TIGHAR TRACKS

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Research Report

Analysis of Recovered Material

Metal Artifacts

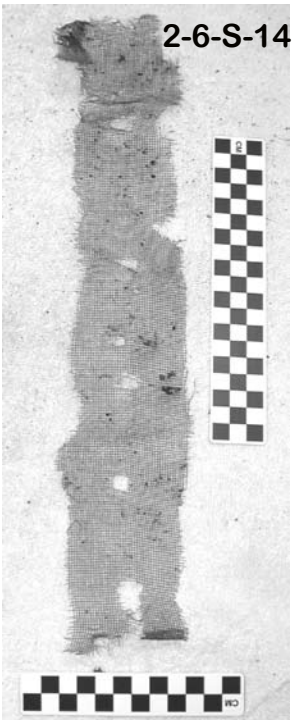
Radio Parts

2-6-S-21f, 2-6-S-32, 2-6-S-43

These objects appear to be damaged components associated with large radio vacuum tubes of the type used at U.S. Coast Guard Unit 92, the Loran station at the southeast tip of Gardner Island. Because we have collected 20 shell casings from .30 caliber M-1 Carbine ammunition, several pieces of broken ceramic dinnerware (one of which bears the Coast Guard logo), and an anecdote from a veteran describing informal target practice at the site, we conclude that these artifacts are all probably attributable to a limited number of Coast Guard visits to the site between July 1944 and May 1946.

Screen

2-6-S-9, 2-6-S-14, 2-6-S-40, etc.



Fine copper screening, usually found in strips roughly 4 inches wide by as much as 21 inches long, and occasionally in larger sheets, was found distributed along a line from the ridge to the southern end of the examined area. A total of approximately 414 square inches of screen was recovered. Flying insects are not generally a problem on Nikumaroro and even the windows on the (still standing) cookhouse of Galllagher's residence in the village have no screens. Screening was used, however, to keep leaves, birds and rats out of stored water and we suspect that the screening found at the Seven Site was once used for that purpose. However, the screening found at the Seven Site is lighter in weight and has a slightly more open weave than examples of screening found at the Loran station and in the settled areas at the west end of the island.

Fasteners

2-6-S-03a, 2-6-S-03b

A firm identification on these fascinating little objects continues to elude us but a few facts we have been able to nail down make them all the more interesting. Each is comprised of a plate and a screw. According to engineer Angus Murray of Sheffield, England, the screws are brass American No. 8, $^{15}/_{16}$″ length woodscrews meeting specifications that were current from the 1930s up until 1970. The plates, however, appear to be aluminum (but apparently not "aircraft" aluminum) and are definitely amateur-made, rather than manufactured. A number of theories have been advanced to describe how they might work and some people have said that they look vaguely familiar, but no one has yet been able to produce an example of a similar device. They might be associated in some way with the sextant box that was found by Gallagher in 1940, but without an example of a very similar manufactured item of known utility their purpose remains a mystery.

