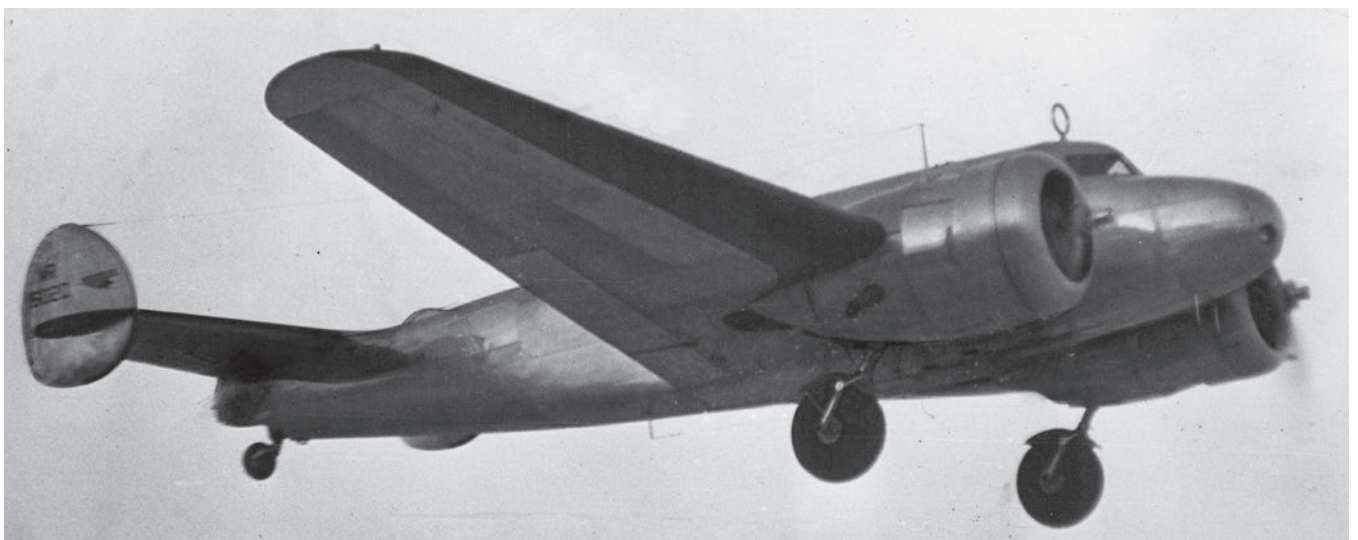
The next day Monday, May 31, was Memorial Day. In the morning Amelia, George and Fred paid a call on the PanAm facility at Dinner Key. The technicians assured them that all systems on the Electra would be in working order and AE decided that a second test flight was not necessary. The plane would be fueled that afternoon with 600 gallons for an early morning departure for San Juan.



This photograph of the Electra being fueled is the first to show the newly installed patch so it would seem that the window was removed and the patch installed sometime during the holiday weekend of Saturday, May 29 to Monday, May 31. Photo by L. Albasi, used by permission of the Albasi family.



The patch is clearly visible in photos of the dawn departure on June 1. © Miami Herald, used by exclusive permission.

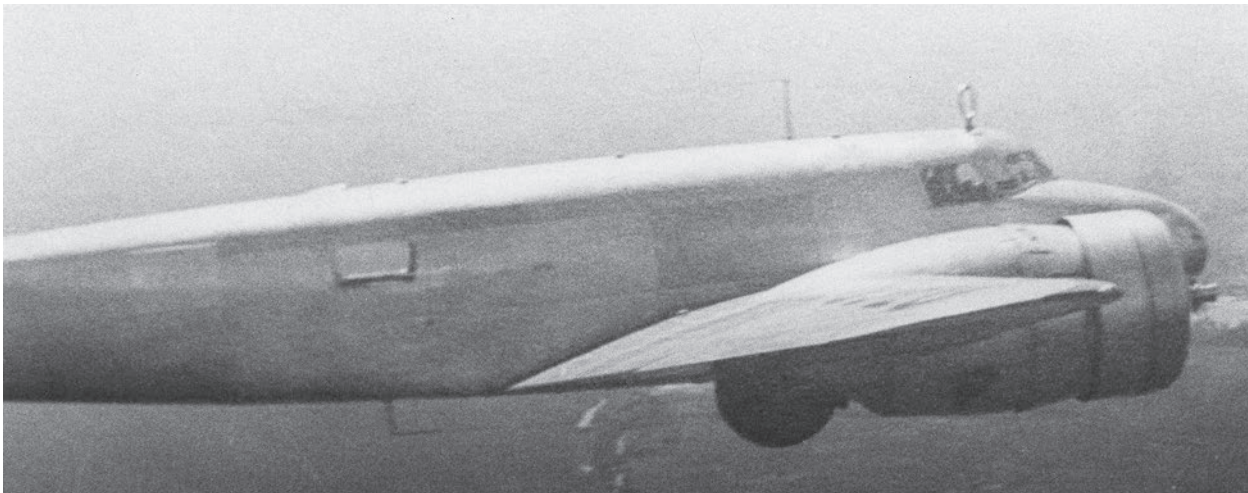


Where did the aluminum come from?

No one knows. Aluminum sheet oxidizes and loses its shine quickly, especially in the southern Florida environment. The shininess of the newly installed patch suggests that it was new metal. In 1937 almost all general aviation aircraft were of wooden or steel tube and fabric construction, so Voelter may not have had aluminum sheet in stock. The PanAm seaplane base at Dinner Key maintained all-metal Sikorsky flying boats so they may have had aluminum sheet on hand, but again, the pristine appearance of the patch suggests a fresh sheet. Although the reason for the change was probably apparent soon after the aircraft's arrival in Miami on May 23, the lateness of the installation suggests that they had to wait for delivery of new aluminum sheet ordered from ALCOA, the only producer of 24ST ALCLAD in 1937.

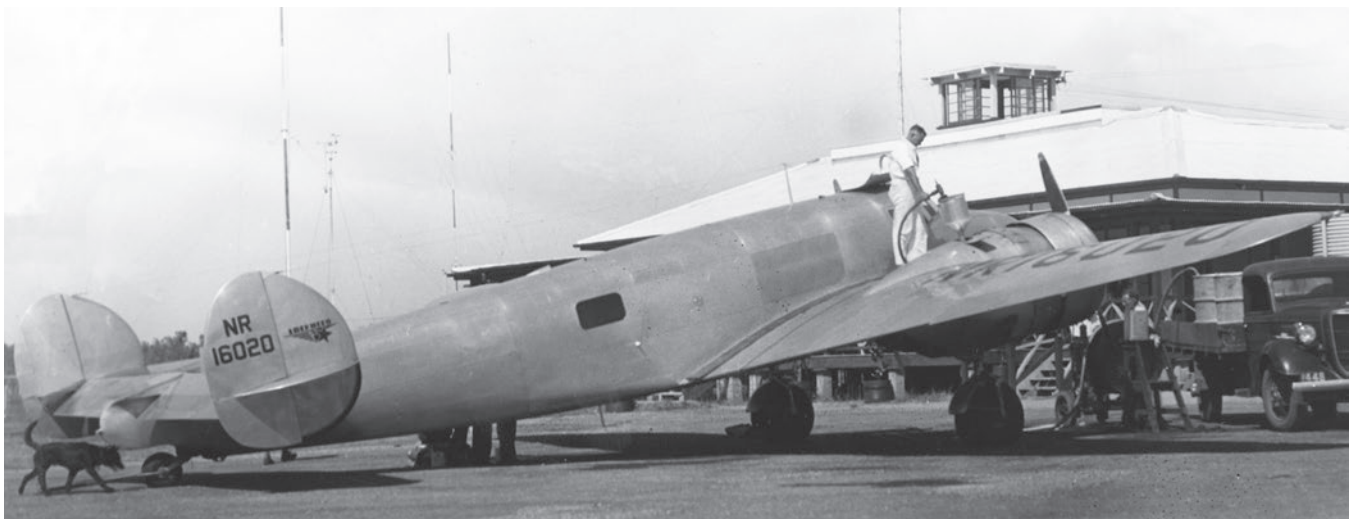
Tracking the patch throughout the world flight.

Photos show that over the course of the month between the takeoff from Miami on June 1 and the takeoff from Lae, New Guinea on July 2 there were noticeable changes in the appearance of the patch.



By the time the world flight reached Bandoeng, Java on June 21 the patch had lost most of its shine. In this air-to-air photo taken from a Royal Netherlands East Indies Airlines DC-2 the patch appears duller but otherwise unchanged. TIGHAR collection.

Earhart and Noonan remained in Bandoeng for two days while mechanics worked to fix malfunctioning instruments. They continued on to Surabaya on June 23 but returned to Bandoeng the next day when one of the repaired instruments stopped working. On June 26, with everything finally fixed, they again flew to Surabaya and from there to Koepang, Timor on June 27.

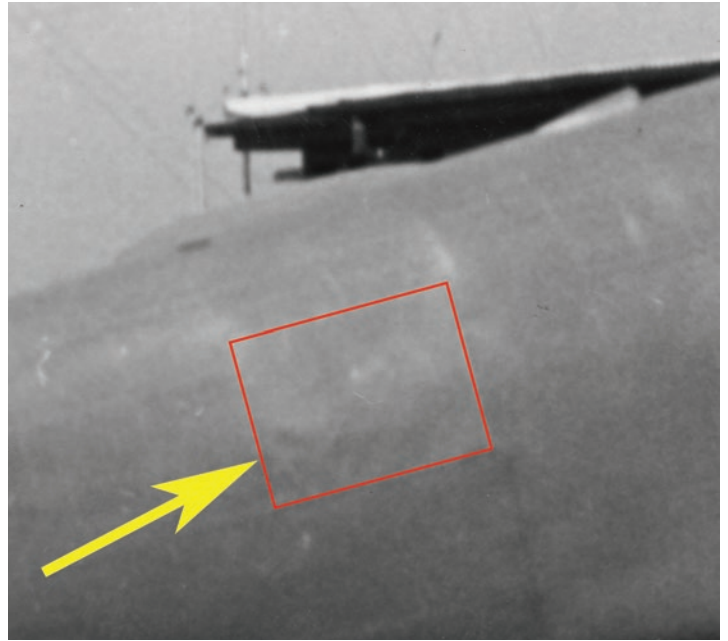


Earhart and Noonan arrived in Port Darwin, Australia shortly before noon on June 28. The aircraft was fueled later that afternoon for the next morning's flight to Lae, New Guinea. A photo taken during the refueling is significant in that it shows changes in the patch. Purdue Earhart Collection, used by permission.

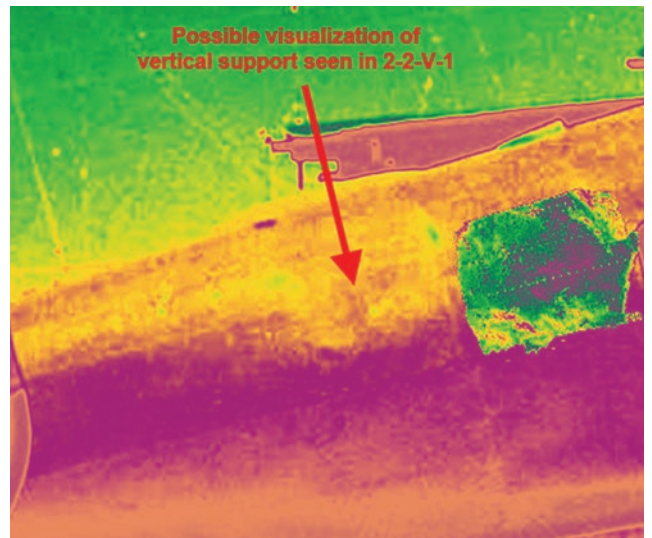
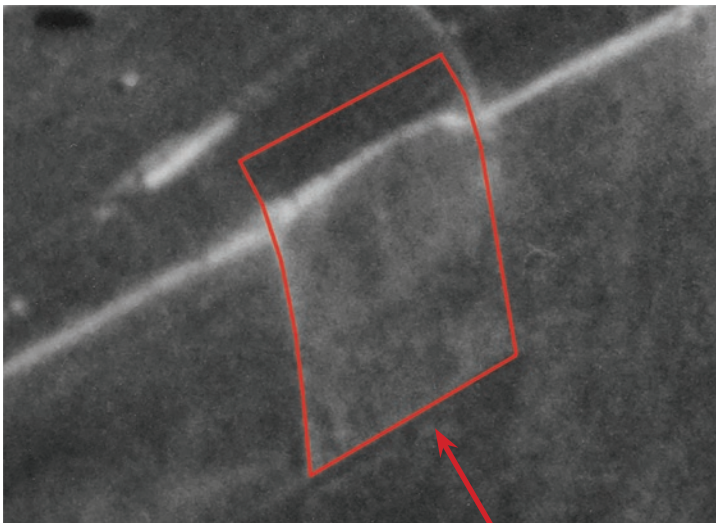


On April 23, 2015 TIGHAR forensic imaging specialist Jeff Glickman made a maximum-resolution copy of the Darwin refueling photo held by the Purdue University Amelia Earhart Special Collection. TIGHAR photo by R. Gillespie.

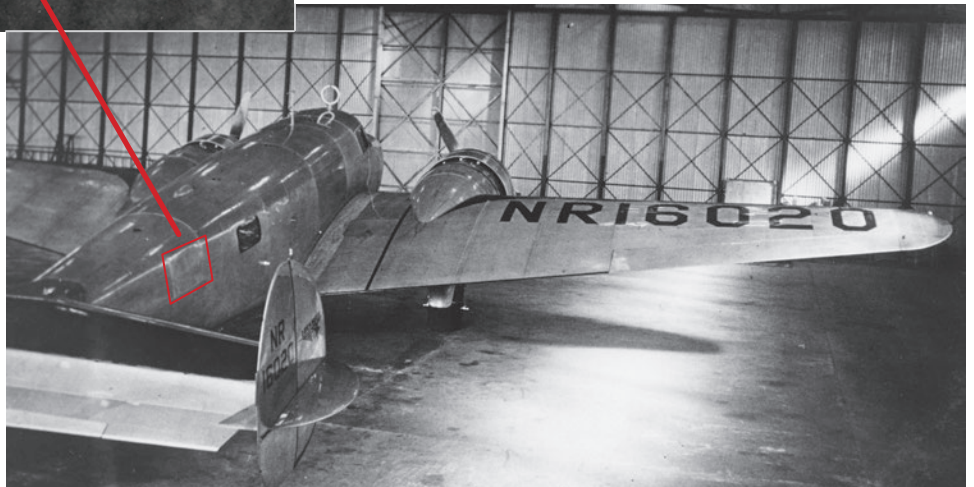
"False color" imaging of the Darwin refueling photo by forensic imaging specialist Jeff Glickman suggests the presence of an underlying vertical structure at or near Fuselage Station 307. Image by J. Glickman.

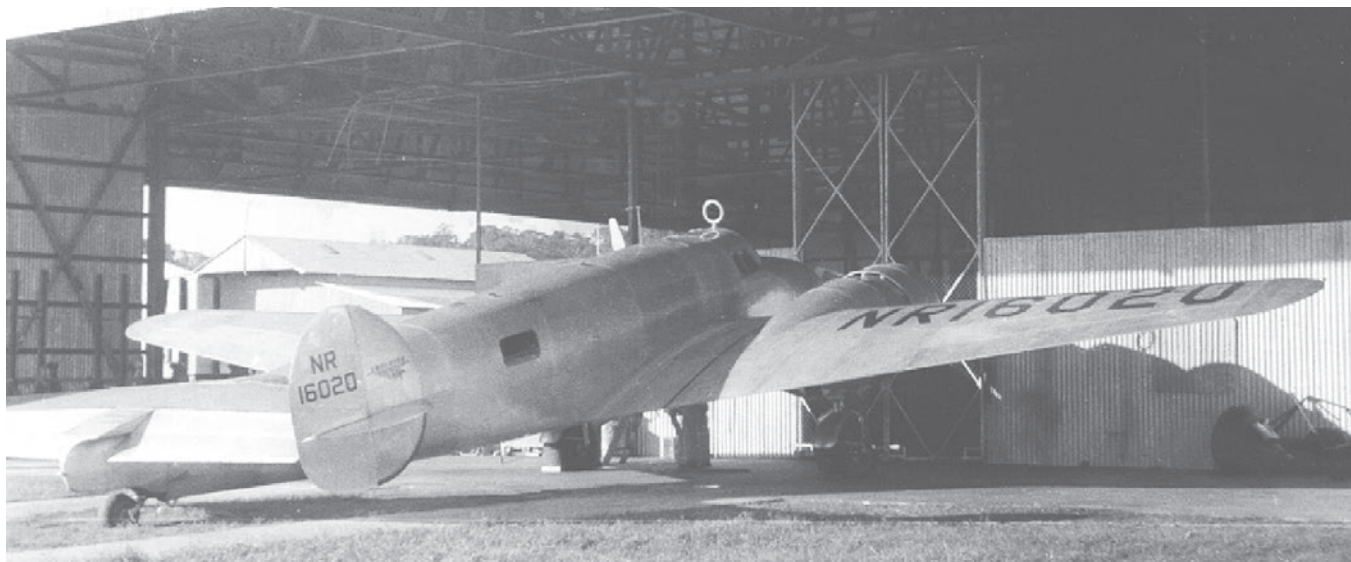


The Darwin refueling photo reveals that sometime between Bandoeng (June 21) and Port Darwin (June 28) the patch had begun to distort or "oil can." Purdue Earhart Collection, used by permission.



After being fueled the airplane was hangared for the night. The oil-canning deformation in the patch is clearly seen in the distortion in the line of reflected light along the fuselage. There is also the hint of an underlying vertical structure as in the fueling photo. Photo courtesy of E. Long.





The last photo of the Electra in which the patch is visible was taken in Lae, New Guinea, but there is insufficient resolution to see any detail. The once-shiny aluminum has oxidized to the point that it is almost indistinguishable from the rest of the airframe. Photo by A. Board, used by permission.

The Miami Patch is a previously unknown curiosity in the Earhart saga, but there is no reason to think that the replacement of the window with the patch and any subsequent problems due to inadequate bracing of the structure had anything to do with the failure of the aircraft to reach Howland Island. The Miami Patch has significance only in that it seems to bear an uncanny resemblance to a piece of aircraft wreckage TIGHAR found washed up on Nikumaroro, the island where so much other evidence suggests the Electra landed and was later lost to the sea.

New information about 2-2-V-1

In the year that has passed since TIGHAR's announcement of a "high degree of certainty" that Artifact 2-2-V-1 is a piece of the Earhart Electra continuing research has raised new questions and revisited some old ones.

Can evidence of a vertical structure be seen on the artifact?

As shown above, photos taken in Port Darwin, Australia suggest the presence of a vertical structure underlying the patch.



As it happens, there are parallel raised ridges in Artifact 2-2-V-1 that suggest the presence of an unriveted underlying vertical structure in the same relative position. Photos by J. Glickman.



If there was an unriveted vertical structure behind the patch was it added in response to the “oil canning” or was it there from the beginning? Did it only become externally visible when the patch began to “oil can” and bang against it?

Does the artifact fit the patch?

It is certainly close but there is no way to be sure. We can measure the artifact because we have the physical object, but we can’t measure the patch except through photographs, and by making assumptions about Earhart’s Electra that may or may not be valid. When Executive Director Ric Gillespie, forensic image specialist Jeff Glickman, and aircraft structures expert Aris Scarla compared the artifact to an existing Model 10A being restored at Wichita Air Services in Newton, Kansas, they concluded that the artifact is a good fit (see [**The Window, the Patch, & the Artifact**](#) on the TIGHAR website.).

One researcher is of the opinion that the artifact is slightly too wide to be the patch.

His analysis concludes that:

“At its extreme width, the artifact could fit as the covering with a reasonable degree of excessive edge distance as to the left and right vertical rivet rows. However this must be discounted because there is a lack of finished edges which should be evident at this full-width article at least at the forward (RH) edge. ... Instead we see a fracture zone.” [emphasis in original]

It’s a damning conclusion, but the methodology of the study is flawed. His analysis, posted on the TIGHAR website in the archives section as “Fit Analysis 2-2-V-1,” is based upon the assumption that distances between rivet lines on NR16020 were identical to the spaces between corresponding rivet lines on the aircraft in Kansas.

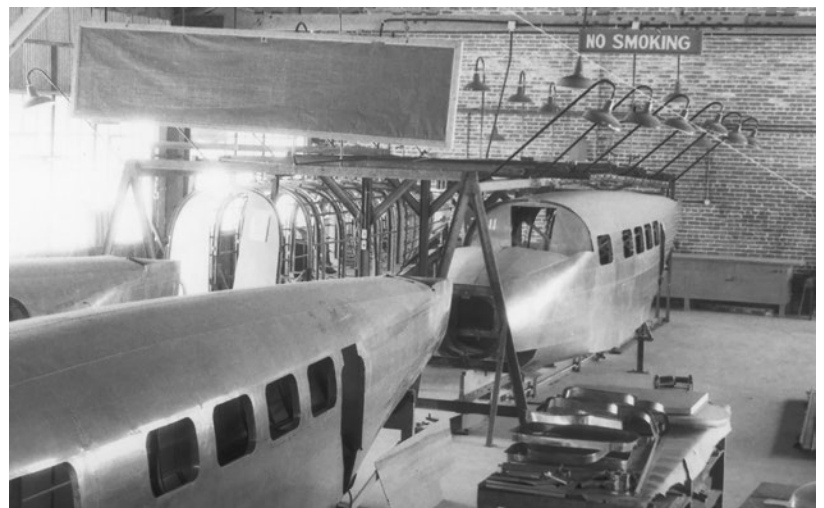
This is one of a series of Lockheed photographs showing Electra construction in the Burbank, California plant. Based on registration numbers visible in other photos in the series, the photos date from circa December 1934. This photo shows Model 10 airframes being framed up and skinned in two jigs. More jigs may have been added as Electra production ramped up. Ten aircraft were delivered in 1934, thirty-five in 1935, twenty-eight in 1936, forty-four in 1937. Lockheed Aircraft Corp., used by permission.



