TIGHAR TRACKS

A Publication of The International Group for Historic Aircraft Recovery
TIGHAR · 2812 Fawkes Drive · Wilmington, DE 19808 · USA · www.tighar.org
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Bad News

The bad news is that the Wheel of Fortune, AKA WoF (see *TIGHAR Tracks,* July 2003) is gone. Not there. Can't find it. At least it is nowhere near where marine biologist Dr. Greg Stone saw it in June of 2002, but there's no mystery about why it's not there. When the team reached Nikumaroro on July 28th they were amazed to see an island much altered by the forces of nature. All along the western and southwestern shoreline the beaches had been scoured and the beachfront vegetation torn up and hurled inland. The village radio shack that had stood near the southern lagoon passage since the early 1950s was flattened. Under water off the edge of the reef, the delicate staghorn and other corals that had so impressed the 2002 New England Aquarium expedition were smashed and scattered. House-sized chunks of the reef platform itself had broken off.

Devastated as the shoreline was, the changes to the lagoon were even more dramatic. Bauareke Passage, the shallow southern lagoon opening, had previously provided little communication with the ocean. As a consequence, in our experience, the water of the lagoon had always been murky. Now Bauareke is open to the sea even at low tide with the result that there is now free passage of clear water through the western half of the lagoon. The "lakes" at the southeast tip of the atoll, formerly brackish and nearly dry, are now filled with clear water and teeming with fish.

Subsequent research has shown that in December of last year Nikumaroro was hit with back-to-back tropical cyclones (as hurricanes are called in the South Pacific). One of them, dubbed "Zoe," was a Category 5 super-cyclone with sustained winds of 178 mph. Based upon an examination of the damage, coral reef geologist and Niku Vp team member Howard Alldred estimated a storm surge (rise in sea level due to reduced barometric pressure) of approximately one meter and wave heights of at least three meters on top of that in 2002.

Given the level of violence visited upon the shoreline where the WoF was seen, it is hardly surprising that it is no longer there. Where did it go? Inland perhaps, and if it did it may still turn up in the detailed searches scheduled for next summer's Niku V Expedition. But it may also have been swept back out into ocean depths that are inaccessible to us unless and until further discoveries on the island bring us the funding necessary to deploy the technology needed to look there.

Good News

THE GOOD NEWS IS THAT THERE IS MUCH MORE GOOD NEWS THAN THERE IS BAD NEWS. In addition to collecting vital data and measurements that will allow us to refine out tidal calculations, the expedition discovered and recovered some of the most promising artifacts we have ever found on Nikumaroro. They found more dados. For an explanation of why that is such a good thing see "Dados Galore," page 3.

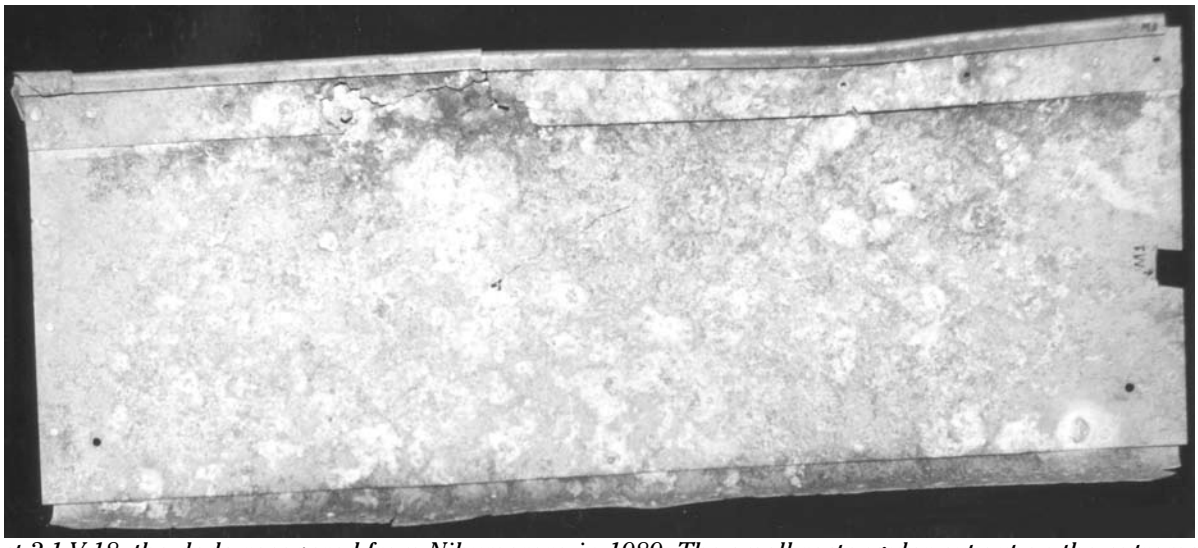
Expeditions are, by their nature, expeditious. They are all about dealing with uncertainty and answering new questions. If an expedition turns

out just the way you expected it to, it was probably unnecessary. The Niku Vp team did a marvelous job dealing with more than their share of uncertainty and new questions. The information they brought back has changed much of our planning for Niku V and the artifacts they found instead of the one they expected to find have set us on a whole new course of investigation. They were the smallest team on the smallest boat we've ever sent into the Phoenix Group and they accomplished their mission with no injuries and no equipment breakage despite many difficulties and obstacles beyond their control. To Van, Walt, John and Howard we say, "Well done." And we extend our thanks and appreciation to Ken, Louise and Mollie of the sailing vessel *Mollie* who patiently endured nearly a month of maddening delays and then carried the expedition out and back with safety, professionalism and good will.