Knob

2-6-S-45

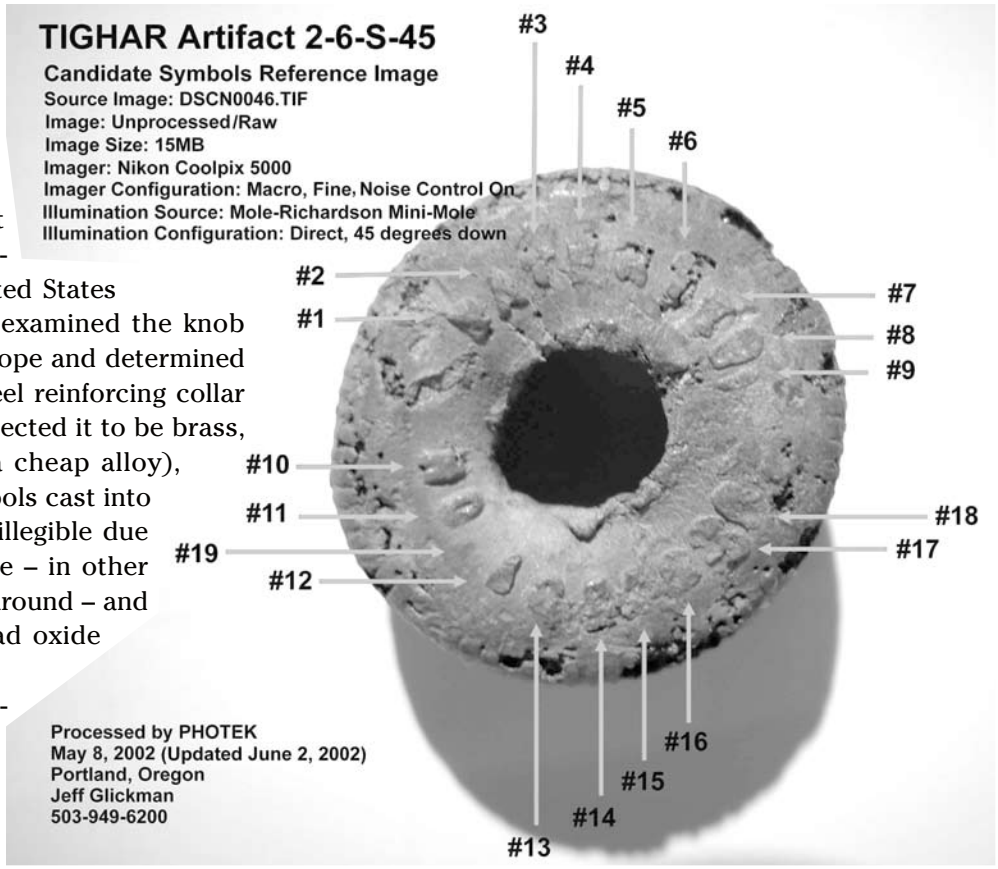
Ironically, the smallest metal artifact recovered from the Seven Site has been the object of the most intense research. The Nondestructive Testing Laboratory at the United States Naval Academy in Annapolis, MD examined the knob using a scanning electron miscroscope and determined that it was made of lead with a steel reinforcing collar inside. That was surprising. We expected it to be brass, aluminum, or even "pot metal" (a cheap alloy), but not lead. There are raised symbols cast into the face of the knob but they are illegible due to "insults" to the soft lead surface – in other words, the knob has been banged around – and a build up of what is probably lead oxide corrosion product.

To make the symbols more legible the Naval Academy lab removed some of the coating with ultrasound in plain water. That helped, but the symbols could still not be reliably deciphered. We then sent the knob to our old friend Jeff Glickman at Photek Forensic Imaging in Portland, Oregon. Jeff experimented with a variety of techniques and found that the best results were achieved by working with digital photography in the visible spectrum using very precisely controlled lighting and then processing the acquired imagery with highly specialized software. Taking it one symbol at a time, Jeff has so far been able to establish that the letters on the knob are:

Symbol #	1	2	3	4	5	6	7	8	9	10	11	19
Letter	**P**	**A**	**T**	**E**	**N**	**T**	**E**	**D**	**:**	**N**	**O**	**.**

and then a seven digit number beginning with **18**. That was as far as he had gotten when we went to press, but from that much we can say with considerable confidence that whatever device or appliance the knob was attached to received a United States utility patent between 1931 and 1933.

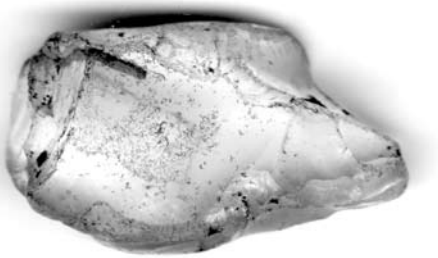
Whether Jeff will be able to get all of the other numbers or not is still unknown, but we're confident that he'll be able to decipher enough of them that we'll be able to find the patent office drawings and get a solid identification of exactly what sort of device this thing came from. As you might guess, there has been a great deal of speculation about what that might be – everything from a kerosene pressure lamp to an aeronautical navigation instrument – but at least we have a reasonable expectation that we'll know for sure fairly soon.