October 7, 2014. TIGHAR's Ric Gillespie compares 2-2-V-1 to Lockheed 10A c/n 1091 in Newton, KS. Photo by J. Glickman.

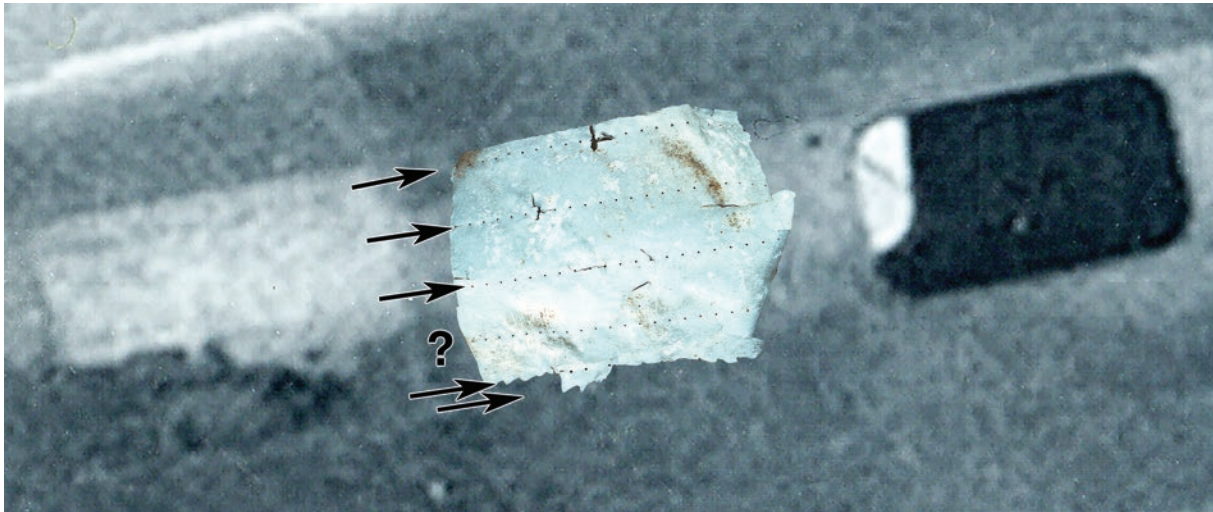
“Eventually, direct measurements were extracted from the Wichita photos and applied in all but the case of scaling that was used on the ‘Nilla-Earhart’ photo made in Miami to determine rivet row offset in the coaming. Direct measurement of ‘landmarks’ on the Wichita photo was used to validate similar distances in the Miami coaming photo.”

The assumption may or may not be true. Earhart’s Electra was delivered in July 1936, and was the 55th Model 10 built. The airplane in Kansas was delivered in April 1937 and was the 91st Electra built – nine months and thirty-six airplanes after Earhart’s. The Lockheed plant is known to have had at least two jigs that were used for framing up Model 10 airframes. In the pre-laser world of the 1930s it seems likely that there were small variations between jigs and the resultant airframes.



Does the rivet pattern match?

There isn't enough resolution in any of the photos of the patch to show individual rivets, but TIGHAR's forensic imaging specialist Jeff Glickman has been able to detect the apparent presence of depressions in the surface of the patch caused by lines of rivets.



The depressions are most apparent in the early photos when the patch was still shiny. As discussed in [A Smoking Gun?](#) on the TIGHAR website. Jeff Glickman has been able to confirm that four of the five lines of rivet holes on the artifact match rivet lines that are detectable on the patch. TIGHAR illustration.

Is the metal from the right time period?

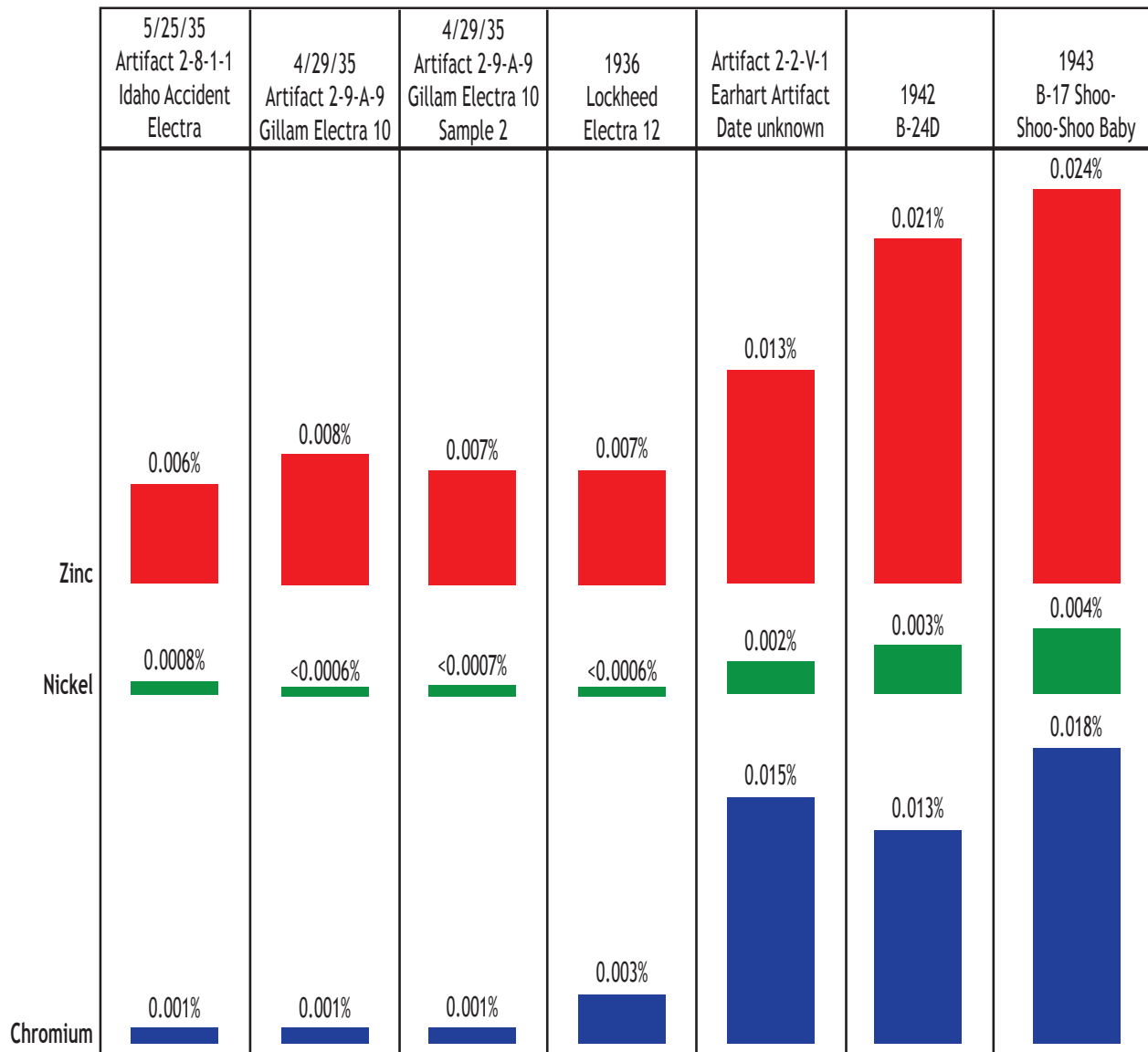
The short answer is, we don't know. At the suggestion of MIT professor Thomas W. Eager we asked Lehigh Testing Laboratories of Wilmington, Delaware, to do a chemical analysis of aluminum samples from an assortment of historic aircraft. Finding verifiable samples of aluminum from vintage aircraft for destructive testing is a bit of a challenge. Museums and collectors generally frown on requests to cut hunks out of their treasures and dissolve them in acid, but fortunately TIGHAR has a small collection of aluminum pieces from vintage aircraft. Samples from the following aircraft were tested:

- the "Gillam Electra," a Lockheed Model 10A Electra delivered in April 1935 (parts collected at the Alaska wreck site)
- the Idaho Wreck, a Lockheed Model 10A Electra delivered in May 1935 (parts collected at the Idaho wreck site)
- a Lockheed Model 12 Electra Junior built in 1936 (sample donated by a TIGHAR member)
- a B-24D probably built in 1941 or '42 (parts collected on Funafuti Atoll, Tuvalu)
- a B-17G built in 1943 (sample donated by Dover AFB Museum, Dover, DE)

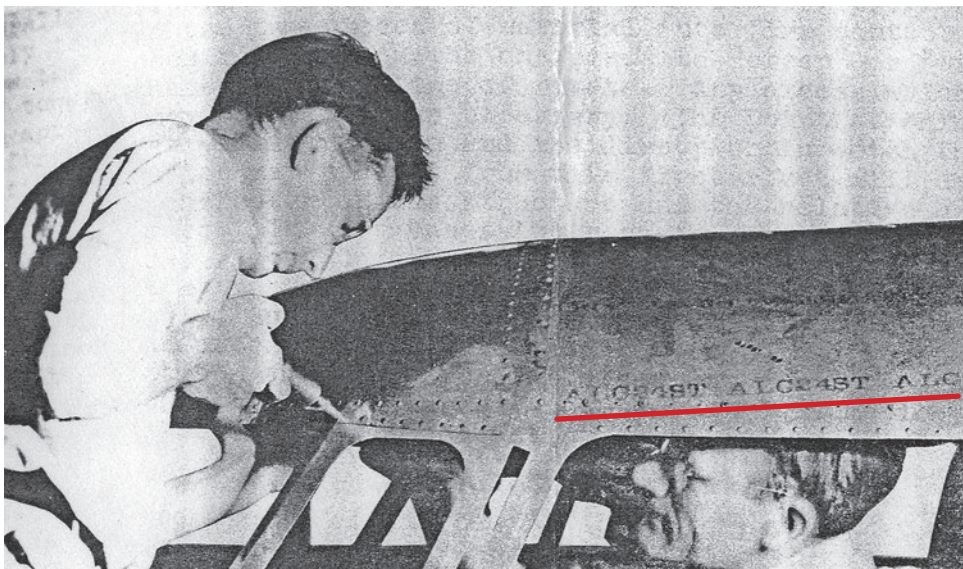
The percentages of elements in these samples were compared to a sample cut from Artifact 2-2-V-1. (The [Lehigh Testing Labs full report](#) is on the TIGHAR website.)

The aluminum alloy in 2-2-V-1 is not identical to any of the other samples tested, but it is more similar to the 1942/43 vintage samples than to the 1935 Electra samples. The primary difference is in the percentages of zinc, nickel, and chromium present in the alloy.

The "Golden Age" of aviation was a time of rapid advancement in the development of aircraft materials and construction techniques. The 24ST ALCLAD aluminum used in the new generation of all-metal aircraft was produced by the Aluminum Company of America (ALCOA). Based on the testing of the limited samples available it appears that adjustments to the formula for 24ST in search of an alloy that yielded the best combination of strength, lightness and resistance to corrosion was an on-going process. The increase in the percentage of certain elements in the recipe for the 24ST alloy appears to have been incremental over time, but we have been unable to find records that document when the changes were made. Exactly where 2-2-V-1 falls in that time line is not known.



Artifact	Artifact 2-2-V-1 Earhart Artifact Date unknown	Lockheed Electra 12 (1936)	Artifact 2-9-A-9 Gillam Electra 10 (1935)	Artifact 2-9-A-9 Gillam Electra 10 (1935) Sample 2	Artifact 2-8-1-1 Idaho Accident Electra (1935)	Unknown WWII Aircraft (B-24?) Date unknown	B-17 Shoo- Shoo-Shoo Baby (1943)
Element							
Aluminum	balance	balance	balance	balance	balance	balance	balance
Beryllium	<0.0001%	<0.0001%	<0.0001%	<0.0001%	<0.0001%	<0.0001%	<0.0001%
Boron	0.0009%	0.0006%	0.0005%	0.0006%	0.0007%	0.0008%	0.001 %
Silicon	0.15 %	0.17 %	0.17 %	0.13 %	0.15 %	0.14 %	0.17 %
Titanium	0.01 %	0.008 %	0.009 %	0.007 %	0.007 %	0.008 %	0.008 %
Vanadium	0.003 %	0.002 %	0.0009 %	0.001 %	0.002 %	0.003 %	0.003 %
Chromium	0.015 %	0.003 %	0.001 %	0.001 %	0.001 %	0.013 %	0.018 %
Manganese	0.62 %	0.59 %	0.43 %	0.48 %	0.45 %	0.51 %	0.45 %
Iron	0.23 %	0.17 %	0.20 %	0.19 %	0.13 %	0.21 %	0.24 %
Nickel	0.002 %	<0.0006%	<0.0006%	<0.0007%	0.0008%	0.003 %	0.004 %
Zinc	0.013 %	0.007 %	0.008 %	0.007 %	0.006 %	0.021 %	0.024 %

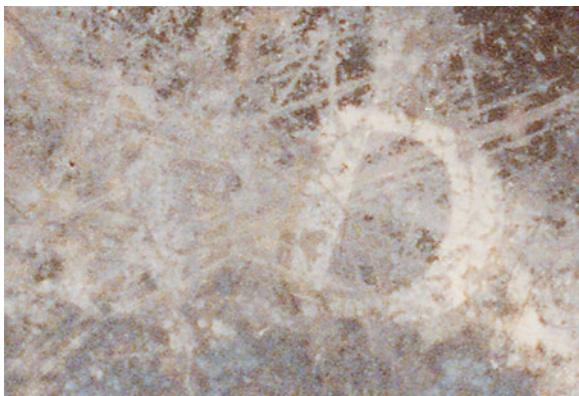


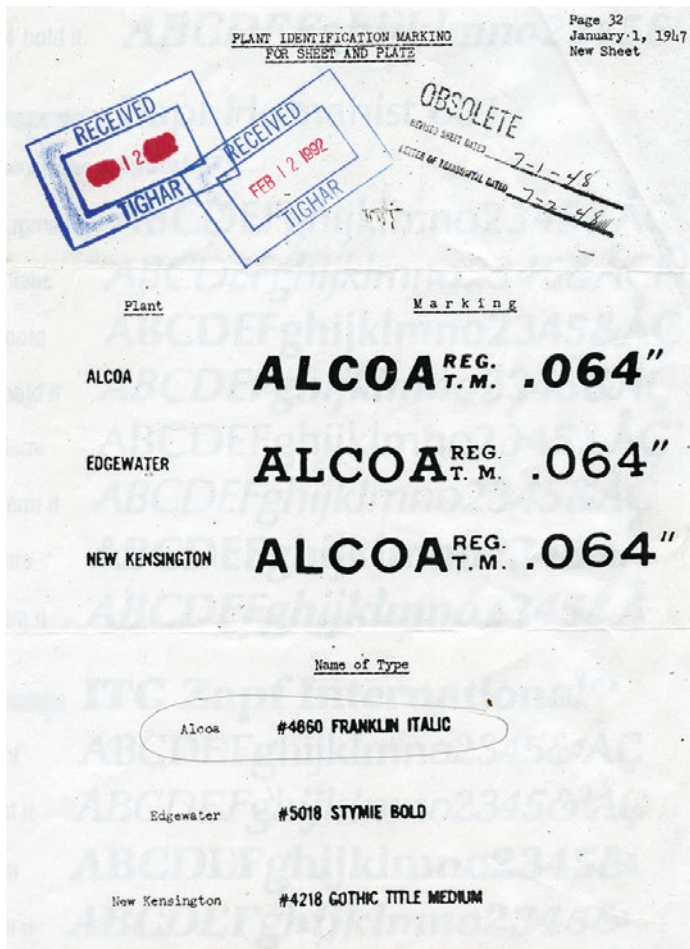
As shown in this undated photo, Electras were built with aluminum sheet labeled ALC24ST. Lockheed Aircraft Corp.

The letters AD are visible on the exterior surface of 2-2-V-1. TIGHAR photo.



The style of the labeling on 2-2-V-1 is similar to, but not exactly like, the labeling on this flap actuator cover from Electra cn1052 delivered in February 1936. The "AN-A-13" specification included in the labeling seems to date from between 1941 and 1943, so the cover must be a replacement.





The style of labeling used by ALCOA changed over time, and also varied from plant to plant. As shown in this document dating from January 1, 1947, each of the three plants producing aluminum sheet – ALCOA, Tennessee; Edgewater, New Jersey; and New Kensington, Pennsylvania; used different labeling. These three plants were also producing sheet in the 1930s. Aluminum used by Lockheed was probably produced at the Pennsylvania plant. The aluminum used to build the Miami Patch probably came from the Tennessee plant which primarily served the southern U.S.

What's In a Name?

In the document showing the labeling style used by different plants, “ALCOA” refers to a town in Tennessee, not to the company. In 1907 the Pittsburgh Reduction Company headquartered in New Kensington near Pittsburgh, Pennsylvania changed its name to The Aluminum Company of America. In 1914 the company began construction a second plant and “company town” in Tennessee. In 1919 the town was incorporated as “Alcoa,” an acronym derived from the name of its patron employer. The acronym gradually came to refer to the company itself but The Aluminum Company of America did not officially become ALCOA until 1999.

What does the labeling mean?

The remnants of ALCOA labeling on 2-2-V-1 are different than the labeling on aluminum used by Lockheed to build Electras, but the significance of that difference is not clear.

What sort of aircraft did it come from?

Beyond issues of dimensions, materials, and labeling, the physical properties of the artifact provide clues to its origin and history.

A set of “Criteria for an Aircraft-of-Origin” was developed by a commission of TIGHAR researchers from studies conducted during a visit to the National Museum of the United States Air Force three months before the Miami Patch hypothesis was proposed. (see [The Riddle of Artifact #2-2-V-1.](#))

“Based on the research conducted at the NMUSAF on March 28, 2014, it is possible to refine the criteria for Artifact 2-2-V-1’s aircraft-of-origin. The available evidence now suggests that the artifact is probably not from a WWII combat or heavy transport aircraft and is probably from an airplane smaller and lighter than any of the military types that served in or transited through the Central South Pacific. If the artifact is from a repaired area, the repairs were probably done at the factory. The artifact is, without question, from an aircraft that suffered catastrophic damage somewhere in the Central South Pacific region. At present, of the known losses in the Central South Pacific, only Earhart’s Electra fits all of the requirements. Further research may yield additional information that will either support or refute the criteria.”

If the artifact is from the Miami Patch, the work was not done at the factory. Otherwise, after a year and a half of additional research, the criteria remain viable.

Is Artifact 2-2-V-1 the Miami Patch?

Unless and until more of the aircraft is discovered, or documentation is found that conclusively disqualifies the metal or the labeling as dating from 1937, there is no way to be sure. As with so many aspects of the Earhart case – the aircraft's path on July 2; the credibility of the post-loss radio signals heard for the next five days; the identity of the castaway whose remains were found in 1940; etc. – we can only look at the available facts, weigh the probabilities, and be ready to change those assessments as new facts become available.

Negative:

NO

Details of artifact dimensions may not fit patch

NO

Alloy may be from later period

NO

Labeling may be from later period

Based on everything we've been able to learn so far about the artifact and the patch, and given the context in which the artifact was recovered, the scales still tip toward Artifact 2-2-V-1 being the tattered remains of the Miami Patch. Research will continue.

Positive:

YES

General dimensions of artifact are correct for patch

Yes

Scale of materials suggests Electra-size aircraft

YES

No match to any alternative aircraft type

Yes

Type of aluminum, 24ST ALCLAD, is correct for Electra

YES

Skin thickness, .032, is correct for modification to Electra

Yes

Rivet type, alloy and size, AN455 Brazier AD 3/3, are correct for Electra

YES

Evidence of an unriveted vertical stiffener on both patch and artifact

Yes

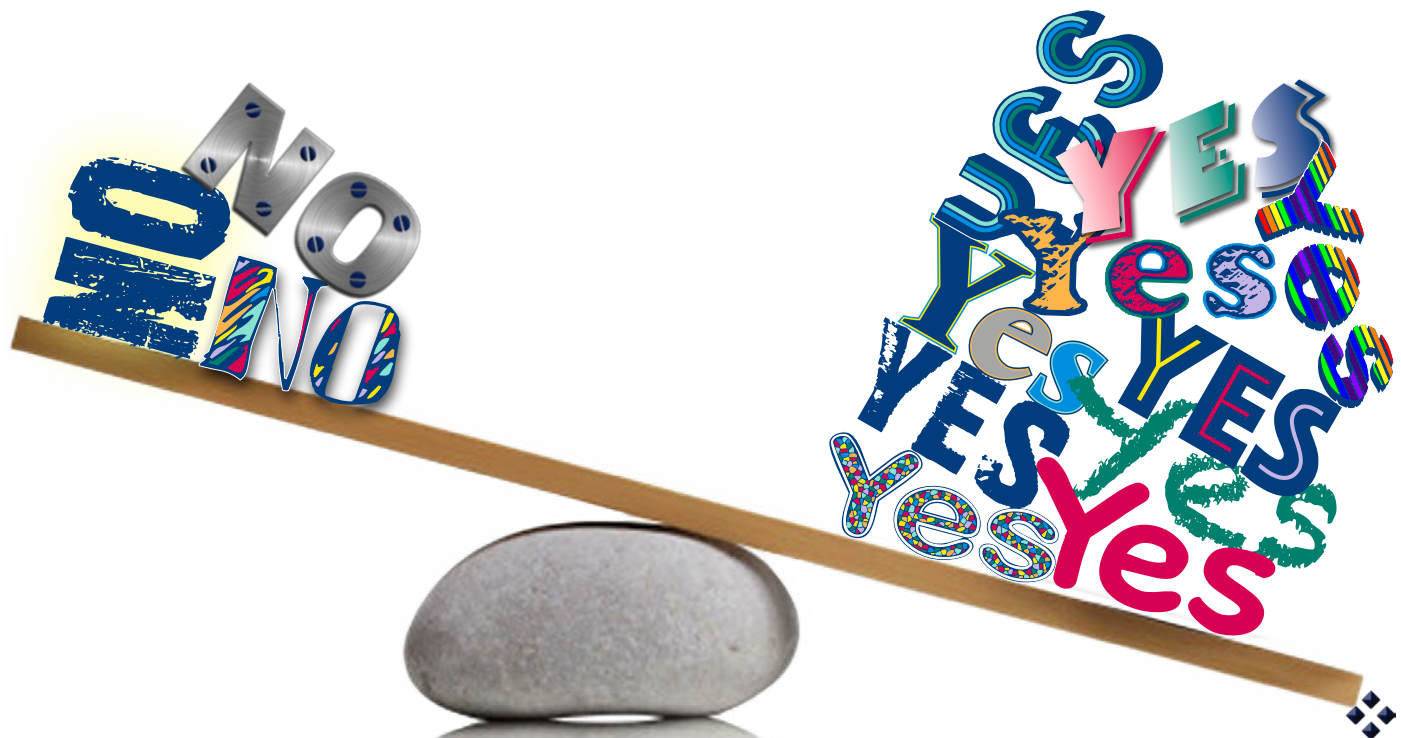
Rivet pattern on artifact matches patch

Yes

Circumstances of discovery are consistent with Niku Hypothesis

Yes

Failure patterns of metal are consistent with Niku Hypothesis





Niku VIII

Final Report



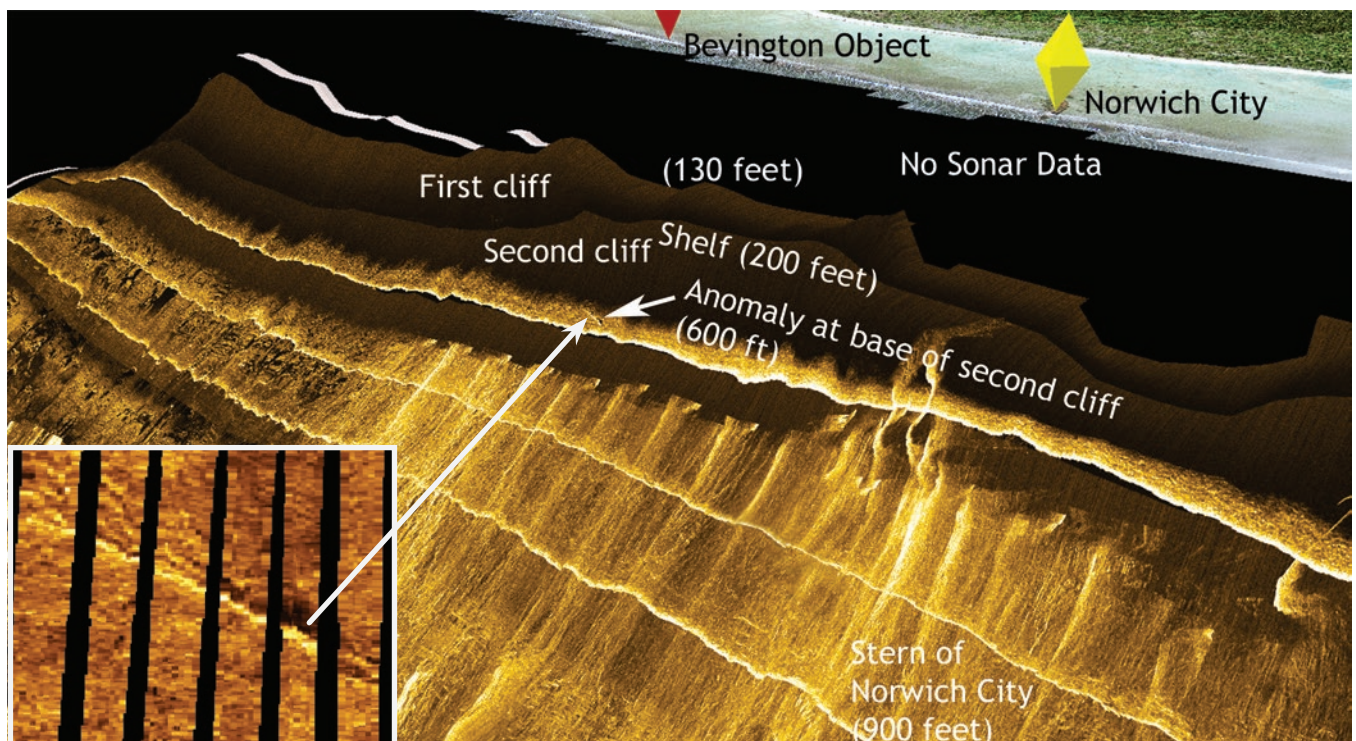
The Niku VIII expedition was originally scheduled to take place in September 2014 using the University of Hawai'i oceanographic research ship *Ka'imikai-O-Kanaloa* (KOK) deploying the two Pisces manned submersibles of the Hawai'i Undersea Research Laboratory (HURL). The subs are undoubtedly the best, and arguably the only, way to perform a through underwater search of the steep reef slope at Nikumaroro, but the \$1.5 million price tag proved to be prohibitive.

Expeditions, like politics, are "the art of the possible." In October 2014 we downsized and rescheduled Niku VIII. Due to an unexpected cancellation, *Nai'a*, the Fiji-based 120 foot motorsailer we had chartered for five previous

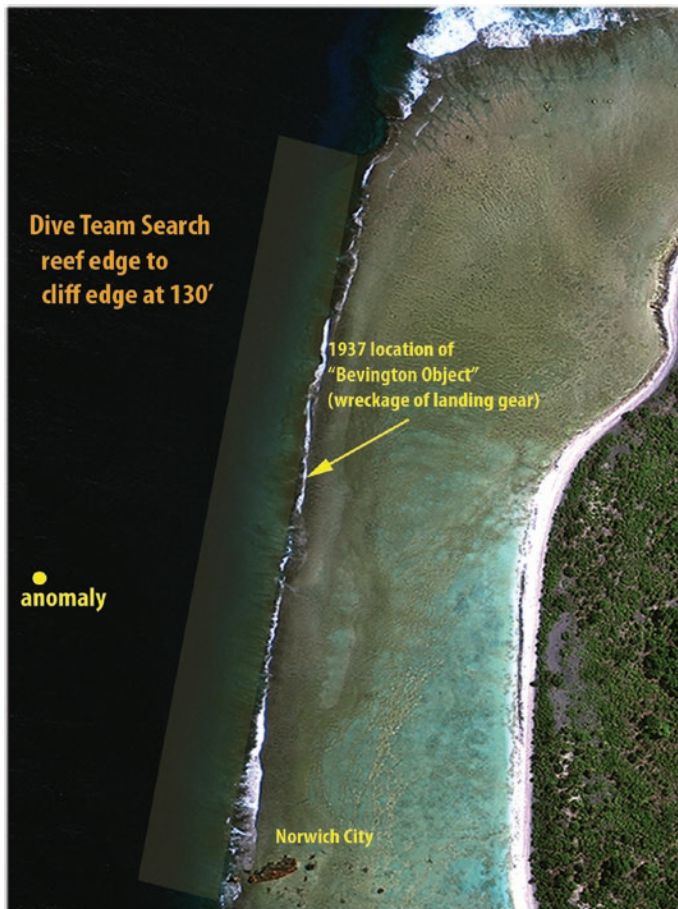
trips to Nikumaroro, was available for the month of June 2015. Using the smaller vessel lowered the anticipated overall expedition budget to \$500,000, but limited the scope of what we could do. With a single screw and no bow-thruster *Nai'a* is a poor vehicle for conducting a "live boat" search using a small ROV (Remote Operated Vehicle). There would be no general search of the reef, but the ship's co-owner, Rob Barrel, felt that by using the prevailing winds to hold *Nai'a* against two lines run to the reef edge, he could provide a stable platform for site-specific work with an ROV. *Nai'a* can accommodate up to eighteen passengers so we could also put teams aboard to conduct other needed search operations.

As ultimately conceived, TIGHAR's eleventh expedition to Nikumaroro sought to answer three questions:

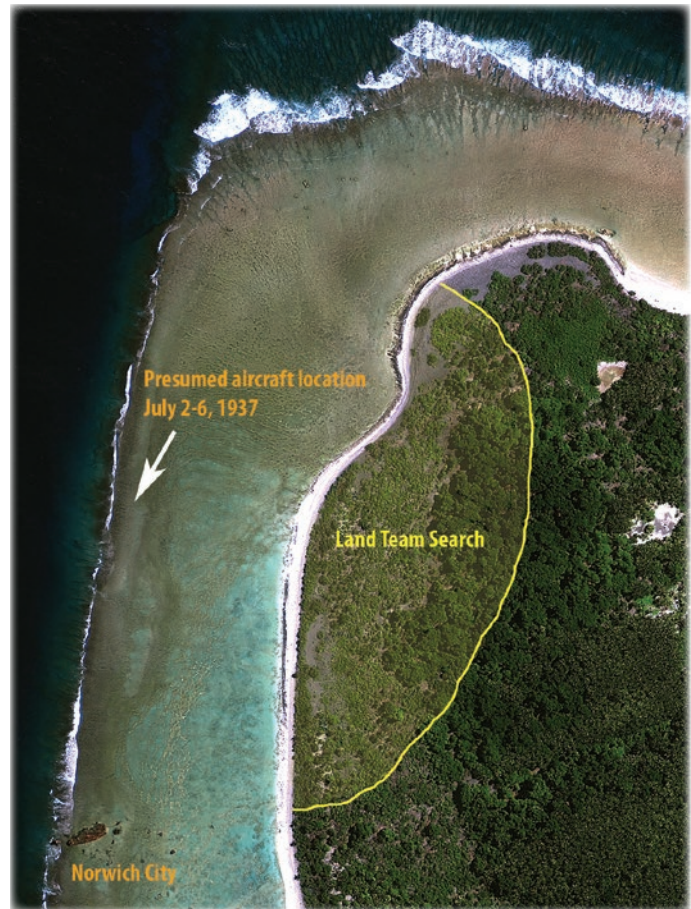
- Is an "anomaly" seen in the side-scan sonar data collected by contractor Phoenix International during the 2012 Niku VII expedition the wreckage of the Earhart Electra?



- Is there debris from the Electra on the underwater reef slope at depths accessible to SCUBA divers?



- Is there any surviving evidence of an initial Earhart/Noonan campsite on the northwestern shore of the island?



We knew there was a good chance that the answer to each of the questions would be “no,” but these were questions that needed answering.

Not Playing It Safe

Before the departure of the expedition Executive Director Ric Gillespie responded to a journalist’s questions about TIGHAR’s expectations.

How confident are you of making a breakthrough Earhart discovery on this trip?

Not confident at all. We’ve made many breakthrough discoveries in the 27 years we’ve been investigating the Earhart disappearance but we’ve never been confident that we would make them. That’s not how it works. You just keep slogging away. You always hope for a breakthrough but you can never be confident that you’re going to make one.

Are there are any specific search areas that you expect to make discoveries in?

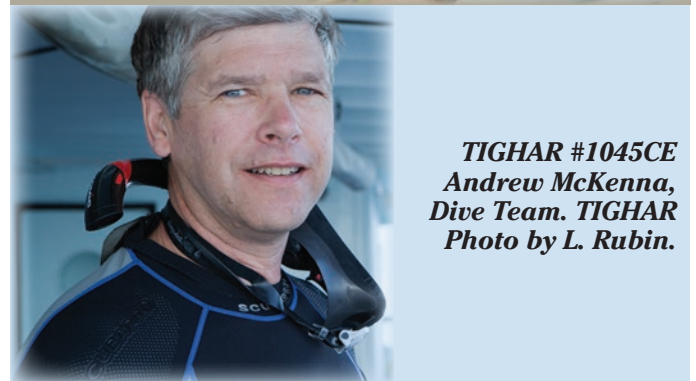
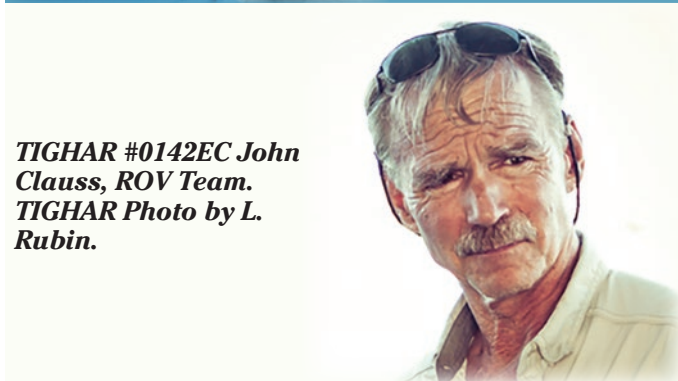
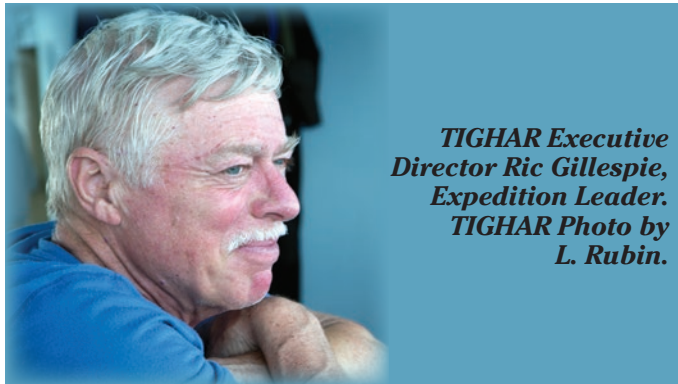
If we were continuing to excavate the castaway campsite at the southeast end of the atoll I would say that we could “expect” to make further discoveries. It’s an established archaeological site where we know a castaway died – apparently female and of Earhart’s height and ethnic origin – and where we have found artifacts that speak of an American woman of the 1930s. It seems reasonable to suppose there is more there to find. It would be a safe place for us to focus our efforts – “safe” in the sense that we could be reasonably sure we would not come home empty-handed – but we’re not going to play it safe. On this trip we’re going to focus our efforts on the west end of the atoll. We’ll use a camera-equipped underwater Remote Operated Vehicle (ROV) to investigate a sonar anomaly at a depth of 600 feet that could be the fuselage of Earhart’s Lockheed Electra. A trained and experienced team of

divers will search shallower depths for aircraft debris. An onshore search team will look for any sign of a theoretical initial survival campsite. We hope, but we do not “expect,” to make discoveries in these areas.

TIGHAR’s eleventh expedition to Nikumaroro is not a last-ditch effort to find “smoking gun” proof of Earhart’s fate. Such an object may or may not still exist, and if it does it may or may not be discoverable with the assets we can bring to bear. This expedition is nothing more, and nothing less, than an attempt to build on the 27-year preponderance of evidence that has already established Nikumaroro as the most likely answer to the Earhart riddle.

The Niku VIII Team

The team for Niku VIII was made up of experienced TIGHAR expedition veterans, volunteers with special skills and a few Sponsor Team Members (STM).



TIGHAR #3202CE
Andrew Sanger
STM, Land Team.
Photo by L. Schorer.



TIGHAR #4721
Steve Genkins MD
STM, Underwater
Photographer. TIGHAR
Photo by L. Rubin.



TIGHAR #3314CE Lee
Paynter, Dive Team
and Communications.
TIGHAR Photo by
L. Rubin.



TIGHAR #4601
Rodney McDonald
STM, Land Team.
Photo by L. Schorer.



TIGHAR #4117E
Laurie Rubin, Still
Photographer.
TIGHAR photo.



TIGHAR #4764
Ron Bernier, ROV
Contractor. TIGHAR
Photo by L. Rubin.



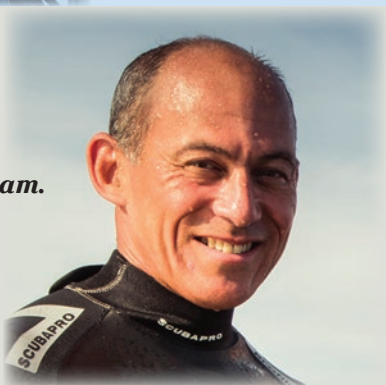
TIGHAR #4243CE Jim
Linder, Dive Team
Leader. TIGHAR Photo by
L. Rubin.



Kiraiti Kirara,
Kiribati
Representative.
TIGHAR Photo.



TIGHAR #4519 Bill
Rodgers STM, Dive Team.
TIGHAR Photo by L.
Rubin.



Rob Barrel, Nai'a
owner. Photo by S.
Genkins.



Special Equipment

ROV



The ROV to be used to investigate the anomaly was a Seabotix VLBV950 with 350m fiber-optic tether operated by Ron Bernier of Advanced Remote Marine Systems of Katy, Texas.

Metal Detectors

The Dive Team and Land Team used new Surfmaster PI Dual Field metal detectors donated by White's Electronics Inc. of Sweet Home, Oregon. White's have been a sponsor of TIGHAR searches for over 25 years.



Communications



Satellite telephone, email and internet capability were provided by an Iridium Pilot system purchased for the expedition by TIGHAR and some of the team members.

Drones



TIGHAR cameraman Mark Smith of Oh Seven Productions deployed a DJI Phantom and a DJI Inspire drone for aerial reconnaissance and video.



Rope Ferry

A five-person inflatable boat (courtesy of Dive Team Leader Jim Linder) and several hundred meters of 12mm polypropylene rope were used to construct a rope ferry for the Land Team to cross the main lagoon passage in their daily three-mile trek to and from the search area.



Funding the Expedition

Raising the money for expeditions is never easy, but funding even the downsized Niku VIII proved to be especially difficult.

- In the past, the granting of exclusive media rights has brought in significant funding, but the television market has changed in recent years. So called “reality” programming has largely replaced historical and scientific documentary production. The money for exclusive rights to expeditions, and the dedicated documentary production departments at major networks, are no longer there.
- Our successful defense against the million-dollar Mellon lawsuit and the plaintiff’s subsequent appeal were complete vindication for TIGHAR but came at great cost. The six-figure legal bills were covered by a TIGHAR donor who in the past has been a major contributor toward expeditions. Fighting the legal fight was necessarily a higher priority.

Nonetheless, the TIGHAR membership rallied to the cause. Contributions poured in, and by the time the expedition was two weeks from departure Sponsor Team Member donations totaled \$116,500; Corporate Sponsorships totaled \$21,000; TIGHAR Board Members put up \$67,000; donations from the general public (mostly from TIGHAR members) came to \$47,500; and a \$100,000 grant from an anonymous foundation brought the total raised to \$352,000. A \$60,000 loan from a TIGHAR Board Member made the total \$412,000, still short of the \$500,000 goal but close enough to proceed with the expedition. Then the goal posts moved.

- The Republic of Kiribati has previously required that we pay for a Customs representative to accompany the expedition. This time, in addition, we were required to pay for a five-person team of Kiribati government officials (Health, Biosecurity, Police, Immigration, and Customs) to travel round-trip from Tarawa to Fiji to clear the expedition vessel out of port. Because air service between Kiribati and Fiji is only available three days each week the officials had to be put up in a hotel for several days before returning to Tarawa. The added cost to the expedition of the new procedure amounted to more than \$3,000.
- One week before the expedition’s departure, FedEx made changes to their giving guidelines and did not renew their twenty years of in-kind sponsorship of TIGHAR shipping costs. Suddenly, and with no warning, TIGHAR would have to cover all the expense of shipping the expedition gear round-trip to Fiji. Just the outbound cost of shipping dive gear, communications systems, metal detectors, etc. was over \$7,000. Outbound shipping of the 800-pound container with the ROV and spare parts came to another \$7,000. Shipping a second container with a backup ROV as originally planned was simply out of the question.

On June 8, 2015, the Niku VIII expedition sailed from Lautoka, Fiji aboard *Nai’a* with as fine a team as we have ever put in the field, a well-crafted plan of operations, and the best equipment we could afford.