Glass Artifacts

The following descriptions were submitted by Dr. Rob Jackson of Pacific Legacy, Inc., Sierra/Central Valley Division in Cameron Park, CA.

2-6-S-16:



length: 0.95 in.
width: 0.53 in.
thickness: 0.29 in.
weight: 0.11 oz.

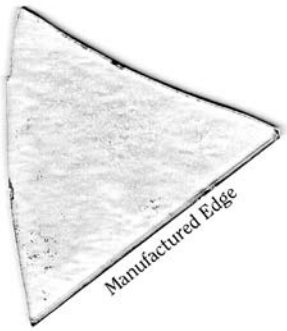
Description:

Colorless, broken, glass, thickness indicates glassware. There are no sharp edges on the entire shard, and all surfaces exhibit tiny, exfoliated cones of force and degradation, particularly along the margins. This piece of glass spent considerable time in a relatively high-energy water environment where granular/pebble sands were washed against it with sufficient force to microfracture the glass hundreds of times. This action obliterated the edges and any other physical evidence that may have been on those edges. This small piece of glass is the only one in the examined assemblage that appears to have spent considerable time in the surf.

TIGHAR comment:

The artifact was found well inland and far beyond where it could have been deposited by the surf. It seems most likely that it was moved from a beach environment to where it was found.

2-6-S-18:



length: 2.72 x 2.76 x 2.51 in.
thickness: 0.06 in.
weight: 0.30 oz.

Description:

Colorless, broken, flat plate glass fragment, triangular in shape with one manufactured edge. The glass fragment was exposed on one surface to the sun for a long time, resulting in an irridescent patina on that surface. No such patina is present on the opposite surface. The thin, uniform thickness of the plate glass suggests that is was a window or casing of some kind. There are small microflake scars on the fractured edges, but these are commonly created during bending fracture, as adjacent edges of the glass make contact during breakage. Examination of the edges under magnification by a stereo zoom microscope ranging from approximately 20x–200x failed to reveal any small striations or evidence of contact between glass and hard materials.

TIGHAR comment:

This was the only piece of plate glass found at the site. We have no idea, at this point, whether it was part of a window or a lantern or the face of an instrument of some kind.

2-6-S-21a:

(two pieces)
1: length: 2.62 in.
width: 0.79 in.
thickness: 0.42 in.
weight: 0.54 oz.
2: length: 2.80 in.
width: 1.07 in.
thickness: 0.52 in.
weight: 1.10 oz

Description:

Two conjoinable, light amethyst, broken glass shards, once part of a glass fishing float. The two conjoinable pieces were broken in a bending fracture that split the original shard roughly in half, lengthwise. The reconstructed diameter of the fishing float, based on curvature of the glass shard, appears to be approximately 165 mm. The glass is relatively free of the air bubbles that are reported as typical of Japanese glass fishing floats made of recycled glass. The glass shards exhibit most of the pontil portion of the float, and the fracture around the perimeter of the shard is radial, forming an acute angle from the outside to inside surface of the float. This acute angle forms a sharp edge on the two distal ends of the roughly oval-shaped glass shard. The surface of the fracture exhibits a laminar appearance, reflected on the exterior surface of the float as thin concentric lines etched in the glass. This may reflect turning of the molten glass as it was being hand-blown. Cross-cutting these laminar lines is a series of radial striations that reflect the fracture of the shard from the larger float. The nature of the fracture suggests to me that a sharp blow **may** have been delivered at the opposing side of the float, resulting in a radial fracture, although this is speculative. The fishing float must have broken several decades ago, as the fractured surfaces have formed a light irridescent patina. Such patina is common on glass artifacts that have been exposed to direct sunlight for a significant amount of time. The rate of such patination

is not well understood, and can be discontinuous upon movement in and out of direct sunlight.