The Expedition



Drone photo courtesy Rob Barrel. Used by permission. All rights reserved.

After a rough five-day, thousand-mile voyage from Fiji, the expedition vessel *Nai'a* arrived at Nikumaroro on June 13. As planned, *Nai'a* co-owner Rob Barrel and Capt. Johnathan Smith succeeded in mooring the ship off the west end of the atoll over the anomaly location by using the prevailing winds from the east to hold *Nai'a*

against two lines to the reef – one to the wreck of *SS Norwich City* and one to the reef edge north of the Bevington Object location.

ROV contractor Ron Bernier assisted by Walt Holm began setting up the differential GPS antenna, power supply and work station for the VLBV950 ROV. All other team members went ashore.



During much of the expedition, sea conditions in the landing channel were unusually turbulent. Drone photo courtesy of R. Barrel.



On June 20 a rogue wave pitched a team member out of the skiff. The confines of the channel trapped him under the boat and he nearly drowned. It was the closest call we've ever had. On June 21 and 22 the channel was too dangerous to use and the land Team had to stand down. Photo by L. Schorer.



On the first day the Dive Team installed the rope ferry across the main lagoon passage while the Land Team surveyed the abandoned village to assess any changes since our last visit. TIGHAR photo by L. Rubin.

The shoreline showed significant damage from recent overwash, probably associated with Severe Cyclone Pam that had struck the region in March. Waves coming ashore had ripped up the beachfront vegetation along the western shoreline. TIGHAR photo by R. Gillespie.



Land Team Operations



The team used GPS and drone reconnaissance to check out suspicious-looking features back in the bush that had been identified in aerial photos dating from 1938 but erratic and inaccurate GPS readings made navigating to the correct locations difficult. The problem, which persisted for several days, was caused by strong solar flares that disrupted GPS signals worldwide. Drone photo by M. Smith.

The next day the Land Team began the task of testing the hypothesis that Earhart and Noonan established a campsite ashore during the time the plane was on the reef; that items were brought ashore and subsequently left behind when AE and FN moved on after the plane was gone; and that items left behind are findable.

Pre-expedition speculation based on satellite imagery identified the tall, open “Buka” (*Pisonia*

grandis) forest about 100 meters in from the beach as the most likely area for theoretical camp. However, on-the-ground inspection found the forest to be damp, oppressive, littered with bird droppings, infested with rats and crabs, and devoid of breeze – not at all a desirable place to camp. Also, from that location Earhart and Noonan would be out of sight of the reef and unable monitor the plane and horizon.



For the Land Team, the commute to and from the search area involved a mile and a half trek each way in 100°F heat and included crossing the main lagoon passage by means of the rope ferry. TIGHAR photo by L. Rubin.



The Land Team eventually succeeded in navigating to and inspecting all of the locations, in many cases by hacking a path on a specific azimuth and distance from a known point through hundreds of meters of nearly impenetrable bush. TIGHAR Photo by L. Rubin.



Land Team Leader Gary Quigg and Expedition Leader Ric Gillespie confer in the Buka forest. TIGHAR Photo by L. Rubin.

Through on-site observation and experience the land team concluded that a more likely place for an initial campsite would be under the one of the “Ren” trees (*Tournefortia argentea*) that dot the shoreline near the beach. However, it was also apparent that the entire shoreline is subject to periodic overwash. Giant waves generated by far-way storms come ashore over the reef and push

beachfront coral into tall berms, scattering and burying anything in their path. Damage from a recent event – probably waves spawned by Severe Cyclone Pam in March – was evident. Although the logic behind an initial campsite remains sound, the chance that anything now survives and is discoverable after 78 years is vanishingly small.



Conditions in the Buka forest were stifling. TIGHAR Photo by L. Rubin.



TIGHAR Photo by R. Gillespie.



On the last day of the expedition, Land Team member Andrew Sanger discovered two aluminum discs embedded in the reef flat on either side of the landing channel. They appear to be identical to an aluminum disc found last year at Mili Atoll in the Marshall Islands by a team led by Mr. Richard Spink, an aluminum boat kit manufacturer and high school teacher from Bow, Washington. Mr. Spink is trying to prove that Amelia Earhart was captured by the Japanese. He believes the disc he found is a “dust cover” from one of the wheels of Earhart’s aircraft (the Electra’s wheels did not have dust covers). We don’t know what the discs are but they are certainly not airplane parts. Our best guess is that they are associated with fishing gear, which would explain their presence on the shore of two Central Pacific islands twelve hundred miles apart. TIGHAR photo by R. Gillespie.

Dive Team Operations

The dive team tested the hypothesis that airplane debris may have survived on the reef slope at depths between 15 feet and the edge of the first underwater cliff at 130 feet. A section of the western reef from well north of the Bevington Object location to the *Norwich City* wreck was divided into vertical lanes roughly 100 feet wide, using yellow rope anchored with dive weights to provide physical borders.



*Andrew McKenna works the slope.
TIGHAR photo by S. Jenkins.*

A thorough visual and metal detector search turned up no identifiable aircraft wreckage but the team did discover a piece of metal debris at a depth of twenty-five feet. The artifact was firmly imbedded in the reef and could not be recovered.

Tango 31 Lima Papa

An Icom IC 7200 transceiver was used to collect data on how well radio signals sent from Nikumaroro similar to those that could have been sent from the Earhart Electra can be heard at remote locations. TIGHAR Communications Officer Lee Paynter applied for and received a reciprocal amateur radio certificate from Kiribati, call sign T31LP. The call sign was popular among listening amateurs who are always eager to log unusual contacts. Consequently, when Lee announced his presence each afternoon at midnight UTC, (4 PM Fiji time) he caused a “train wreck” on the amateur bands.

During the expedition Lee was successful in working approximately 600 stations worldwide. Most of the contacts were on the amateur 40 and 20 meter bands, although attempts were also made on the 17, 15, 12 and 10 meter bands. Contacts were made all over the continental US, Hawai’i, the Caribbean, South America, Oceania and Russia.

Some of the most interesting contacts were made on the amateur 40 meter band which is close to one of Amelia’s operating frequencies of 6.210 MHz. Those signals traveled great distances. Low power (5 watts) transmissions were heard by multiple operators on the U.S. Mainland and elsewhere.



The Dive Team's impression was that the metal is cast iron. After examining photos of the object, TIGHAR underwater archaeologist Megan Lickliter-Mundon concurred with that assessment. The source of the object is no known. It seems to be too far north to be *Norwich City* wreckage, but there were no cast iron components aboard the *Electra*.

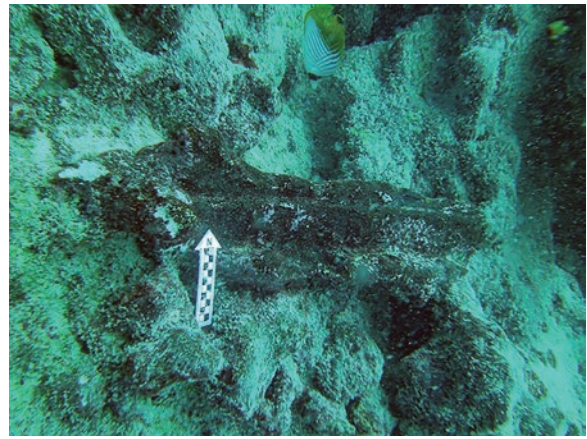
Inspection of shallow water debris from the shipwreck revealed relatively lightweight pieces of copper sheet that had not been swept away by storm activity. This discovery seems to argue against the theory that the Earhart aircraft was torn apart in the surf. If lightweight sheet metal from the ship survived in shallow water, so should lightweight metal from the plane. The plane may have sunk in deeper water more or less intact. That's good news and bad news. The deeper the water the better the preservation, but searching deeper is more expensive.

ROV Operations

The greatest frustration was the total meltdown of the ROV we were counting on to investigate the anomaly detected in the side-scan sonar imagery from the 2012 expedition. A series of malfunctions was addressed with determination and creativity by the ROV team and, from day to day, it seemed like successful deployment of the vehicle was imminent. Ultimately the problems proved to be insurmountable. Walt Holm's complete log of the struggle to get the ROV working is posted on the TIGHAR website at <http://tighar.org/Projects/Earhart/Niku8/dailies/ROVDailyLogs.html>.

We intended to have a second Seabotix ROV aboard as a back-up, but due to a last minute cascade of unexpected additional expenses we simply could not afford the cost. Delaying the expedition until more money was raised was not an option. The expedition vessel was booked for a particular time period – June 8 to July 1 – and had other charters booked for the rest of the year. Delaying the expedition would mean canceling the charter, losing everything we had paid, and starting the fundraising all over again. We had no choice but to go with what we had.

On both the 2010 and 2012 expeditions we had a second back-up ROV but in neither case was the second ROV needed. On this trip the contractor brought extra spare components expecting to be able to handle any problems that should arise, but an unprecedented series of component



Cast iron artifact. Photo by J. Linder.



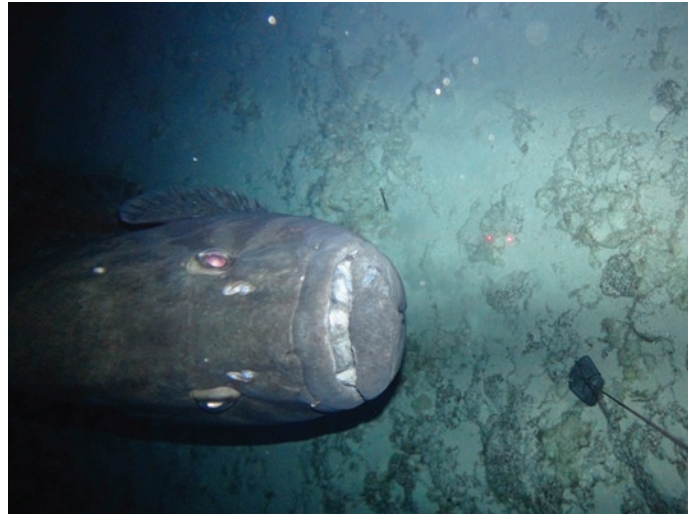
malfunctions ultimately led to the failure of the vehicle's main computer motherboard. Nonetheless, the ROV team never gave up trying to contrive some way to investigate the anomaly.



One of the underwater features we hoped to investigate was a possible debris field of man-made objects seen in video shot by the Submersible Systems, Inc. ROV in 2012. The feature was at a depth 60 meters (about 200 feet), too deep for divers but within the range the home-built OpenROV that Walt Holm had brought with him. Some searching was accomplished but the tether became snagged. The vehicle was eventually freed but the pressure vessel imploded and the OpenROV was destroyed. TIGHAR photo by L. Rubin.



In the final hours of the expedition the ROV and Dive Teams were successful in deploying a crude but functional camera system – dubbed the “Hail Mary” – that captured 170 high definition images of the bottom in the vicinity of the anomaly. TIGHAR photo by R. Rubin.



Smile for the camera! This Grouper gave the Hail Mary device a toothy grin. The camera, set to take a photo every 5 seconds, was lowered from a skiff. The operator stopped paying out line when felt the dive weight (visible in front of the fish) touch the bottom. Photo by R. Bernier.

Nai'a and the Niku VII team departed Nikumaroro on the evening of June 25 and arrived back in Fiji on June 29 after a record-setting but rugged four day voyage.



The Niku VIII team and Nai'a crew, Lautoka, Fiji, June 30, 2015.

The Betchart Amelia Earhart Expedition

The day before *Nai'a* departed for the return voyage to Fiji, the cruise ship *Fiji Princess* arrived with the first-ever tourist visit to Nikumaroro. Aboard were 61 tourists, including several TIGHAR members, who were eager to visit the sites on the island associated with TIGHAR's discoveries and carry out some searching of their own under the supervision of TIGHAR's Senior Archaeologist, Dr. Tom King, and a staff of experienced TIGHAR expedition veterans. *Fiji Princess* remained at Nikumaroro for four days. Fortunately the temperature and sea conditions were excellent and the passengers were able to safely explore the island.



Calm water in the landing channel greeted the first load of tourists to come ashore from Fiji Princess. Photo by A. McKenna.



TIGHAR Senior Archaeologist Dr. Tom King explains the dos and don'ts of touring Nikumaroro.

During the visit TIGHAR archaeologist Dawn Johnson collected soil samples from the island as part of an experiment to determine whether specially trained forensic dogs might be able to help locate human remains. Dawn collected soil from known grave sites in the abandoned village, "clean" sites in the village as a control, and from locations at the Seven Site – the castaway campsite at the far end of the island where a partial skeleton

believed to be Earhart's was found in 1940. The soil samples would be presented to the dogs back in the U.S. to see if they could sense a human presence in the known grave samples and if they "alerted" on any of the samples from the Seven Site.

Dawn Johnson collecting soil samples at the Seven Site. © D. Johnson, used by permission.



Post Expedition Research

Going to the dogs

On August 2, 2015 soil samples from the Forensic Canine Soil Test experiment were shown to forensic dogs of the Institute of Canine Forensics. One of the dogs alerted on a sample from one of the known village graves, and two of the dogs alerted on soil samples taken from near a “Ren” (*Tournafortia argentia*) tree at the Seven Site. According to the historical record, the bones of the castaway were found under a “Ren” tree. The experiment will be repeated later this year. If the results are replicated we’ll have a good idea of exactly where the body was lying, and be able to focus our search for any surviving bones, and especially teeth which can be an excellent source of DNA.

Dawn Johnson’s full report, [Canine Forensic Test](#), is on the TIGHAR website.

Looking in the wrong place.

The high-definition Hail Mary photos were of excellent quality but contained no sign of airplane wreckage nor did they reveal an alternative explanation for the anomaly in the sonar data. Post-expedition research revealed why. The positioning data from which the anomaly location was derived were inaccurate due to calibration errors by Phoenix International in 2012. In short, the anomaly wasn’t where we thought it was.

Now you see it, now you don’t.

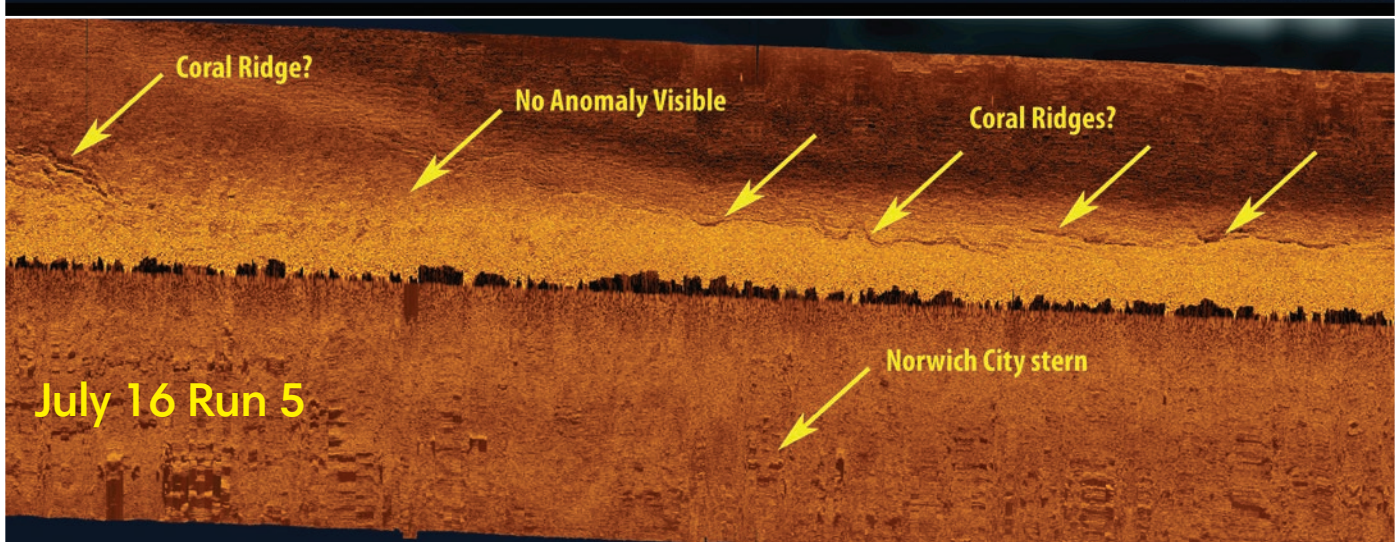
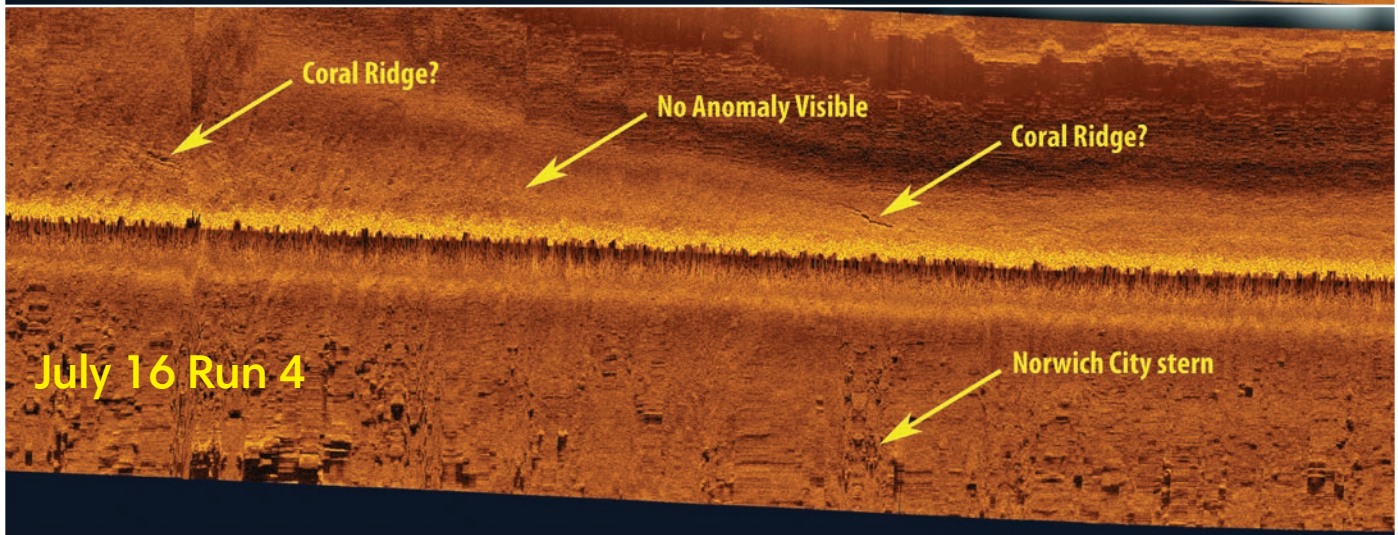
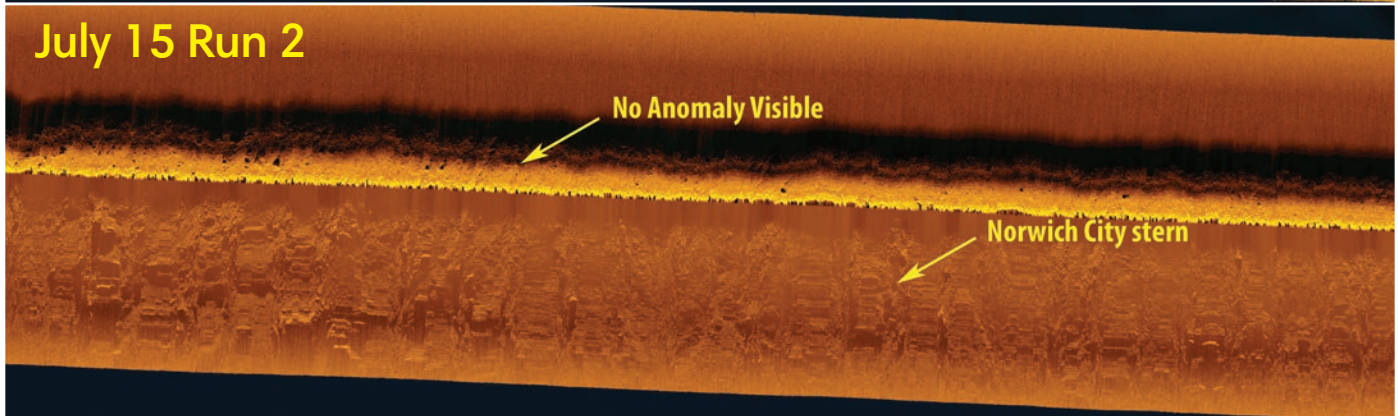
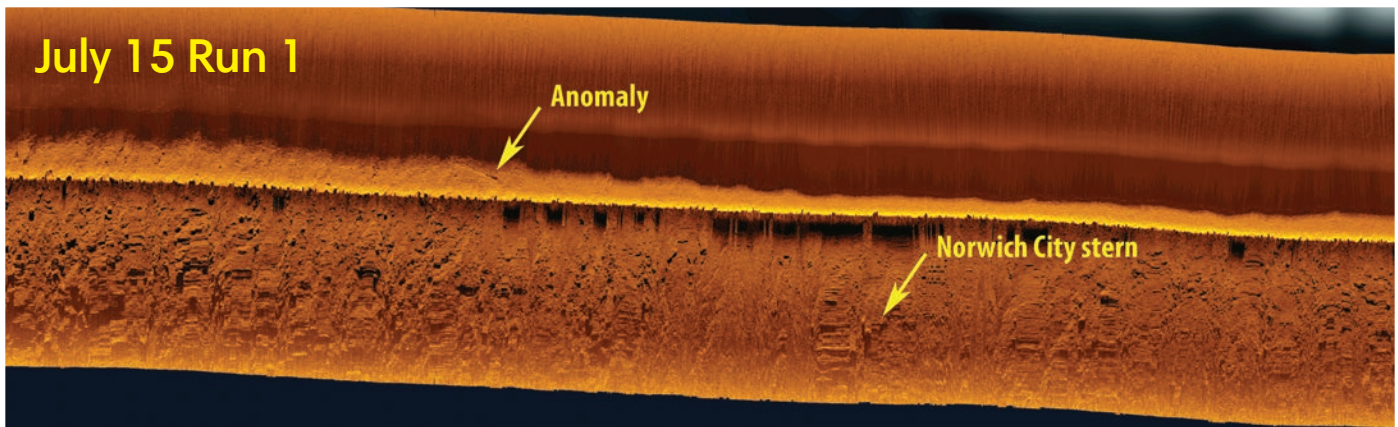
Further research into the sonar data collected by Phoenix International in 2012 has recently turned up evidence that the anomaly is not as anomalous as it appears to be in the imagery provided to TIGHAR.

Side-scan sonar produces images by sending out sound waves that “bounce” off the ocean bottom and any features or objects on the bottom. How, and even whether, a feature or object appears in the sonar imagery depends upon the angle at which the sound waves strike and bounce. Just as radar can fail to detect an aircraft with a “stealth” profile, sonar can completely miss a feature or object if the angle is not right. We had a dramatic illustration of this during the 2012 expedition when the Phoenix AUV flew directly over the massive wreckage of the stern of *Norwich City* at a depth of 900 feet without “seeing” it. We knew the wreckage was there because we had stumbled upon it with the ROV the day before. Phoenix sent the AUV back over the wreckage from a different angle and the debris became visible in the sonar imagery.

The same effect now appears to have made the anomaly seem more anomalous than it is. At the end of the 2012 expedition Phoenix delivered sonar imagery from which the Hawai’i Undersea Research Laboratory aboard *KOK* produced graphical representations of the area covered by side-scan sonar deployed from the AUV, overlaid with the “snail trail” of tracks inspected visually with video cameras on the ROV. The maps were constructed by combining lines of sonar data collected during various AUV missions into a mosaic of the entire western reef slope. The line of sonar data used in the mosaic to represent the portion of the reef slope that includes the anomaly was collected during a mission in which the AUV ran north and south along the reef slope. In that line of data the anomaly stands out dramatically as the only feature of its kind.

Following the publication of the Niku VIII Preliminary Report detailing the frustrations we encountered in trying to check out the anomaly, TIGHAR member Byron Ake asked if he could review the raw sonar data from the 2012 Phoenix International survey. Although strictly an amateur, Byron was curious as to whether anything new could be learned. We had the raw data but TIGHAR has neither the software nor the expertise to process it. There was nothing to lose in letting Byron take a crack at it.

Byron discovered that Phoenix had used only one of five north/south lines of sonar data to create the mosaic. Three lines were run on July 15 and two more were run on July 16. The anomaly appears in the first run on July 15 but not in the second. The third run passed too far to the west but, both runs flown on July 16 covered the anomaly area. The anomaly is not visible, but there are multiple features along the base of the second cliff that appear to be coral ridges and are similar in appearance to the anomaly. There is, of course, no way to be sure short of an on-site inspection, but based on this previously unknown data it seems likely that the anomaly is a ridge of coral.



Niku VIII Questions & Answers

The Niku VIII expedition asked three questions. We now have the answers.

- Is an “anomaly” seen in the side-scan sonar data collected by contractor Phoenix International during the 2012 Niku VII expedition the wreckage of the Earhart Electra?

Answer: Probably not. The anomaly is most likely a ridge of coral.

- Is there debris from the Electra on the underwater reef slope at depths accessible to SCUBA divers?

Answer: No, at least none discoverable by visual and metal detector survey.

- Is there any surviving evidence of an initial Earhart/Noonan campsite on the northwestern shore of the island?

Answer: No, at least none discoverable by visual and metal detector survey.

The questions needed to be asked. The answers are not the answers we would prefer, but in scientific inquiry you can pick the questions, but you don't get to pick the answers.

More funding and more reliable technology would have made for a less frustrating expedition but, in all likelihood, it would not have changed the outcome. Niku VIII did not find new evidence of Earhart's presence on Nikumaroro. Neither did it find anything that disqualifies or offers an alternative explanation for the abundance of evidence that says Nikumaroro is where the flight ended.



What's Next for the Earhart Project?

Deep Water Search

Three expeditions have demonstrated that underwater search operations on Nikumaroro's steep, unstable coral reef slope using remote sensing technology (AUVs and ROVs) are inefficient, inconclusive, and problem-plagued. Manned submersibles are probably the only way to do a thorough underwater search for whatever remains of the Electra. However, the future of the Hawaii Undersea Laboratory Pisces subs is in doubt and it is presently unclear whether other suitable manned submersible technology is available. In any case, a thorough search using manned submersibles will require a level of funding that may or may not be achievable. We'll be looking for the right subs and a willing sponsor.

Onshore Archaeology

TIGHAR Senior Archaeologist Dr. Tom King is exploring the possibility of a small team of experienced TIGHARs accompanying another Betchart Expeditions tourist cruise to Nikumaroro in 2017. The TIGHAR team would continue archaeological work at the Seven Site and other locations on the island plus conduct shallow water explorations with another OpenROV.

Castaway Redux

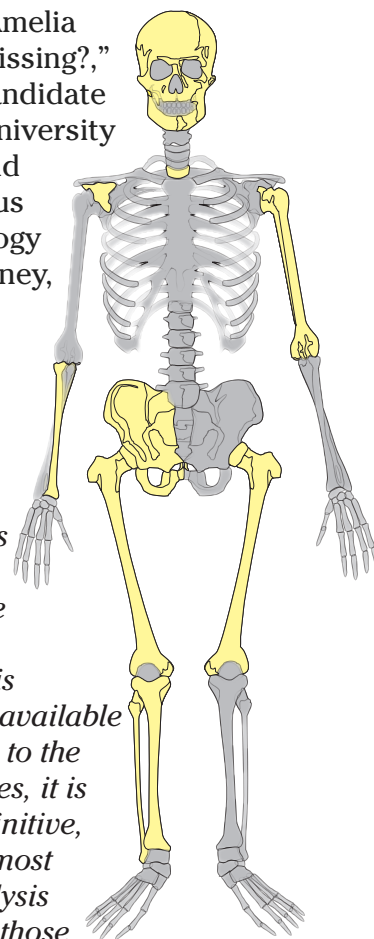
A paper published in the *Journal of Archaeological Science* (Volume 3, September 2015) takes issue with the conclusions reached in a 1999 TIGHAR paper titled "**Amelia Earhart's Bones and Shoes?** Current Anthropological Perspectives on an Historical Mystery." In that paper, forensic anthropologists Dr. Karen Burns and Dr. Richard Jantz concluded:

It is, of course, impossible to know whether the bones inspected by Dr. Hoodless in 1941 were in fact those of a white female, and if anything even less possible to be sure that they were those of Amelia Earhart. ... What we can be certain of is ...that the morphology of the recovered bones, insofar as we can tell by applying contemporary forensic methods to measurements taken at the time, appears consistent with a female of Earhart's height and ethnic origin.

In "The Nikumaroro bones identification controversy: First-hand examination versus

evaluation by proxy – Amelia Earhart found or still missing?," Pamela Cross, a PHD candidate in archaeology at the University of Bradford, England and Richard Wright, Emeritus Professor of Anthropology at the University of Sydney, Australia argue that:

A critical review of both investigations and contextual evidence shows that the original British osteological analyses were made by experienced, reliable professionals, while the cranial analysis is unreliable given the available data. Without access to the missing original bones, it is impossible to be definitive, but on balance, the most robust scientific analysis and conclusions are those of the original British finding indicating that the Nikumaroro bones belonged to a robust, middle-aged man, not Amelia Earhart."



Much has happened in the sixteen years since the TIGHAR paper was published.

- A co-author of the study, our dear friend and colleague Dr. Karen Burns, has died.
- Forensic tools for assessing gender and ethnicity from bone measurements have greatly improved.
- Research has turned up new information about the artifacts found with the bones in 1940.
- TIGHAR archaeological excavations in 2001, 2007, and 2010 of the castaway campsite where the bones were found have produced new clues to the identity of the person who died there.

TIGHAR is working with Dr. Richard Jantz to re-examine the data and respond to the Cross/Wright critique. We're hoping to publish the new study early in 2016.

Understanding Amelia

Dr. Guthrie Ford's application of language-based psychological analysis to the Earhart post-loss radio signals (see "Language-based Research on the Niku Hypothesis," page 42) produced such interesting results that he has begun a similar study of Earhart's documented in-flight radio transmissions during the Lae/Howland flight. What does what she said, and didn't say, tell us about how she was handling the deteriorating situation? What new insights might we gain? Dr. Guthrie's work has come to the attention of Dr. John Leach, SERE Psychologist at the Extreme Environmental Medicine & Science Group, Extreme Environments Laboratory, University of Portsmouth, England. Dr. Leach is a recognized authority on behavioral analyses of accidents and psychological factors in disasters. He has joined the TIGHAR team of researchers who are assisting Dr. Ford in applying this fascinating new perspective to the tragedy of July 2, 1937. We'll publish the new study when it's finished.

Sharing the Knowledge

Essential to testing the hypothesis that the Earhart/Noonan flight ended at Nikumaroro has been researching the documented facts of the case. Sharing that information with the public, replacing folklore and myth with reliable information, is a privilege and a responsibility. *Finding Amelia: The True Story of the Earhart Disappearance* by TIGHAR Executive Director Ric Gillespie (Naval Institute Press, 2006) is "Superb...first-rate history. An epic narrative...carefully researched, eloquently written. Probably the most detailed and factual account of Amelia Earhart's disappearance and the massive and failed attempt to find her we shall ever have."

Continuing in that tradition, we're now researching and writing *The Earhart Electra: From Drawing Board to Disappearance*. The lavishly illustrated coffee-table book will document the evolution of the world's most famous missing airplane. Delivered to Amelia on her 39th birthday – July 24, 1936 – the aircraft was in service less than a year when it vanished on July 2, 1937. During that time Amelia's Model 10E Special underwent many modifications. Instruments, fuel tanks, registration markings, radios, antennas, even windows, came and went as the so-called Flying Laboratory was readied for its globe circling mission. It is long past time for a documented

history of the plane's development, what is known – and not known – about the changes that were made and what they say about the people who made them. The first draft of Chapter One, "The Twin-Engined Lockheed," 1932 – 1934 begins on page 54 of this *TIGHAR Tracks*.

TIGHAR's Own Documentary

Over the years TIGHAR's expeditions to Nikumaroro have been the subject of several television documentaries. The sale of exclusive media rights has sometimes been an important factor in funding the expeditions, but there are downsides to letting others tell our story. Not only do we relinquish editorial control, but the time and structural constraints of broadcast television necessarily limit even a two-hour show to a tip-of-the iceberg treatment of the work. For the Niku VIII expedition we decided to shoot our own video and produce our own documentary funded by public contributions of \$50 or more, for which contributors would have their name listed in the credits of the film.

In part because the video shot during the expedition by award-winning TIGHAR cameraman Mark Smith of Oh Seven Films includes such stunning aerial drone footage, we've decided to expand the scope of the planned film. Rather than a short film about one trip, the TIGHAR documentary will be a comprehensive, multi-episode retrospective of the entire Earhart Project incorporating footage from TIGHAR's vast archive of footage from past expeditions going all the way back to our first trip to Nikumaroro in 1989.

Of course, a much bigger film will need a much bigger budget and will take longer to fund and produce, but everyone who has contributed so far will still be credited as will everyone who contributes going forward. This is the film that needs to be made and now is the time to start putting it together.



If Amelia Earhart Was Talking, She Was Not Sinking

Language-Based Research on the Nikumaroro Hypothesis

J. Guthrie Ford, Ph.D. TIGHAR #3422

Psychology and the Earhart Project

On July 2, 1937, Amelia Earhart and Fred Noonan took off from Lae, New Guinea, on the Pacific leg of their around-the-world flight. Their destination that day was Howland Island, a small dot on the vast ocean. Earhart and Noonan did not find Howland, and what happened to them after they became lost has remained a lingering question in aviation history.

A popular answer is offered by the Crash-and-Sank Theory: Earhart's Lockheed Electra aircraft ran out of fuel and crashed in the ocean.¹ TIGHAR's Niku Hypothesis is that while searching for Howland Island, Earhart spotted Gardner Island (now named Nikumaroro) and, running low on fuel, landed on the reef encircling Gardner.²

TIGHAR research on the Niku Hypothesis is known for its scientific orientation. TIGHAR has used information from forensic imaging analysis, metallurgy, materials testing, aerodynamics and celestial navigation, forensic anthropology, DNA testing, archeology, botany, submersible technologies, oceanography (tide times, island/reef formation), radio propagation analysis, radio direction finding, archival science, and eye-witness testimony.³

I wondered if my discipline of scientific (research) psychology might make a contribution to TIGHAR by demonstrating that, apparently through her own words, Earhart may have been telling the world since 1937 what happened to her after she became lost. This study presents the various scientific ways that that statement is empirically supported.

The Language Baseline as a Testing Tool

There is a psychological principle that a powerful situation produces very similar if not unanimous human behavior.⁴ For example, a movie theater rapidly filling with smoke is a powerful situation. Imagine that on sensing the smoke, moviegoers may call out, FIRE! EXIT! MOVE! GET OUT!, or close synonyms thereof. The moviegoers' common words and expressions constitute the characteristic language of the smoky theater situation, and so define the smoky theater language baseline.

I adapted the powerful-situation principle into a language-based, hypothesis-testing tool. Consider the hypothesis that Ophelia Gerhart was in a smoke filling theater on Tuesday. Having the transcript of Gerhart's language for that day, we find grouped together the words FIRE! EXIT! KEEP MOVING! Because Ophelia's language closely matches the smoky theater language baseline means that it is possible that Ophelia was in a smoke filling theater on Tuesday.

I saw merit in using this method of comparing a subject's language to a language baseline to test the Niku Hypothesis that after Earhart became lost, called the post-lost period, she ended up in a

powerful, life-threatening situation.* The hypothesis that Earhart was, post-lost, in a life-threatening situation can be tested by comparing Earhart's putative post-lost language to the appropriate language baseline. That language baseline would be the characteristic post-lost language produced by lost aviators who ended up in a life-threatening situation comparable to Gardner Island. If Earhart's putative post-lost language closely matches that post-lost language baseline, then it is possible that Earhart, after becoming lost looking for Howland Island, ended up in a life-threatening situation.

This study fleshed out the subject's language-matching-the-language-baseline method as a way to test the Niku Hypothesis. That work began by streamlining the method's name to the Aviation Language Baseline Test. The proposed usage of the ALBT in the Earhart Project is overviewed in Figure 1.

* For semantic purposes, "life-threatening situation" is for a while used synonymously with Gardner Island. Indeed, in 1937 the island was – still is – a life-threatening situation: unpopulated, equatorially hot and humid, having no fresh water, and possessing large, aggressive, and carnivorous coconut crabs.

- Principle: powerful situations produce sameness in people's language.
- Inverse of Principle: A person's presence in a powerful situation can be inferred by the person's language matching the language baseline, that is, the characteristic language, of the powerful situation.
- Assumption for Earhart Project: a life-threatening situation is a powerful situation.
- Hypothesis: Earhart was in a post-lost life-threatening (L-T) situation.

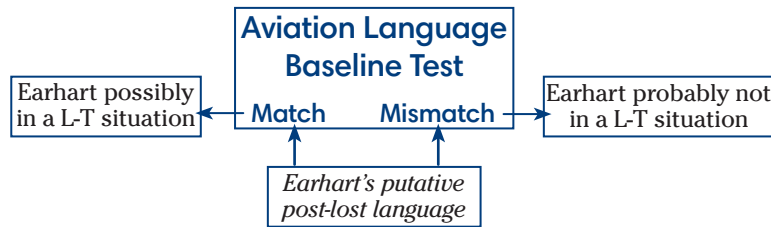


Figure 1. A language matching method to test a hypothesis regarding Amelia Earhart.

Two components were needed: A. Earhart's putative post-lost language for comparison to, B., the post-lost language baseline. Fortunately, there is an archive of Earhart's putative post-lost language, so that component was in hand. The other needed component is records of aviators who ended up – post lost – in life-threatening situations after their flights were interrupted. The last criterion is that those aviators had to produce post-lost language that would serve as the ALBT language baseline.

"Lady Be Good" and Captain Lancaster

There are two historical cases quite comparable to Earhart's. In April 1943, an Army Air Forces B-24 bomber, dubbed "Lady Be Good" (LBG), was returning from a mission to its base on the Libyan coast.⁵ Flying at night, the coast was overflown, and the aircraft kept flying south into the great Sahara Desert. Before LBG ran out of fuel the nine crew members bailed out. Second Lt.



John Woravka, bombardier, died when his chute failed to deploy fully. The crew's plan was to trek north to the coast and safety; unfortunately, that did not occur. (LBG was found in 1958.)

In April 1933, ex-RAF officer William (Bill) Lancaster was attempting to set the fastest flying time from England to South Africa.⁶ When Lancaster, flying solo, landed his Avro Avian biplane at Reggan, Algeria, he was half way across the Sahara; and at Reggan, Lancaster prepped for his nighttime flight over the rest of the desert. He

did not make it. The engine failed and Lancaster ended up unconscious in the inverted Avian cockpit: "I came to in a terrible shape, bad cuts about forehead.... I dug and clawed my way out." Lancaster never left the crash site, which was not found until 1962. His well-preserved body had "mummified."



Psychologically, Amelia Earhart, the LBG airmen, and Bill Lancaster have similar profiles. All had the grit to be life players rather than sideline dwellers: the LBG airmen were aerial warriors operating a deadly war machine; Captain Lancaster had completed (in 1928) a hazardous flight from England to Australia; and of course Earhart had a record of achievements in the burgeoning field of women's aviation. These people also shared the negative experience of a flight ending unexpectedly and placing them, post lost, in comparable life-threatening situations.

My next agenda was to construct the post-lost language baseline for the Aviation Language Baseline Test. That baseline required post-lost language from the LBG crew and Captain Lancaster. The former was provided by diaries kept by 2nd Lt. Robert Toner (co-pilot) and T/Sergeant Harold Ripslinger (flight engineer). Lancaster's post-lost language is also available as a diary. The LBG and Lancaster diaries each have about seven daily entries. The LBG diaries are in Appendix 1, Lancaster diary in Appendix 2. (Before looking at these you should read the next section.)

Language Scoring Protocol

The language baseline of the Aviation Language Baseline Test is derived from the LBG and Lancaster diaries. The first step was to reduce the hundreds of words in those daily records into manageable units of information. To achieve that, the language in the diaries was content analyzed,⁷ and two major language types were found; these became the language scores. The types center around the theme of these men's experience,

which was their physical condition and mental normality being constantly deteriorated by the life-threatening situation.

The first language type is Objective, “O,” language. This language appears at the beginning of the life-threatening situation when the person is essentially normal. The person is focused on external, factual topics, and his language is professional as per his training as an aviator. O language is about the wind, temperature, assets, and problem solving vis-a-vis escaping the situation: “wind NW; heat this a.m. is high; starting trek today,” etc. Every diary day received the O score. The second major language type is Desperation, D, language. After three or four days the barbs of the life-threatening situation have sunk deeply into the individual and deteriorated his body and mind; he is no longer the person he once was. Heat, nighttime cold, glare, thirst, hunger, pain, fatigue, hopelessness, plus the general aura of life ebbing away have produced Desperation language, the language of urging rescuers to hurry, about being unable to go on, struggle, prayer, sensing the coming of death, and finally wishing for death itself.

Pre-Desperation language, called Subjective, S, language was also noted in the analysis. S language marks the start of the deteriorative process, when attention is pulled to melancholic themes as well as the myriad internal states that are changing for the worse. S language marks the beginning stages of Desperation. Lancaster’s sentimental words to his girlfriend and his parents are S language. S language is also about starting to feel the life-threatening situation: the heat, the pain, the incessant thirst. For example, the words “heat today is high” is Objective reporting, while “heat today is from hell” is personal S language, indicating that the diarist is beginning to register the impact of the heat.

The three language scores resulting from the analysis are O alone, OS (O & S mixed), and OD (O & D mixed). (Recall each day had an O score, so S and D always have an O component.) Sequentially – across the diary days – OD never preceded O or OS. Logically, that is expected because it takes time for the person to deteriorate to the desperate level. There are instances where S and D language appear in the same day, and those days were scored OD because Desperation, being the more

dire psychological state, already includes the less dire Subjective level; that is, it is because of “heat from hell” (S language) that the person is now desperately praying for rescue (D language). (An important feature of the language scoring in this study is addressed in endnote 8.)