There is no evidence of purposeful secondary flaking of the edges of the shard. The edges were examined under a stereo zoom microscope at magnifications ranging from approximately 20x–200x (relatively low power). The edges exhibited tiny microflaking that was intermittent and bifacial. This microflaking is scarcely visible to the naked eye, and would take only light pressure to produce. Such flaking is not uncommon during large flake detachment (i.e., when the fishing float was struck and broken). In fact, such microflakes can be observed along the surface of the shard at the edges of the conjoinable, perpendicular fracture. Because the edges are 90 degrees, the edges of the conjoinable pieces would not be suitable for effective cutting, and it is likely that the microflaking is a consequence of the shard breaking into two pieces. This does not preclude the possibility that the microflaking of the sharp distal edges were created in another way. Such damage could be the result of trampling or even light use of the edge for cutting, but the microflaking evidence is inconclusive.

The laminar nature of the sharp, fracture edges makes it difficult to see micro-striations. Only a few large, unifacial striations were observed, running diagonal from the edge across the fractured surface. These striations are few in number (fewer than ten) and could have been created by a single incident of abrasion. One would expect a larger number of striations if the glass shard was used in a repetitive motion such as cutting. However, cutting soft material would not create striations. The final physical examination for evidence of use involved the morphology of the microflakes themselves. Repetitive motion would be expected to dull or further microflake small prominences and protruding arretes (ridges formed by the intersection of adjacent flake scars). No such dulling or microflaking was observed.

In summary, after the fishing float was broken and the shard(s) were created by a forceful impact, the shards were not subject to any further purpose modification. Although two edges of the conjoined shards are quite sharp and suitable for cutting, the glass fragments do not appear to have been heavily used. If they were used as tools at all, that use was brief and did not involve contact with hard or abrasive materials.

TIGHAR comment:

Given the amount of glass in a complete fishing float and the total lack of other fishing float glass in the area, it would appear that this object – like the other glass artifacts found with it – was brought to the site from somewhere else.

2-6-S-21b:

length: 1.65 in.
width: 1.18 in.
thickness: 0.21 in.
weight: 0.28 oz.

Description:

Clear, broken, glass, most likely part of a midsection of an octagonal bottle. The diameter of the section of bottle represented is estimated to be approximately 45 mm, although the bottle appears to have tapered and was wider at its distal end. The maximum length and width of the bottle is cannot be estimated on the basis of the dimensions of the fragment. Comparison of the fragment against complete bottles would likely identify its size and shape. All edges of the bottle exhibit bending type fractures that are not diagnostic of the nature of breakage (i.e., purposeful or accidental). However, none of the edges exhibit any purposeful secondary modification with one possible exception. The intersection of two fractured margins form relatively sharp, acute points in three locations. Two of these points do not exhibit any modification. The third point, however, has been altered by four small and overlapping flake scars on one face (the inside surface) and one small flake on the outside surface. Such small flakes could be coincidentally created by crushing. The freshness of the flake scars as they intrude into the patinated inside and outside surfaces of the bottle fragment indicate that the flake scars are much more recent (perhaps by decades) than presumed breakage and exposure of the bottle to the sun and elements.

All edges of the bottle fragment were examined under a stereo zoom microscope at magnifications ranging from approximately 20x–200x. Some small, intermittent microflaking was noted, but there is no patterning or regularity in the spacing, frequency, or location of these flakes. They occur on near 90 degree angled edges that would not make effective cutting edges and do not appear to result from use.

One portion of one ridge on the exterior surface of the bottle appears smoother and more worn than the other ridge. It is likely that this ridge was exposed to abrasive forces such as sand or water more than the other, and may indicate that the bottle or bottle fragment was partially buried long enough to subject it to differential wear.

TIGHAR comment:

This artifact was also examined by Dr. Richard Fike, retired Bureau of Land Management archaeologist for the State of Utah and an expert in glass bottles. In his opinion the artifact is more likely to be part of an octagonal drinking glass rather than a bottle. It was produced

sometime after the mid-1920s when manganese was first commonly used as a clearing agent in glass.

This item seems to be part of an object that was broken and lay partially buried in an abrasive environment for a considerable time before being moved to the non-abrasive Seven Site environment where it was found. The crushing damage to one of the points is more recent than the abrasion damage and apparently occurred after it was "beachcombed."