Evolution of the Aviation Language Baseline Test

To create the baseline for the Aviation Language Baseline Test, the Lancaster, Ripslinger, and Toner post-lost language scores (in Appendices 1 and 2) were compiled in the upper part of Figure 2. To qualify as baseline material these three men’s scores had to be comparable, and comparable for the right reason.

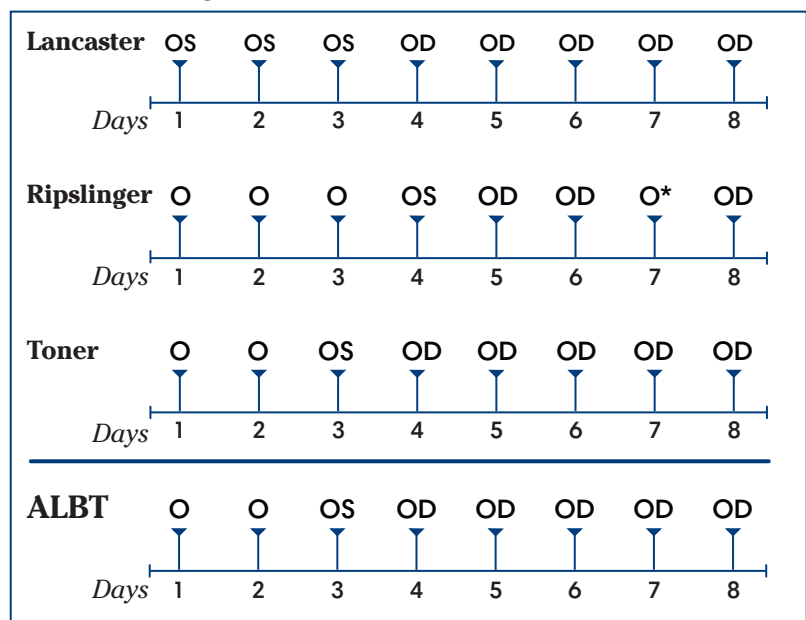


Figure 2. Evolution of the base line for the aviation baseline test.
O*=Artifact.

A critical feature of the three diarists’ scores is that Desperation scores (OD) appear after O (or OS) scores. That sequencing pattern reflects the days it takes for the life-threatening situation to deteriorate people down to the desperation level. (The O* was the day Ripslinger walked day and night, and in sheer fatigue jotted down about half the words he usually wrote. I believe O* is an artifact; the man had been and was surely still at the desperate level–OD.)

Unlike Toner and Ripslinger, the Subjective OS score appears from the get-go for Lancaster. That is not surprising. He began his post-lost period seriously injured, and so his attention was naturally pulled to the subjective (internal) state of pain. Nevertheless, Lancaster’s scores did follow the “OD sequence” rule given above.

Overall, the three diarists' languages are quite comparable. In fact, if Ripslinger's OS was replaced with OD on day 4, the three records would be practically identical (given the caveat about Lancaster's OS scores). The comparability of the language scores is important as a prerequisite for the ALBT baseline. The baseline must demonstrate empirically the conceptual principle that there is a common language spoken by post-lost aviators in life-threatening situations. Had the three diarists' languages been different, then that principle would have been invalid, and I would have abandoned this language-matching paradigm all together.

However, are the Lancaster, Toner, and Ripslinger language scores comparable for the right reason? Conceptually, they should be comparable exclusively for the reason that these men produced their languages in a life-threatening situation; but instead, what if the languages were comparable only because the diarists influenced what each other had written. That would badly confound the issue. Of course, the Lancaster and the LBG languages are independent of each other because of the time frame (1933, 1943). However, are the Toner and Ripslinger languages independent entities? I assumed so because a diary is a domain for private expression, and so there is little if any chance that Lt. Toner and Sgt. Ripslinger conferred on what to write. With the language scores of the three diarists being independent entities, one can be confident that the comparability of the scores is due exclusively to the fact that the languages were produced in a life-threatening situation.

The Lancaster, Ripslinger, and Toner language scores are a convincing empirical demonstration of the psychological principle that a powerful situation can produce commonality in the words people produce. However, for the sake of measurement economy it is best that the Aviation Language Baseline Test have a baseline provided by only one of three sources shown in Figure 2. For that function the author chose the Toner scores, which are repeated and re-labeled ALBT in Figure 2. By having the second OS score on day three and the second OD score on day four, Lt. Toner represents the "majority" position as per the three score sources. (In a later grand overview the reader can see the other two sources as the ALBT baseline. Importantly, the study's conclusions are unchanged.)

Testing Earhart's Putative Post-Lost Language Scores

The Aviation Language Baseline Test was used to evaluate the Niku Hypothesis that having failed to find Howland Island, Amelia Earhart ended up, post lost, in a life-threatening situation (instead of crashing and sinking). Were Earhart in a life-threatening situation, then the internal logic of the ALBT specifies that Earhart's putative post-loss language scores will match the language scores (values) of the ALBT baseline, which is known to have originated in a life-threatening situation.

Earhart's putative post-lost language is available through six reports from people claiming to have heard Earhart speaking after she went missing. That was only possible by Earhart transmitting on her aircraft radio, which did not work on water. These post-lost reports contain transcriptions and/or descriptions of Earhart's putative language. The reports span the post-lost dates of July 2nd through the 7th (excluding the 6th). Appendix 3 contains these reports and the scoring of Earhart's putative post-lost language in each of them.

Hypothesis testing occurred by mapping Earhart's putative post-lost language scores onto the ALBT baseline and examining the comparability of these scores (see Figure 3). Firstly, the putative Earhart Desperation (OD) scores did not precede her O or OS scores, which satisfies the important OD sequencing rule. The matching to baseline is excellent. Four of the five AE days match the ALBT; or viewed alternatively, five of the six AE post-lost scores match the ALBT.

If one accepts the principle that people's commonality of language may indicate the people sharing a powerful situation, then the matching results in Figure 3 strongly confirm the Niku Hypothesis that, post lost, Earhart was in a life-threatening situation, at least for the period of July 2-7, 1937.

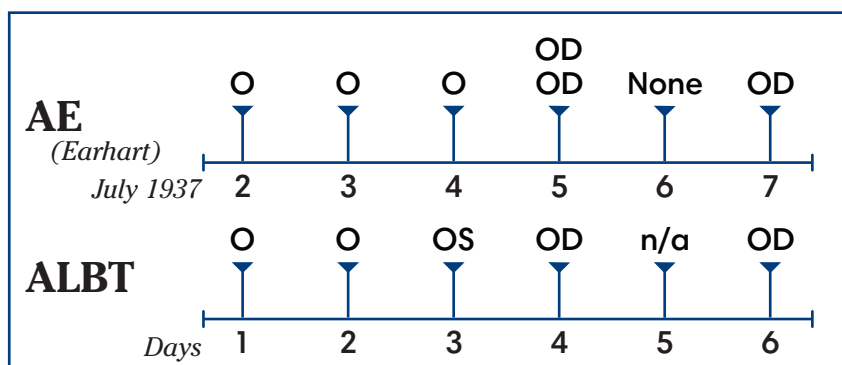


Figure 3. The high degree of matching of AE's putative post-loss language scores to the ALBT.

A moment of reflection shows how extraordinary, and telling, these results are. Amelia Earhart and the people involved in creating the ALBT baseline, Robert Toner, Harold Ripslinger, and Bill Lancaster were worlds apart. At 35 years of age, Lancaster was a ne’er-do-well Englishman looking in 1933 to revitalize his life with a record setting flight; the Lady Be Good airmen were young warriors engaging the Axis powers in 1943; and Amelia was a middle-aged woman who, in 1937, was at the zenith of her fame as the world’s premier aviatrix. Nevertheless, these aviators are psychologically bonded by having been in horrendous situations subsequent to ending their failed flights. It is haunting to the author to think about these people’s post-lost language scores that reach across so much time and space. (Appendix 5 contains two methodological considerations that are relevant to evaluating the results reported in this study.)

Confirming the Validity of the ALBT Results

In Figure 3, the Aviation Language Baseline Test showed it is capable of identifying a language that seems to have been produced in a life-threatening situation. If the ALBT is successful in identifying such a language, then it should be equally successful in identifying a language that was not produced in a life-threatening situation. That language should mismatch the ALBT baseline.

Appendix 4 contains nine apparent bogus reports of “Earhart” language. Bogus means that it appears hoaxers made up the language and in their reports lied about it being Earhart’s. What is important for testing purposes is

that the bogus “Earhart” language was not produced in a life-threatening situation. Therefore, if the ALBT is worth its salt as a measurement tool, the bogus post-lost language scores will not match the ALBT baseline; that is, the baseline will be able to detect the bogus scores because they do not have the “fingerprint” of a life-threatening origin.

The hoaxers’ putative post-lost language reports were scored and the bogus scores were mapped onto the ALBT–AE included for comparison’s sake. Figure 4 shows that ALBT and the

bogus scores are thoroughly mismatched. Most crucially, the bogus scores fail the deterioration criterion not one, but two ways.

Firstly, the OD scores appears too early and they do not precede the O score. Secondly, the new positive sentiment score, O+ (see Appendix 4) is at the last of the post-lost period. What that says is that after a week of stress, fatigue, privation, and torrid equatorial conditions, a person would blithely declare, “all is well.” That is wholly absurd. No more time need be spent with the bogus scores. It is apparent that they came from the imaginations of people looking for a bit of fame by lying about hearing Amelia Earhart. (Earhart’s putative post-lost language scores were included in the figure just to have the bogus-AE contrast on the record.)

The mismatch results in Figure 4 show the validity of the Aviation Language Baseline Test in terms of the capacity of the ALBT baseline test to discriminate between a language with probable life-threatening origins (Earhart’s) and a language apparently without that origin (hoaxers’). That capacity increases confidence that the crucial hypothesis-testing results in Figure 3 are not some sort of fluke, but are very likely a genuine sign of a language – apparently Earhart’s – that was produced in a life-threatening situation.

I have a challenge for those who doubt the authenticity of the post-lost voice transmissions that TIGHAR hypothesizes were made by Amelia Earhart. The challenge is succinctly presented in Figure 4. If Earhart did not speak the July 2-7 voice transmissions, then the language whose scores are marked AE had to have come from hoaxers.

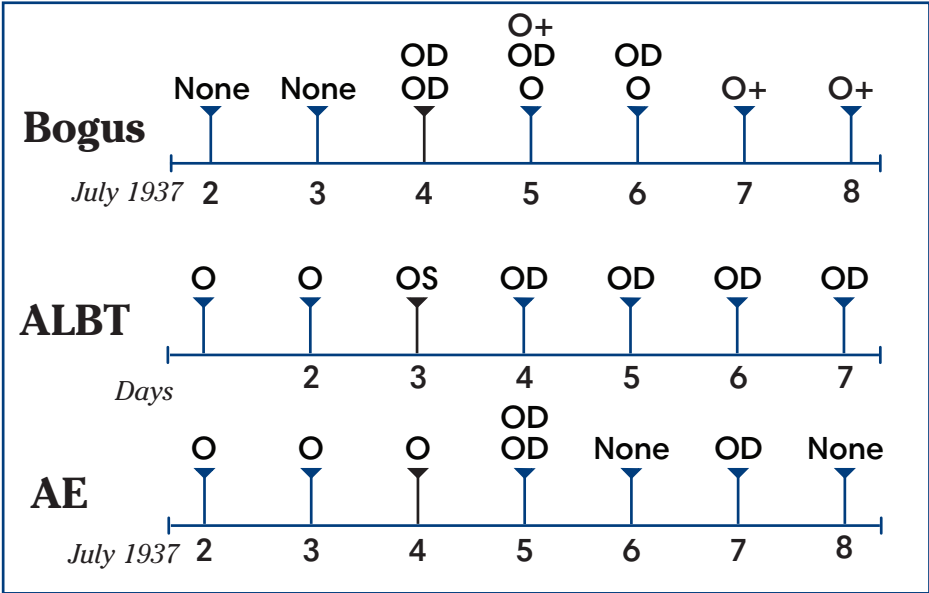


Figure 4. Hoaxers’ putative language scores relative to the ALBT and AE.

And so if the post-lost reports are hoaxers' bogus words, why are the bogus and AE scores in Figure 4 so strikingly different? And why do the AE scores (putatively) match the ALBT, which is known to have its origin in a life-threatening situation comparable to Gardner Island?

Before closing this paper I want to acknowledge the TIGHAR policy that consumers of TIGHAR information decide for themselves about the information. In the spirit of that tradition, Appendix 6 contains this study's total data package.

Conclusions and Implications

Gardner Island Reinstated

While it was conceptually advantageous in this study to use "life-threatening situation" in lieu of Gardner Island, it is now time to return the island to its rightful place in the Niku Hypothesis. Brandenburg's seminal research provides indisputable radio direction finding (DF) evidence that post-lost radio signals were transmitted from a small south central Pacific zone containing Gardner Island.¹⁰ I strove to complement Brandenburg's work by showing that the chances are excellent that Gardner is where the post-lost transmissions originated, and chances are also excellent that Amelia Earhart made those transmissions. This is the reasoning behind those statements and the scientific evidence that supports them.

The ALBT matching results in Figure 3 leave little doubt that the language putatively identified as Earhart's (AE) was produced from July 2-7 in a life-threatening situation. The location that is life-threatening and within the Brandenburg DF zone is Gardner Island.¹¹ Even if Gardner is the most likely place of origin for the voice transmissions that people reported (in Appendix 3), what points to Earhart being the person who made those transmissions? Gardner Island was uninhabited in 1937, and so it is preposterous to think that a woman other than Earhart was identifying herself as Earhart and transmitting radio signals on or around Gardner Island from July the 2nd through the 7th, 1937. (July 8th if you allow for a record of the word "Earhart." See Appendix 3, second heading.)

It is my scientific opinion that the empirical evidence – Brandenburg's DF findings and Ford's ALBT matching results – strongly supports the proposition that Amelia Earhart and Fred Noonan were, post-lost, in a life-threatening situation called Gardner Island. It is also highly likely that Earhart

transmitted voice and other type radio signals,¹² and of course that could not have happened had the flyers crashed and sank in the ocean. Because the transmissions had to have come from the radio inside Earhart's Lockheed Electra, the chances are also excellent that evidence of that aircraft exists on Gardner Island and/or in the waters close to that atoll. Indeed, the possibility of that is supported by extant evidence.¹³

The ALBT as a Forensic Tool

Other than a hypothesis testing tool, what might be another application for the Aviation Language Baseline Test? Scenario: TIGHAR receives a handwritten document found in an old steamer trunk. It is dated July 7, 1937, and was written by a woman claiming she heard Amelia Earhart on a shortwave radio. The document is a transcript of what the woman claims she heard, off and on, over the course of an hour. While the July 7 date is in the window of the possible Earhart radio transmissions, is the transcript gold or fool's gold? The ALBT could be part of the forensic package used to answer that question. After scoring the language in the transcript, compare that score to the ALBT (and AE) scores for July 7, the OD score would be expected. A match supports the transcript as possibly being the real deal, while a mismatch casts doubt on the transcript's authenticity.

Notes

- 1 Elgen Long, "Crash and Sank Theory," <http://www.elgenlong.com/#/earhart/crash-and-sank> (accessed 11 August 2015).
- 2 The Niku Hypothesis, http://tighar.org/wiki/The_Niku_Hypothesis (accessed 11 August 2015).
- 3 What is the Evidence? The Earhart Project, <http://tighar.org/Projects/Earhart/AEdescr2.html> (accessed 11 August 2015).
- 4 Situationism, <http://www.alleydog.com/glossary/definition.php?term=Situationism> (accessed 11 August 2015).
- 5 Lady Be Good.net, <http://www.ladybegood.net> (accessed 11 August 2015).
- 6 Staff, "Bill Lancaster: Lost in the Sahara..." <http://www.historynet.com/bill-lancaster-lost-in-the-sahara-after-attempting-to-break-the-england-cape-town-flight-speed-record.htm> (accessed 11 August 2015).
- 7 Content Analysis, <http://writing.colostate.edu/guides/guide.cfm?guideid=61> (accessed 11 August 2015).

- 8 The author alone scored the language materials in this study. Might he have subconsciously biased the scoring to support the Niku Hypothesis? To cancel that concern, the author was transparent about the scoring protocol and case by case explains the actual scoring of the study's 39 language samples (Appendices 1-4). Readers are invited to score some language samples to assure themselves that the data are valid (which they are).
- 9 Bob Brandenburg and Ric Gillespie, "Catalog and Analysis of Radio Signals During the Search for Amelia Earhart in July 1937," <http://tighar.org/Projects/Earhart/Archives/Research/ResearchPapers/Brandenburg/signalcatalog2.html> (accessed 11 August 2015).
- 10 Bob Brandenburg, "Analysis of Radio Direction Finder Bearings in the Search for Amelia Earhart," <http://tighar.org/Projects/Earhart/Archives/Research/ResearchPapers/Brandenburg/RDFResearch/RDFAnalysis/RDFAnalysis.htm> (accessed 11 August 2015).
- 11 What about close-by McKean Island as the life-threatening situation? TIGHAR archeologically investigated McKean and found no evidence of Earhart's presence on the island. See, Thomas F. King, Ph.D., "McKean Island," <http://tighar.org/Projects/Earhart/Archives/Research/ResearchPapers/McKean/McKean.html> (accessed 11 August 2015).
- 12 In addition to the ten language reports in Appendix 2 Brandenburg and Gillespie (endnote 10) also found 47 credible reports of transmissions of Morse code and the carrier wave, which is the sound heard when the radio microphone talk button is pressed down.
- 13 The Window, the Patch, and the Artifact, the Earhart Project, http://tighar.org/Projects/Earhart/Archives/Research/Bulletins/73_StepbyStep/73_Step_by_Step.html (accessed 11 August 2015).

Appendix 1 — Diaries From Crew of Lady Be Good

For readers' ease of understanding, Objective (O) language is black, blue is Subjective (S) language, and red is Desperation (D) language. Scoring guidelines in this section are pertinent to understanding the scoring in other language materials in this paper. Comments are in italics.

Diary of Second Lieutenant Robert Toner

Entry 1 Sunday, Apr. 4, 1943 Naples – 28 planes. Things pretty well mixed up. Got lost returning. out of gas, jumped. Landed in desert at 2:00 in morning, no one badly hurt, can't find John, all others present. *Score, O. All factual, professional level language.*

Entry 2 Monday 5. Start walking N.W., still no John. a few rations, ½ canteen of water, 1 cap full per day. Sun fairly warm. good breeze from N.W. Nite very cold, no sleep. Rested & walked. *Score, O. All factual, professional level language.*

Entry 3 Tuesday 6. Rested at 11:30, sun very warm, no breeze, spent P.M. **in hell**, no planes, etc. rested until 5:00 P.M. walked & rested all nite, 15 min. on, 5 off. *Score, OS. Classic example of deterioration effect. Day 2, sun is fairly warm; Day 3 11:30, very warm; by the afternoon, S language of "in hell." Diarist beginning to feel the life-threatening situation.*

Entry 4 Wednesday, Apr. 7, 1943. Same routine, every one getting weak, can't get very far, **prayers all the time**, again P.M. very warm, **hell**. Can't sleep. Everyone sore from ground. *Score, OD. "Getting weak" not scored as Subjective language because it is already subsumed under the psychologically more dire Desperation language of prayers; that is, praying because getting weak and having trouble walking.*

Entry 5 Thursday 8. Hit Sand Dunes, very miserable, good wind but continuous blowing of sand, everybody now **very weak**, thought Sam & Moore were **all gone [deceased]**. LaMotte eyes are gone, everyone else's

eyes are bad. Still going N.W. *Score, OD. Previous day's "getting weak" has now deteriorated to more Desperate level of "very weak."*

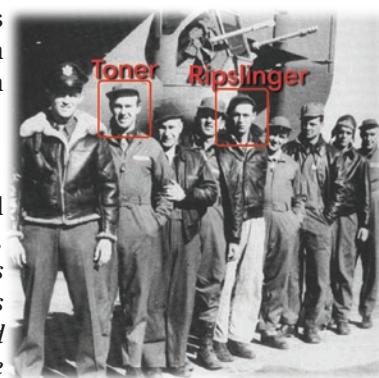
Aura of death introduced by thinking moribund crew members were dead and the realization that LaMotte's eyes "are gone." Lt. Toner's Desperation was accurate in that this was the last day he moved.