Wood Artifacts

Samples from the remains of two wooden poles found beside the tank and a broken piece of finished wood (24 x 1.25 x .5 inches) were examined by Dr. Regis Miller at the U.S. Forest Service laboratories in Madison, Wisconsin. One of the poles, 2-6-SB-45, proved to be a local hardwood known as kanawa (*Cordia subcordata*). The other pole, 2-6-SB-46, and the piece of finished wood, 2-6-SB-13, were Douglas fir (*Pseudotsuga menziesii*). Of course, no Douglas fir trees grow on Nikumaroro but Douglas fir, imported from Canada or the American northwest, was a common building material throughout the Pacific. The Douglas fir at the Seven site might have come from either the Coast Guard station or the British-sponsored Gilbertese village.

In the next issue of *TIGHAR Tracks* we'll report on what has been learned about faunal material (animal remains) found at the site and what they might tell us about the person or persons who dined there. We'll also, of course, include an update on anything more we've learned about the artifacts still being researched.

Planning Starts for Niku V

Earlier this year the TIGHAR Board of Directors authorized the establishment of an Earhart Project Advisory Council (EPAC for short) made up of selected scientists, scholars, professionals, and expedition veterans whose knowledge, skills, and expertise are particularly needed in evaluating the evidence and data collected to date and in planning the next expedition. A charter group of about 30 experts in a wide range of disciplines has been recruited. Most are long-standing TIGHAR members and all are donating their time and expertise.

Next month, through a generous grant from Select GIS Service, Inc., EPAC will convene a three day conference at the Oberod Conference Center in Centreville, Delaware to begin planning the Niku V Expedition, now scheduled to take place in the summer of 2004. We'll report the results of that meeting in the August issue of *TIGHAR Tracks.*

Originally built in 1937 as a private country estate, Oberod is now operated as a conference center by the Episcopal Diocese of Wilmington, Delaware.

Deep Water Handicap

Race Results

This year there was no Triple Crown winner and also no winner in the Amelia Earhart Deep Water Handicap. As previously reported, Mike Kammerer's "In Search of Amelia" effort scratched when its underwater search technology proved to be less efficient than advertised; Dana Timmer's "Howland Landing" search was a nonstarter; and we can now report that the David Jourdan's Nauticos $1.7 million dollar expediton, led by Earhart author Elgen Long, completed 27 days of searching before the failure of the cable winch hydraulic system brought operations to a halt. An estimated two-thirds of the targeted area had been covered without result. Jourdan says that Nauticos plans to return to the area near Howland Island in the near future to complete the search but no date was given.

According to a press release on the Nauticos website (www.nauticos.com) the Nauticos search area was developed using the company's proprietary RENAV system to analyze data collected by Long and others. However, a key element in Long's data has recently been shown to be in error.

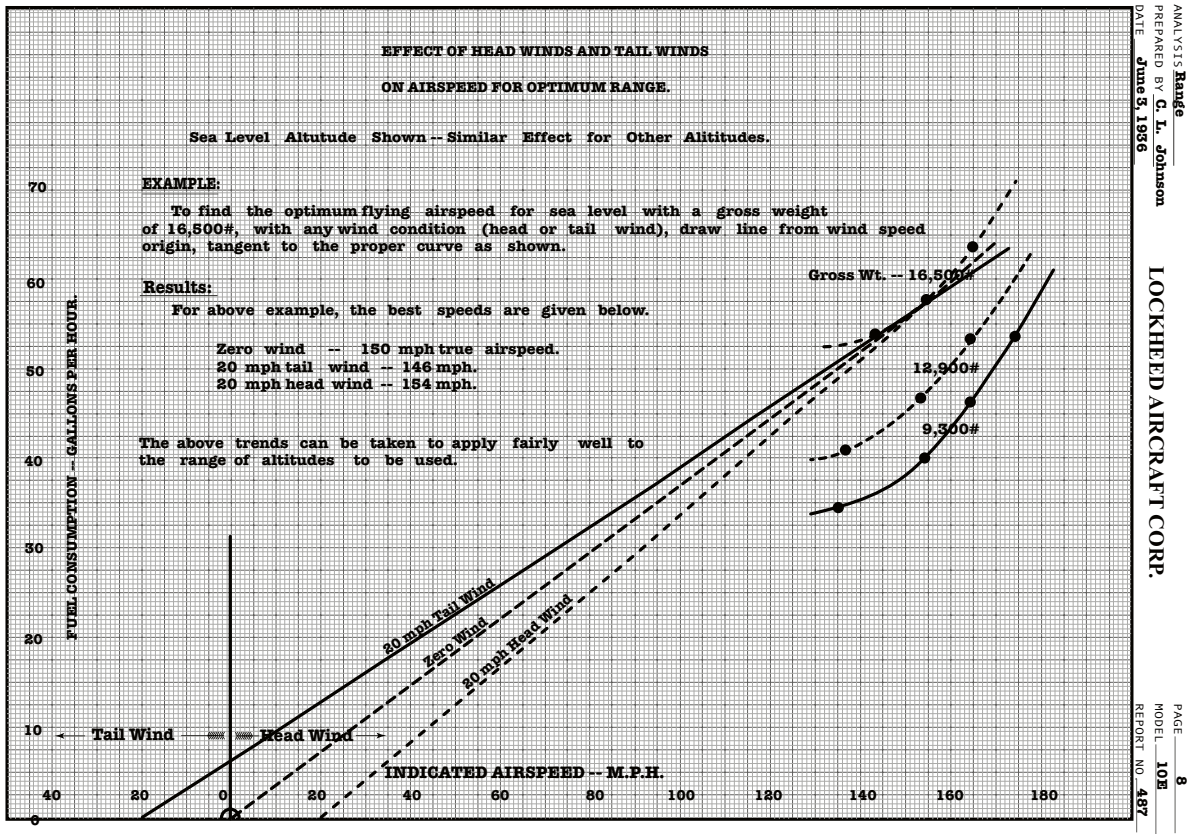
In his book *Amelia Earhart: The Mystery Solved*, Elgen Long alleges that Earhart's statement "wind 23 knots" in an in flight transmission heard by the radio operator in Lae, New Guinea, refers to a headwind. He also interprets her message "speed 140 knots" (just over 160 mph) to be airspeed rather than groundspeed. Such an increase over the airplane's flight-planned cruise speed of 150 mph could only be achieved by higher power settings which would use more fuel and would explain why the airplane ran out of gas in the area where Nauticos was searching. Long justifies his assumptions about wind and speed by saying:

> According to the Lockheed Model 10 Flight Manual, with a headwind of 26.5 mph (23 knots) the correct true airspeed for maximum range is 160.5 mph.

But that's not what the manual says. In a California university collection TIGHAR member Alan Caldwell (#2329) found the full text of Lockheed Aircraft Corp. Report No. 487 " Range Study Of Lockheed Electra Bimotor Airplane" by C.L. "Kelly" Johnson dated June 4, 1936. The document specifically addresses the performance of the Model 10E on long range flights and contains the performance chart that Long used to draw his conclusion. Unfortunately Long seems to have miscalculated. As discovered by TIGHAR member Oscar Boswell (#2340), even if Long's 26.5 mph headwind assumption is correct, the recommended adjustment in airspeed is only 5.3 mph, not 10.5. There is, in fact, no correlation between Lockheed performance data and Long's assumptions about what Earhart said.

Elgen Long's guess about where to search for the Earhart Electra could, of course, still be correct but it now appears that the data upon which Nauticos has defined its search area are flawed.

This chart is a facsimile of the actual performance chart qppearing in Lockheed A/C Report No. 487.