Entry 6 Friday 9. Shelley, Rip, Moore separate and try to go for help, rest of us all very weak, eyes bad. Not any travel, **all want to die**, still very little water. Nites are about 35, good N. wind, no shelter, 1 parachute left. *Score, OD.*

Entry 7 Saturday, Apr. 10, 1943. Still having prayer meetings for help. No signs of anything, a couple of birds; good wind from N. Really weak now, can't walk, pains all over, **still all want to die**. Nites very cold, no sleep. *Score, OD.*

Entry 8 Sunday 11. Still waiting for help, still **praying**, eyes bad, lost all our wgt. aching all over, could make it if we had water; just enough left to put our tongue to, have hope for help very soon [delusional], no rest, still same place [sic]. *Score, OD. Awaiting death.*

Entry 9 Monday 12. No help yet, very (unreadable) cold nite. *Not scored. The end may have come to Lt. Toner on this day.*



Diary of Technical Sergeant Harold Ripslinger

Entry 1 Sunday. Mission to Naples, Italy. T.O. 3:10 and dropped bombs at 10:00. Lost coming back. Bailed out at 2:10 A.M. on dessert [sic]. *Score, O. All factual, professional level language.*

Entry 2 Monday. All but Woravka met this A.M. Waited awhile and started walking. Had ½ sandwich [sic] & piece of candy & cap of water in last 36 hr. *Score, O.*

Entry 3 Tuesday. Started out early walking & resting. It's now sundown and still going. One teaspoon of water today. The rest of the boys are doing fine. *Score, O.*

Entry 4 Wednesday. Started early A. M. and walked til about near spent. **Terrible hot** afternoon. Started again at 6 P.M. and walked all night. One spoon full of water is all. *Score, OS. "Terrible hot" shows diarist's attention is now on deterioration effect; he is starting to feel the life-threatening situation.*

Entry 5 Thursday. Tired all out. We can hardly walk. Our 4th day out. A few drops of water each. **Can't hold out much longer** without aid. **Pray.** *Score, OD. Continual deterioration produces D language.*

Entry 6 Friday. 5th day out & we all thought we're gone. **All wanted to die** during noon it was so hot. Morn & nite okay. 2 drops of water! *Score, OD. Apparently everyone thought the others were gone. Deterioration has moved diarist well past the S language level, directly to Desperation.*

Entry 7 Saturday. Walked all day and night. Suggested Guy, Moore and I make out alone. [Lt. Toner wrote that these three men left his immobile group on Friday.] *Score, O. I believe this score is an artifact. Having walked all day and night with essentially no water, the author contends that Sgt. Ripslinger had no energy to write more than what he did. The O score appears to be artifactual; the man was actually desperate.*

Entry 8 Sunday. Palm Sun. Still **struggling** to get out of dunes and find water. *Score, OD. Sgt. Ripslinger's last entry.*

Appendix 2 — Diary of William Lancaster

The Lancaster daily diary is massive, requiring 16 pages in Ralph Barker's Verdict on a Lost Flyer, St. Martin's Press, New York, 1969. A sample of the diary is presented below. The difference from the Lady Be Good diaries is the amount of daily writing space; the LBG diarists used pocket size diaries while Lancaster wrote in a ledger book. Also, Lancaster never walked away from this plane, so he had naught to do but think, feel, and write. The full Lancaster diary (in the Barker book) was analyzed in this study. I have provided a sample of the diary including each day's language score.

Lancaster crash landed the night of April 12th, 1933, in the Algerian Sahara well west of his intended course, the reason he was not found. His Avro Avian biplane flipped over and Lancaster, with head lacerations, managed to free himself after a period of unconsciousness. The diary began on the 13th and ended on the 20th. The same color coding used in scoring the LBG diaries is used here.



Day 1 I corkscrewed myself out into the open. My eyes were full of blood which had congealed, but eventually I managed to get them open. My thought was the water: had it run out? No, thank God. Two precious gallons of it. I can live for a few days. **I am naturally feeling shaky** but must keep my head at all costs.... **I find I am cut above the nose and above eyes.** I hope it does not become an infected wound. The sun is now going up into the heavens and I suppose I must crawl under the lower wing and hide myself until sundown.... As **hot as blazes** even under the shade of the wing.... I am going to ration my water. One thermos bottle a day which I shall pour from the 2-gallon tank.... People who haven't been in the desert have no real idea of **thirst**. **It's hell.** I did not realize it until this moment.... I will light the [signal] fire at 10:30 pm and flares from then on at half-hour intervals. *Score, OS.*

Day 2 My flares were a success, at least they showed a brilliant light for 60 seconds. No one saw them.... I certainly saw no lights at all. Oh! please send out your planes now. I am not as strong as I have had no real food since I left England.... **Felt bad owing head pains** [sic]. Tried little alcohol out of compass [to treat his head wounds]; not good. Sprinkled it over head, the evaporation was cooling for a few seconds.... Oh Chubbie [significant other] my darling, shall I ever see you again? *Score: OS.*

Day 3 I must now conserve every bit of energy to keep alive for about three or four days in the hope that I will be rescued. If the planes start searching today I hope for relief.... The hours from 11 am to 4:30 pm are the dreaded ones. The **heat of the sun is appalling**.... [Must get] water. That is my **constant craving**. WATER. *Score: OS.*

Day 4. Wind has died down. All day yesterday afternoon there was a strong wind and sandstorms. [Focused on water.] It [water container] is now half full so I may be able to last three more days after today. **This will be my limit**, so please planes start your search.... Let me go over the crash again.... I left Reggan at 6:30 pm feeling fine to fly to Gao.... After flying one hour and 40 minutes the engine coughed. Nothing happened for five minutes then coughed and missed badly.... Down, down I came.... I hit the ground before realizing it, bounced 50 yards, hit again and rolled over.... Upside down confined in cockpit. With strength of desperation I dug and clawed my way out. [Lancaster writes what appears to be a **practice farewell letter to Chubbie and his mother, closing with “God be with you,” signs his name.**] I suppose I can last two or three more days. Then it will be a few hours – madness – and **death at last. I pray that it comes quickly if it has to be.** Score: OD.

Day 5 I am suffering mental torment again. I am positive I saw [a] light last night and the person who fired it must have seen mine [flare], yet nothing has come to support the fact that they have located me.

[Probably dream or hallucination.] Not a breath of air. **I am resigned to the end** if it has to be.... **I am resigned to my fate, I can see I shall not be rescued unless a miracle happens.** Score: OD.

Day 6 Here in the day I lay gasping for air and WATER.... Well, this sixth day I open with **a prayer** that something will happen today. It is now almost unbelievable that shall be rescued.... Can last today but **doubtful about tomorrow...** Score: OD.

Day 7 Now my water will give out today. It cannot be made to last longer. It is then just a matter of a few hours and **please God a quick end.** As this is the last entry I want to say a few words more to all who are dear to me. [What follows is a long farewell to Chubbie, mother, and father.] I am now going to tie it [the log] up with a note on the outside. Goodbye to you and God be with you. Bill. [PS] If there is another world, if there is something hereafter (and I feel there is), I shall be waiting, Bill.... The chin is up right to the last I hope. Score: OD.

Day 8 (written on gas credit card). I have no water. No wind. **I am waiting patiently. Come soon please.** Score: OD.

Appendix 3: Six Post-Loss Language Reports

Brandenburg and Gillespie⁹ found “credible” reports from people claiming they heard Earhart speaking on their radios. Credible means it is physically possible for a radio voice signal emanating in the south central Pacific area to reach the people’s radios. It was not those researchers’ purpose to demonstrate that the voice small bodysignal may have been transmitted by Earhart.

There are ten credible post-lost language reports that span from July 2, ostensibly the day Earhart landed on the Gardner Island reef, through July 7, the post-lost period. While the Gardner locale might be argued by some, there can be no argument that if Earhart spoke on her aircraft radio from the 2nd through the 7th, then the aircraft **was not in the water.** (Water would have flooded the main electrical junction box and shorted out the electrical system.)

Six of the ten post-lost reports were usable in this research, and the language in each of those reports was scored using the OSD Language Scoring Protocol (p. 10). The SC# designation gives the location of the report in Brandenburg and Gillespie’s Signal Catalog (endnote 10).

July 2, 2100-2145 hrs. (Gardner Island time): Mabel Larremore, SC #28.

Larremore claimed to have listened to Earhart and paraphrased what she heard. Earhart said SOS. Plane was down on an uncharted island. Small, uninhabited. Plane was partially on land, part in water. She stated that her navigator Fred Noonan was seriously injured; needed help immediately. She also had some injuries but not as serious as Mr. Noonan. She gave the latitude and longitude of her location, but over the years, that information had become lost.

Scoring: All objective, factual information. Just as LBG Lt. Toner described his crew’s condition, this speaker did the same. Score, O.

July 3, 0800 hrs.: Nina Paxton, Kentucky, SC#47

Paxton claimed to have heard Earhart say “down in ocean,” then “on or near little island at a point near ...,” then something about “directly northeast,” and “our plane about out of gas. Water all around. Very dark.” Then something about a storm and that the wind was blowing, “will have to get out of here,” “we can’t stay here long.”

Scoring: All fact-oriented, Objective material, reported in a professional way. “We can’t stay here [presumably in aircraft] long” is factual as per response to an apparent storm. Score, O.

July 4, 0400-0425 hrs. Dana Randolph, Wyoming, SC#81

Randolph claims he heard Earhart say, "This is Amelia Earhart. Ship is on a reef south of the equator. Station KH9QQ." The woman then began to give her location, but the signal faded before it was given. That sequence was repeated an unknown number of times during a 25 minute period.

All Objective material. Score, O.

July 5, 1030-1215 hrs. Betty Klenck, Florida, SC#142

The famous Betty's Notebook is too large to be reproduced here, but can be read on line at <http://tighar.org/Projects/Earhart/Archives/Documents/Notebook/notebook.html>. Sample material for scoring purposes:

"This is Amelia Earhart" is Objective, professional distress call language. "Help us quick" and crying are Desperation level. Score, OD.

July 5, 2216 hrs. Howard Coons, California, SC#118

Coons claims to have heard Earhart say, "still alive. Better hurry. Tell husband all right."

This is partly the replay of the Desperation spoken earlier on this day. That is, "Better hurry" is synonymous with "Help us quick." Still alive is an Objective statement of fact. Message to husband is S language, trumped by the D language. Score, OD.

July 6

No usable records available.

July 7, 0130 hrs. Thelma Lovelace, Canada, SC#170

Lovelace claims to have heard, loud and clear, Earhart saying, "Can you read me? Can you read me? This is Amelia Earhart. This is Amelia Earhart. Please come in." Earhart then give her latitude and longitude, which Thelma wrote in a book, and continued: "we have taken in water, my navigator is badly hurt; we are in need of medical care and must have help; we can't hold on much longer." That was repeated: "We are in need of medical care and must have help; we can't hold on much longer."

Objective material followed by sheer Desperation. Score, OD.

Four Unusable Language Reports

On July 4th, 5th, and 6th (SC#s 82, 140, 161) Mrs. Ernest Crabb (in Canada) claimed to hear bits and pieces of what she described as conversations between Earhart and Noonan. Crabb did not identify the speaker, making it impossible to analyze Earhart's putative words. On July 7, the word "Earhart" was reported by a Coast Guard radioman. No more words were reported. SC# 175.

Appendix 4: Ten Post-Loss Language Reports

Brandenburg and Gillespie (endnote 8) documented ten "not credible" reports from people claiming to hear post-lost voice transmissions from Earhart from July 4-8, 1937. It was not credible that the voice signals below reached these people's radios. People making bogus

reports about hearing Earhart are hoaxers, probably looking for a moment of fame by claiming to hear Earhart. The full narratives of these bogus reports are in the Signal Catalog. Below are samples of each report's language that warranted the assigned language scores.

July 4, SC# 48

Reporter claimed Earhart give "call letters of her plane" and heard her "pleading for help." Call letters is Objective language; pleading, Desperation language. Score, OD.

July, SC# 119

Reporter claimed Earhart gave some numbers and said "waterlogged," followed by, "can't last much longer." Score, OD.

July 5 SC# 111

Reporter claimed Earhart said plane on the water and water leaking in. Navigator computing their location. Objective. Score, O.

July 5 SC# 154

Reporter claimed to hear Earhart give her location and say, "We cannot last more than 3 hours longer..." Score, OD.

July 5 SC# 153

Reporter claimed to hear Earhart (possibly Noonan) gave her location and say "all is well so far." A new text color for a new language type called Positive, P, language, which positively describes things as going along just fine: "all is well..." Score, O+.

July 6 (circa), SC# 158

Reporter claimed Earhart gave radio call sign and then being located off Howland Island. Also said battery very weak. Score, O.

July 6 SC#162

Reporter claimed to hear Earhart give location and say, “cannot hold much longer...” Score, OD.

July 7, SC#168

Reporter claimed to hear Earhart give location and say, “we are OK but a little...” Score, O+.

July 8 SC#180

Reporter claimed to hear Earhart give location and say that she and Noonan were OK. Score, O+.

The tenth not credible voice report, SC#177, was a woman apparently reporting snippets of a radio theater program she had picked up; that is, the woman was not lying, but had been fooled by a good actress reading a good script. This report was not used in the study.

Appendix 5: Two Methodological Considerations

Are the three language sources, Bill Lancaster, Lt. Toner, and Sgt. Ripslinger, a sufficient number of sources for deriving the baseline for the Aviation Language Baseline Test? There is no set number, but the greater number of scores, the greater the confidence that the baseline is a true reflection of aviators’ language that is common to post-lost life-threatening situations.

I used sources that I found via internet search and consultation with an aviation historian. I ask TIGHAR readers to contact me if they discover *diary-type* information written by aviators in life-threatening post-lost circumstances. (I am aware of the South African Air Force personnel lost in the Sahara during World War II (<http://samilitaryhistory.org/vol122jc.html>).) Thank you.

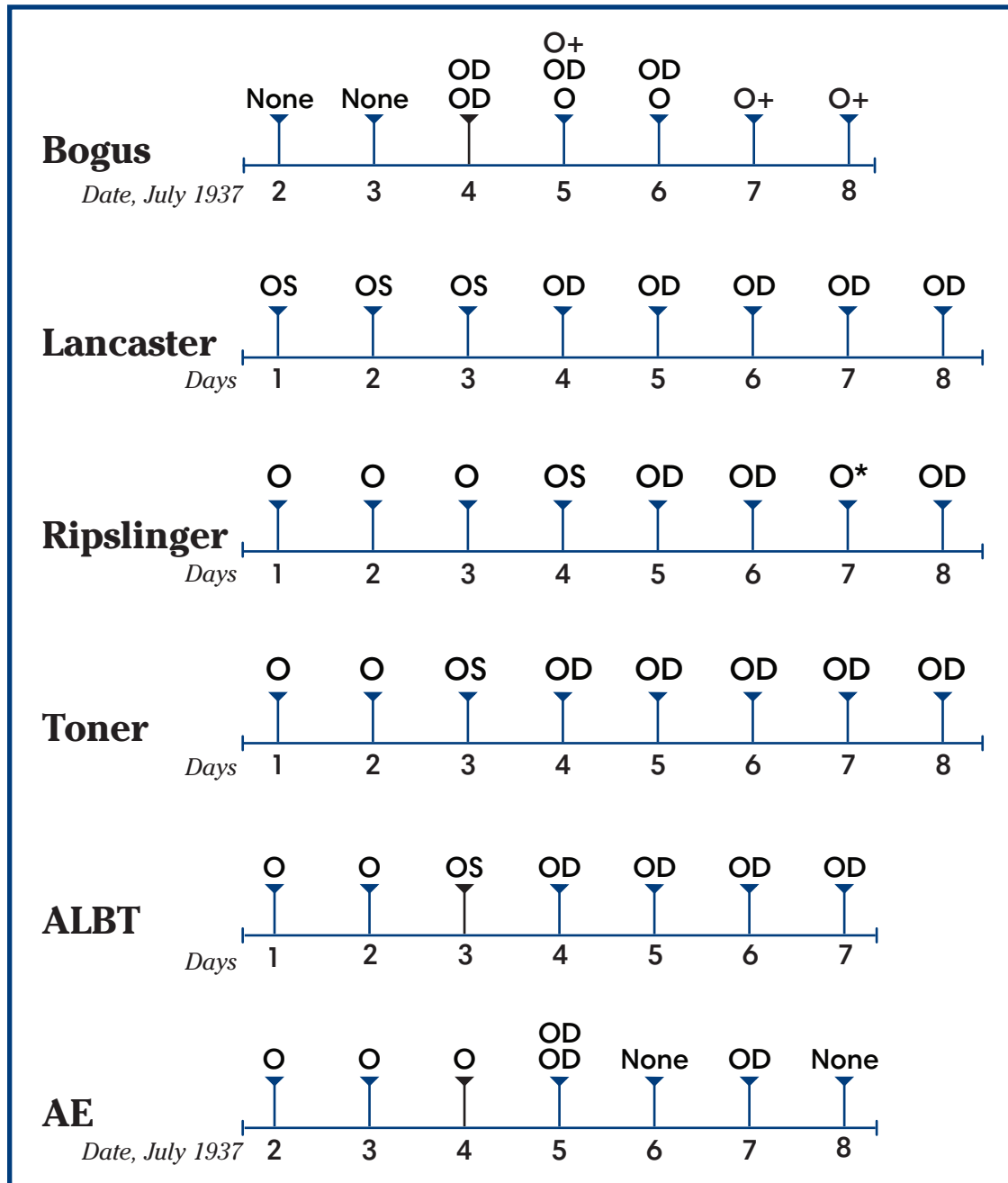
Each of the six credible records of Earhart’s putative post-lost language (Appendix 3) is incomplete. That is

because the radio signal the reporters claim they heard was erratic, cutting off some of the transmitted words. Therefore, it is possible that the speaker, ostensibly Earhart, could have spoken language that might have had language scores other than those shown in Figure 3. For example, perhaps Subjective language was the language dropped by the erratic signal on July 3rd, meaning that if that language had been heard and transcribed, that day would have been scored OS rather than O, and therefore would constitute a mismatch with the baseline. The more mismatches there are with the baseline, the weaker the support for the proposal that Earhart ended up in a life-threatening situation – Gardner Island. That means that the erratic signal phenomenon, and the associated potential for mismatching, is a reason to curb overzealous enthusiasm for the study’s positive results.

About the Author

J. Guthrie Ford, Ph.D., was a teaching and research psychologist at Trinity University (San Antonio, TX) from 1972-99, when he retired as an emeritus professor. Ford’s area of speciality is personality and social psychology, and methodologically, Ford developed a psychological test relevant to testing hypotheses from his Temperament/Actualization Theory. At the millennium, Ford began a second career as a historian specializing in life and times on the Texas coast in the the Port Aransas (Mustang Island) area. For R&R from that history enterprise, Ford rekindled his childhood interest in Amelia Earhart, and on “discovering” the Niku Hypothesis in 2012 was impressed by TIGHAR’s empirical standards and scientific rigor. Ford hoped to conduct research in the Earhart area and was led to the present study by noting pattern similarities in Earhart’s putative post-lost language and the post-lost language of crew members of other lost aircraft.

Appendix 6: The Total Data Package



The Earhart Electra: From Drawing Board to Disappearance

by Ric Gillespie

Chapter One: “The Twin-Engined Lockheed”

1932 – 1934

Sometimes the door of history swings on small hidden hinges. Were it not for the persistence of a precocious young engineer and the influence of a celebrity consultant, the reincarnation of a company that became and remains a giant of the aviation industry may have died with the failure of its first aircraft.

1932: Infant Mortality: The Demise and Precarious Rebirth of Lockheed

Interest in aviation had fairly exploded in the wake of Lindbergh’s 1927 transatlantic triumph, but the general public’s appetite for new records and new heroes did not translate into widespread use of air travel. And who could blame them? Lumbering 100 mph trimotors slogged through bumpy weather, their cabins reeking of vomit. Crashes were commonplace. When Herbert Hoover took office in 1928 there were forty-four separate carriers vying for a share of the market. Many were under-capitalized, skating by with antiquated airplanes that often flew with only the crew aboard. No airline could turn a profit without government-subsidized airmail contracts.

One bright spot in the otherwise bleak commercial aviation landscape was the Lockheed Aircraft Company. From 1927 to 1932, Lockheed, founded in 1912 by brothers Allan and Malcolm Loughhead (a Scottish name pronounced Lawkheed) built fast single-engine airplanes with sleek molded-plywood bodies and cantilevered wooden wings. Flown by customers with names like Post, Earhart, Lindbergh, and Kingsford-Smith, Lockheed aircraft set records of every description. The Model 9 Orion, a six passenger, 200 mph, single-

engine airliner with retractable landing gear, was faster than the military fighters of its day.

Through no fault of its own, Lockheed’s fortunes changed in the sky over Kansas on the last day of March 1931, when Transcontinental & Western Flight 599 shed a wing and plunged to the ground carrying legendary Notre Dame coach Knute Rockne and seven others to their deaths. When it was determined that moisture had weakened the wooden wing of the Fokker F10 trimotor, the public’s faith in biodegradable airliners followed Rockne to the grave. Almost overnight, an airline that did not operate all-metal equipment flew empty airplanes. Sales of new Lockheeds virtually ceased and by October the company was in receivership. On June 16, 1932 the Title Insurance and Trust Company of Los Angeles locked the doors of the Burbank factory.¹

The wooden-airplane Lockheed Aircraft Company was dead, but just five days later the company was reborn, its assets purchased for \$40,000 by a group of investors who saw a new day dawning for commercial aviation. The rise in demand for all-metal airplanes coincided with a revolution in aircraft design. Advances in materials and techniques meant that rather than fastening sheets of corrugated aluminum to a supporting steel-tube framework, as in the Ford “Tin Goose” trimotor, an aircraft’s external covering, the aluminum “skin,” would carry the aerodynamic load. Semi-monocoque construction would mean tremendous savings in weight, and reduction in aerodynamic drag resulting in a quantum leap in speed and payload.



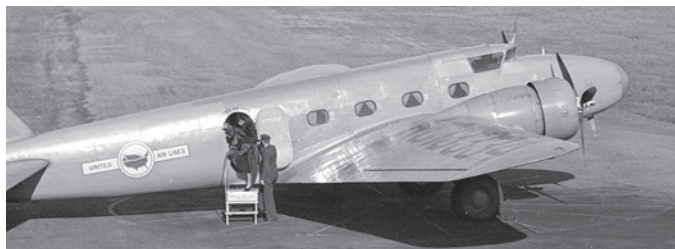
Lockheed Model 9C Orion “Shelllightning” flown by Jimmy Doolittle.

¹ R.J. Francillon, *Lockheed Aircraft Since 1913* (Annapolis, Maryland: Naval Institute Press, 1987), 13.

A new Lockheed design team headed by Lloyd C. Stearman began sketching out a stressed-skin, all metal, low wing monoplane with retractable landing gear carrying two pilots and ten passengers. The proposed aircraft was basically an enlarged, metal Model 9 and, like the Orion and all previous Lockheeds, it was to have a single engine. To preserve the appearance of continuity with the former company, the new design was designated the Model 10 and, in keeping with the Lockheed tradition of naming its products after celestial bodies, it was named “Electra” after a star in the Pleiades Cluster of the constellation Taurus. The design was a logical, conservative step for the new company but Chairman and Treasurer Robert Ellsworth Gross saw a problem. Gross looked at the market place and became convinced that the future of commercial sales was in multi-engine aircraft. The design team agreed to add a second engine. It was a wise move. Two years later the U.S. Civil Aeronautics Authority banned the commercial use of single-engine aircraft on domestic routes at night and over rough terrain.

1933: Betting the Farm on a Flawed Design

Lockheed Aircraft Corporation was a latecomer to the revolution. The company’s new airliner was still on the drawing board when the first of the new breed of commercial aircraft took to the air on February 8, 1933. The Boeing Model 247 was a ten-passenger, twin-engine monoplane of stressed-skin aluminum construction with retractable wheels that cruised at nearly twice the speed of existing airliners. The new airplane would be going to United Airlines, the Boeing company’s own airline. Not to be outdone, Transcontinental & Western Airlines (TWA), still recovering from the Rockne disaster, asked designer Donald Douglas to develop an airliner that could compete with the 247. The



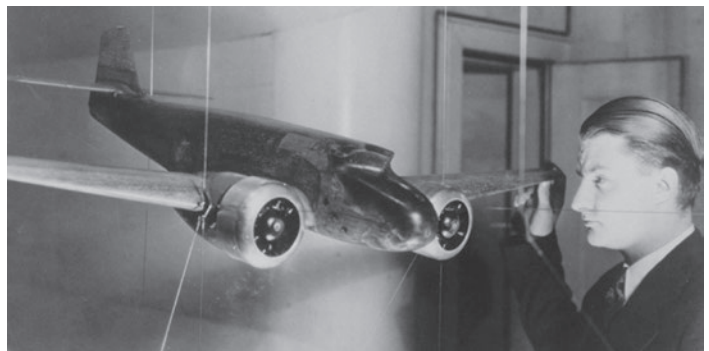
Above: Boeing Model 247 Below: Douglas DC-1.



twelve-passenger Douglas DC-1 made its first flight on July 1, 1933. Only one was built, but the follow-on DC-2 was soon flying with a wide range of U.S. and international carriers. The Douglas design’s next iteration, the DC-3, would become a legend.

In deciding to accept the high development costs of the twin-engine aircraft with no sales orders in hand, Robert Gross was betting the farm on the success of an airplane that existed only on paper.

By March of 1933 the new design was ready for wind-tunnel analysis. Lockheed sent a scale model to Professor Edward Stalker, aerodynamicist at the University of Michigan’s Department of Aeronautics. The mock-up featured a single vertical fin and rudder, large wing fillets (graceful fairings that swept from the wing root to the fuselage), and a rearward sloping windshield. The young graduate student who ran the tests, Clarence “Kelly” Johnson, didn’t think much of the results. “It had very bad longitudinal stability and directional control problems.”² The student’s opinion was ignored



Lockheed Model 10 wind tunnel model with Clarence “Kelly” Johnson.

and Professor Stalker, in consultation with Lloyd Stearman, decided the design was acceptable. The directors decided to go ahead with construction of a prototype. What Lockheed needed now was a customer.

Enter Amelia Earhart

In 1933, Northwest Airways in St. Paul, Minnesota was a small regional carrier with one 350-mile route between Minneapolis and Chicago, and a secondary route of similar length to Winnipeg, Manitoba. The changing political climate promised opportunities for growth. On Sunday, March 4, Franklin Roosevelt had been sworn in as the 32nd Chief Executive of the United States, assuring a country wracked by unemployment and bank failures that “the only thing we have to fear is fear itself.” More to the

² Clarence L. Johnson, *Kelly: More Than My Share Of it All* (Washington, DC: Smithsonian Books, 1985), 21.

point for Northwest Airways founder Col. Lewis Brittin, his airline need no longer fear the U.S. Post Office.

One of the new president's first official acts had been to fire Postmaster General Walter F. Brown, ending the corruption and favoritism that awarded the lucrative intercontinental airmail contracts to giants United Airlines, Transcontinental & Western Airlines (TWA), American Airlines, and Eastern Air Transport while leaving regional carriers like Northwest to survive on the scraps.

Lewis Brittin knew that Roosevelt's victory heralded an opportunity for Northwest to bid the coveted airmail contract for the northern route from Minneapolis to Seattle. Also in play was a proposed federal appropriation of \$1.2 million dollars for airfield and facilities improvements along the 1,500 mile route. To land this windfall Northwest would need to make its case in Washington, and the airline's general manager John Croil Hunter was courting just the person who might be able to help. In January 1933, he invited Amelia Earhart to fly as a guest aboard a Northwest Airways Ford Trimotor on a portion

passenger Hamilton H-47s and fifteen-passenger Ford 5AT Tri-motors. Later that spring, when Croil Hunter expressed interest in the new Lockheed ship, Robert Gross was quick to schedule a sales call. Before Gross arrived Hunter solicited Amelia's opinion about what Northwest should be looking for if it chose to go with the twin-engine Lockheed, still in the design stage and a year from its first flight. Like the invitation to accompany the January survey flight, Hunter's query appears to be primarily an effort to keep Earhart engaged. Amelia's value to Northwest was not her technical expertise but the influence she might be able to exert in Washington to make Northwest's need for new airplanes a reality.

Earhart replied with her recommendations on March 9, 1933. In light of later events, the letter fairly drips with irony. Her own twin-engined Lockheed and her ill-fated world flight were years over the horizon, but the letter is sprinkled with the opinions and attitudes that would be her undoing (see spread pp. 58-59).

A few days after Hunter received Earhart's letter, Brittin wrote to him, "Amelia Earhart had lunch last week at the White House and I think it is quite possible a meeting could be arranged when we could lay our problem ... directly before the new Administration."⁴ Ultimately, Northwest got the airmail contract and Northwest ordered new airplanes. To what extent Amelia's endorsement of Robert Gross "and his gang" influenced Northwest's decision to be the first to place orders for the Model 10 is unknown and unknowable, but the thirteen Electras Northwest ordered saved the Lockheed company and launched a production run that eventually totaled 148 airplanes, including the one in which Earhart would meet her fate.

Fixing the Flaws

While Robert Gross was trying to find a buyer for his paper airplane, Kelly Johnson was trying to make sure that the final product would be worth selling. As a grad student at the University of Michigan, Johnson had found the design to be badly flawed and had disagreed with the university's official wind-tunnel report. Upon receiving his Master of Science degree, he bought a used Chevy and drove to Burbank to ask Lockheed for a job. He was hired to work in tool design for \$83/month. "I think an important reason for my being hired was that I had run the wind-tunnel test on the company's new plane." Kelly Johnson was



Northwest Airways survey flight crew with guest Amelia Earhart. Minnesota Historical Society, used by permission.

of the northern route to "assess the desirability of flying the route in mid-winter."³ The Northwest crew had far more experience than Earhart who had never flown for an airline. Amelia rode as a passenger in the frigid cabin. It is difficult to see her participation in the flight as anything more than a flattering, and successful, publicity stunt.

To service the hoped-for route, Northwest would need to upgrade its fleet of single engine, six

³ Doris Rich, *Amelia Earhart: A Biography* (Washington, DC: Smithsonian Institution, 1989), 170.

⁴ Rich.

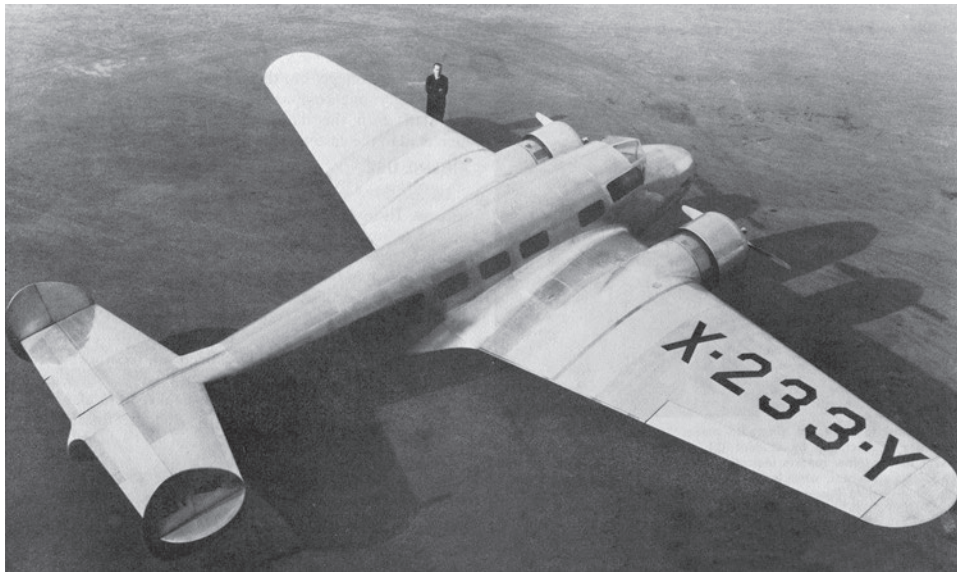
never known for his tact, and he wasted no time in telling his new employers that their new design was unstable. He persisted in his criticism until Lockheed Chief Engineer Hall Hibbard relented. “Why don’t you go back and see if you can do any better with the airplane?” Johnson headed back to Michigan with the wooden model in the back of the Chevy.⁵

It took Kelly Johnson seventy-two further wind-tunnel tests to isolate the problems with the Model 10 design and come up with solutions. The wing fillets and the inverted-slope windshield, although

much in fashion, were disturbing the airflow and causing unnecessary drag. More seriously, the single vertical fin and rudder lacked sufficient authority to hold the aircraft straight in the event of an engine failure. Johnson returned to Burbank with his recommendation that the wing fillets be removed, the windshield be replaced with a conventional design, and the aircraft be given a twin tail. Hibbard was pleased with Johnson’s work and promoted him to full-fledged engineer. He agreed to change the tail but the fillets and reverse-slope windshield remained.

⁵ Johnson, 23.

1934: A Star Is Born

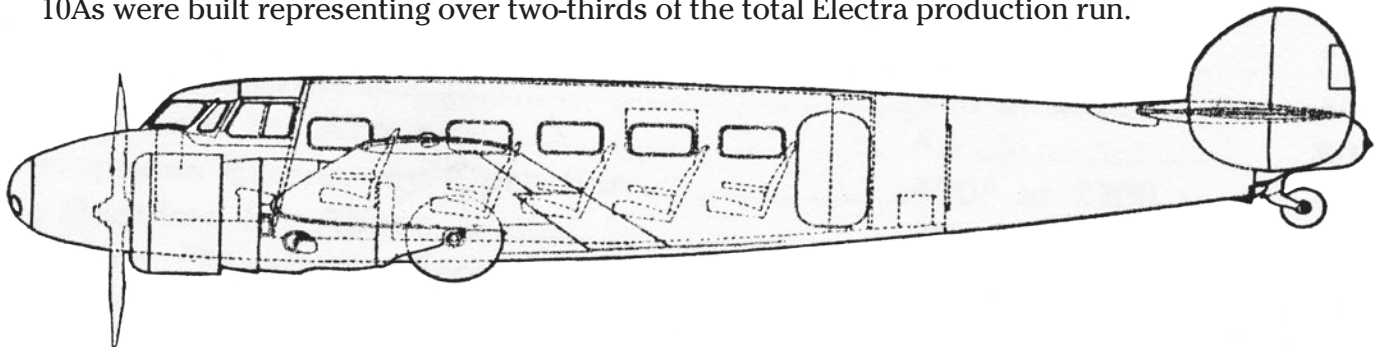


Prototype Model 10A with wing fillets and reverse-slope windshield.

The prototype Model 10A flew for the first time on February 23, 1934 with chief test pilot Marshall “Babe” Headle at the controls. The airplane performed well but Kelly Johnson had been right. The wing fillets and funky windshield would have to go. With those changes made, airworthiness certification trials were successfully completed that spring and constructor’s number (c/n) 1001 was delivered to Northwest Airways as NC233Y on June 29, 1934.⁶

Five versions of the Model 10 were ultimately offered:

- The Model 10A was powered by two 450 hp Pratt & Whitney R985 Wasp Jr. engines. A total of 101 10As were built representing over two-thirds of the total Electra production run.



⁶ Francillon, 120.

AMELIA EARHART

Locust Avenue,
Rye, New York

March 9, 1933.

Dear Croil:

I am glad Robert Gross is calling on you Monday. I think you will like to do business with him and his gang.

Concerning specifications for the twin-engined Lockheed, Paul Collins expressed himself as satisfied with details of construction, motors, gear, sound-proofing, instruments and their arrangement, as well as with all "gadgets". Thus the requirements to insist on, boil down to important ones of capacity and load distribution, speed, power plant specifications, and radio equipment.

Under the first it seems advisable to have 10 passenger seats, 2 pilot places, 4 gasoline tanks holding 40 gals. each, and a 300 pound baggage compartment. This arrangement could be used in any combination of passengers, pilots, mail and gasoline, depending on the run.

As to speed, the planes should cruise 180 MPH at 85% motor output. With flaps, the landing speed should not be more than 65 MPH, though a higher one would not be a valid cause for much concern, in my opinion. Take-off and climb are not very important in commercial flying.

Two motors are only a nuisance unless altitude with full pay load can be maintained at 4000 ft. by means of one engine alone.

In considering radio equipment I believe serious thought should be given to the necessity of two-way transmission. It is of course desirable in some instances but before you plan to sacrifice other features to make sending possible I should advise a thorough check in the light of high speed operation. It may be that reception

AMELIA EARHART

-2-

of the beam and weather reports will be found all that is essential. I shall talk with you more about this later. As with radio, please think in terms of high speed operation when you juggle the variables of load, gasoline capacity and pay load, as enumerated in the first paragraph.

For instance, remember that with shorter runs the necessity for two pilots diminishes.

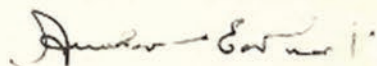
Paul Collins suggested to Lockheed officials that they were wasting space by having the cabin as wide as it is. He said it could be decreased by 6", which reduction would tend to increase speed and facilitate flying on one motor, because the power plants could be brought in closer to the cabin. Further, such reduction would not interfere with passenger comfort.

You will find that in ordering ships on paper the purchaser will probably be required to put up 20% of the final price. This amount covers for the engines, which manufacturers will not supply on credit. Ownership of the engines would be your protection should the deal fall through because specifications were not lived up to.

If the foregoing does not cover what you want, telegraph me at Rye.

Sincerely yours,

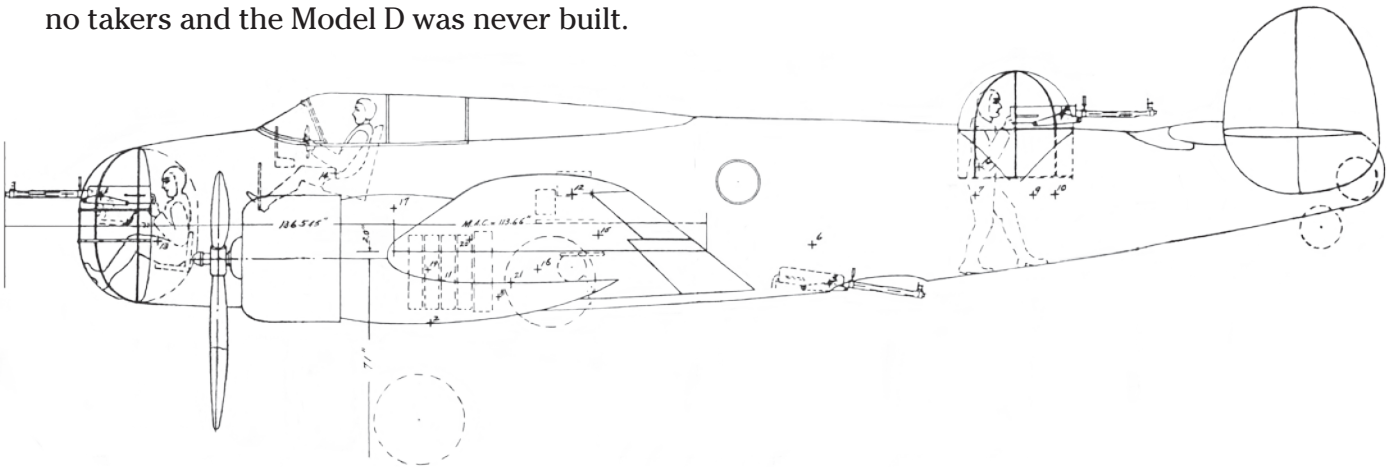
Croil Hunter, Esq.,
Northwestern Airways,
St. Paul, Minn.



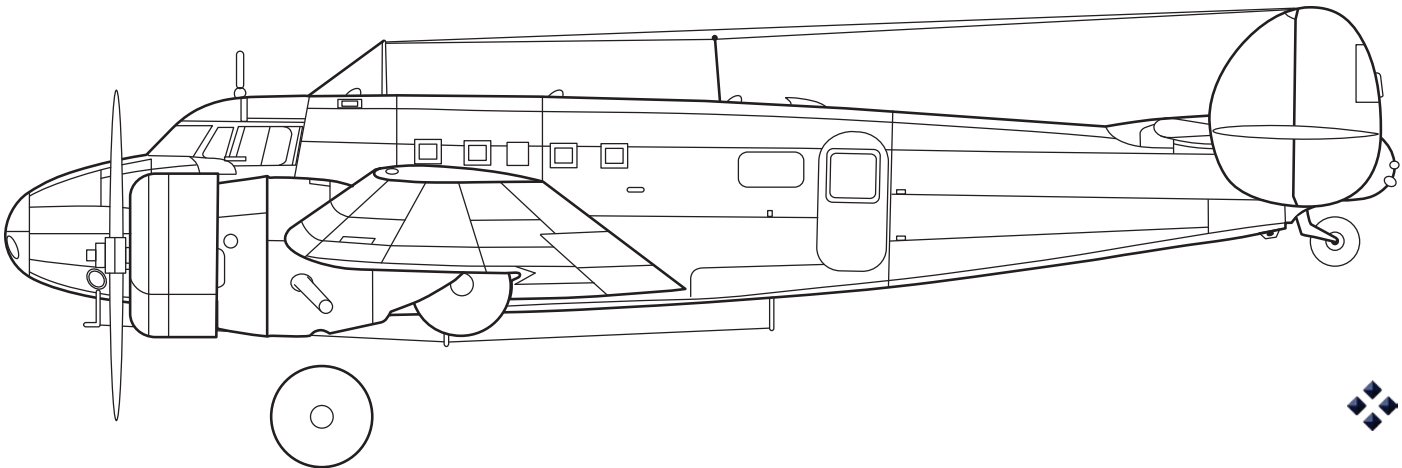
P.S. While talking with Gross you might sound him out on the possibility of gearing the motors. Pratt & Whitney have told me gearing would add about 250 lbs. in weight. However, speed and efficiency might be increased to offset this load. I am looking into the details of this further.



- The Model 10B was powered by two 440 hp Wright R975-E3 Whirlwind engines. Eighteen customers preferred the Wright engine.
- The Model 10C was powered by two 450 hp Pratt & Whitney R1340 SC1 Wasp engines. The 10C was an accommodation for Pan American Airways. PanAm had a surplus of old SC1 Wasps and offered to become Lockheed's second customer for the Electra if they could save money by providing their own engines. Eight 10Cs were built.
- The Model 10D was a proposed military version. In the mid-1930s, recognition that light, single-engine fighters would not have sufficient range to escort bombers to and from distant targets led to the development of long range, multi-engine "heavy fighters." Lockheed's offering was to have a crew of three and be armed with a 37 mm cannon and three .50 caliber machine guns. There were no takers and the Model D was never built.



- The Model 10E was powered by two 550 hp Pratt & Whitney R1340 S3H1 Wasp engines. When PanAm ran out of SC1 Wasps they asked Lockheed for Electras equipped with the new, more powerful S3H1 version of the R1340. Fifteen 10Es were eventually produced including two "10E Specials," a modification that eliminated most of the cabin windows and replaced the ten passenger seats with fuel tanks for long-range, record setting flights.



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