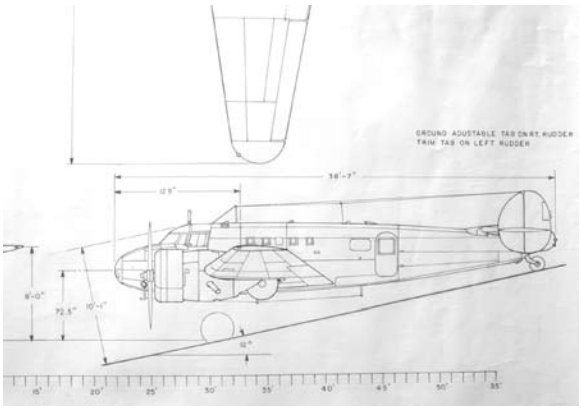


Baking in the tropical sun, the world's most famous missing airplane waits on the reef at Gardner Island for the rescue that will never come. This never-before-published photo was the only salvageable image on an undeveloped strip of film found in a badly rusted camera buried on Nikumaroro ....

Just kidding. The photo is a digital composite created from a photo taken during the Niku IIII expedition and a picture of a most remarkable model. Bill Harney (TIGHAR #1309) of Manomet, Massachusetts has always enjoyed building model airplanes. Several years ago when he showed the Smithsonian's National Air & Space Museum his North American B-25 they were so impressed that they asked to have it for their collection. Now Bill's Mitchell lives at the museum in Washington.

Twenty-four years ago Bill got the idea that it would be fun to build a model of Amelia Earhart's Lockheed Electra. He wanted to include as much detail as possible so he decided to build the biggest model possible. The only limiting factor was that the airplane, minus detachable outer wings panels, had to fit in his station wagon. Having decided on a wingspan of fully six feet he would have lots of room for detail, but he immediately ran into a problem. Nobody seemed to know what those details were.

If there's one thing that Bill Harney absolutely insists upon in his models it's accuracy, so before he could even begin to create the drawings from which his Electra would be built, Bill launched his own research campaign to ferret out every photo, every drawing, every piece of movie film, and every written description that revealed the particulars of what NR16020 really looked like, inside and out. In 1991, through publicity about TIGHAR's work, Bill discovered that there were some other people who were very interested in pinning down accurate information about Earhart's Electra, although for a rather different reason. It wasn't long before he was an enthusiastic member of TIGHAR.



By then Bill had the basic drawings laid out and the actual model under construction, but there were still many questions to be resolved about the multitude of modifications that appear and disappear in the dozens of photos of Earhart's plane. He wanted his model to be accurate to the way NR16020 looked in its final configuration when it departed Miami on the second

World Flight attempt. We, of course, were after that same information, so it was a natural collaboration. Over the next eleven years Bill Harney and Ric Gillespie exchanged hundreds of letters, drawings, photos and phone calls – puzzling, arguing, sharing and comparing sources, and, for the most part, ultimately agreeing upon an ocean of minutiae. Bill's drawings have appeared in *TIGHAR Tracks* on numerous occasions and his help was essential in assuring the accuracy of the smaller, commercially produced models that we marketed to the TIGHAR membership.

This past spring Bill Harney completed his model of NR16020 and Ric made the pilgrimage to Cape Cod to congratulate him and photograph his accomplishment. The photos speak for themselves.

Save A Place On The Wall

Through the generosity of TIGHAR board member and expedition team member Capt. Richard B."Skeet" Gifford, and the special cooperation and consideration of Thomas Van Hare's (TIGHAR #2252) HistoricWings.com, TIGHAR has commissioned aviation artist Scott Allbee to create an original work of art depicting the Earhart Electra on final approach for a landing on the dry reef flat at Gardner Island late on the morning of July 2, 1937. Every effort is being made to assure that this dramatic depiction of the TIGHAR hypothesis portrays the island and the airplane as they were on that day.

When completed later this summer, the painting will be rendered as high quality art prints to be marketed to the general public. All proceeds from the sale of the prints will go toward funding further Earhart Project research and the Niku V Expedition. A limited edition of 200 prints will be numbered and signed by both the artist and by TIGHAR's executive director Ric Gillespie. An additional 300 unsigned and unnumbered prints will also be available.

We'll publish ordering information and full color pictures of the finished artwork in *TIGHAR Tracks* and on the TIGHAR website (www.tighar.org) as soon as they become available.