The radio shack, before and after. Veryl Fenlason stands in front of the shack in 1997 in the photo above by K. Spading. Van Hunn took the photo at right this year.

Photo of Mollie *at sea by Van Hunn.*

DADOS GALORE



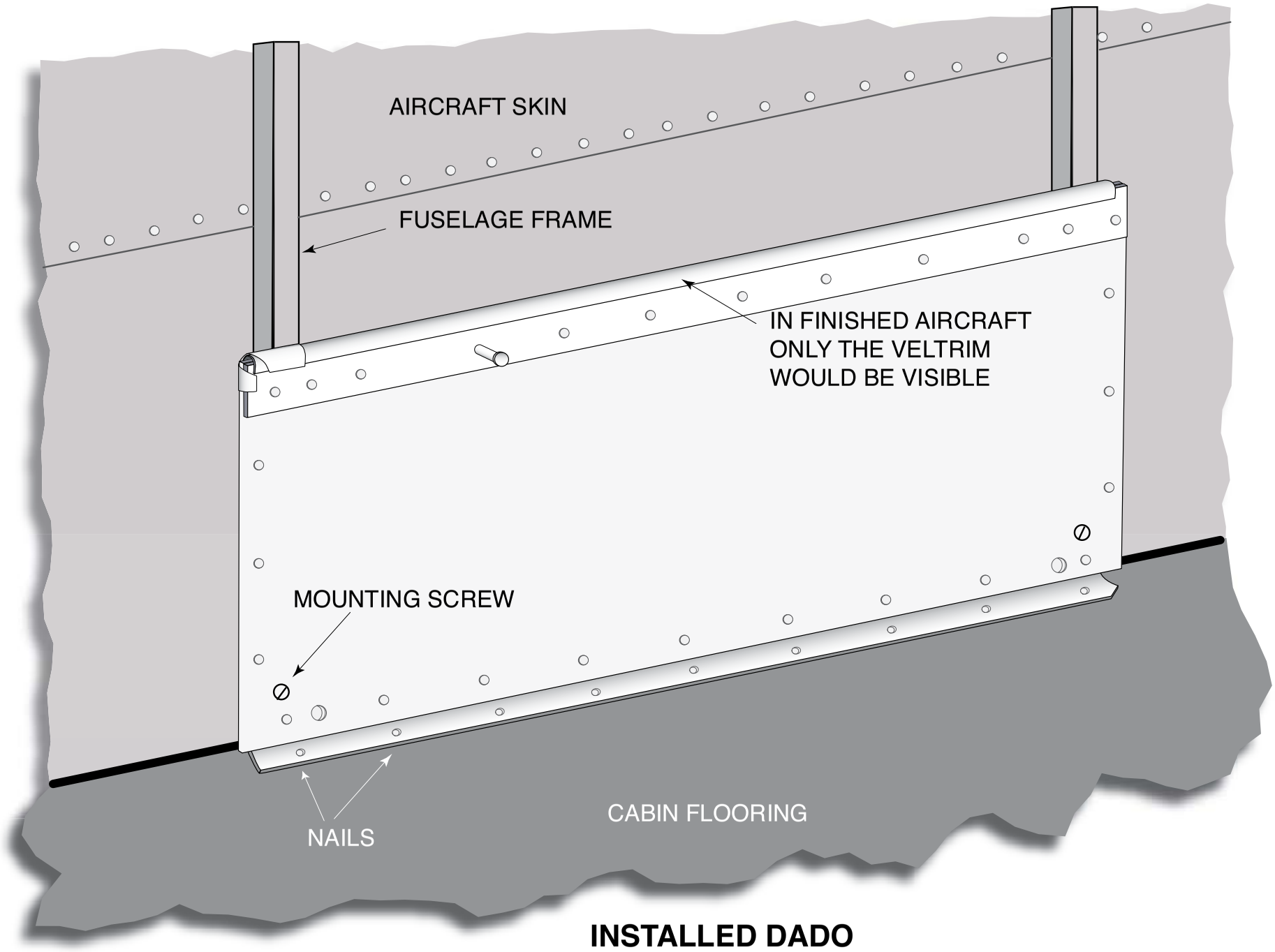
Artifact 2-1-V-18, the dado recovered from Nikumaroro in 1989. The small rectangular cut-out on the extreme right was made in 1992 by the National Transportation Safety Board laboratory for materials anaylsis. TIGHAR photo by Frank C. Lombardo.

TIGHAR's first expedition to Nikumaroro in 1989 brought back an artifact we thought at the time might be a cover to some sort of aluminum box. It was originally assigned artifact number 2-18 and later, under an expanded cataloging system, became Artifact 2-1-V-18. The materials and the nature of the construction suggested an aviation origin but nobody we talked to recognized it as any known part of an airplane.

Especially interesting was the fact that we had the entire assembly rather than the cut-up scraps of aluminum we usually find in the village – and there were no part numbers stamped into it anywhere. Virtually all WWII military aircraft assemblies were festooned with stamped-in part numbers because they were built in great quantity at diverse locations by a hastily trained and constantly changing work force. The pre-war Lockheed 10, by contrast, was built in small batches by a relatively stable group of employees in a single shop. There were some part numbers cast into major Electra components such as landing gear legs, and we've seen hand-written part numbers on some components, but no stamped-in numbers. The absence of part numbers on a complete assembly suggested that the assembly either wasn't an airplane part at all or that it came from an aircraft that predated the revolution in aircraft mass production that began in 1939.

Lockheed Electra construction, Burbank, California; 1935. Photo courtesy Lockheed Aircraft Corp.

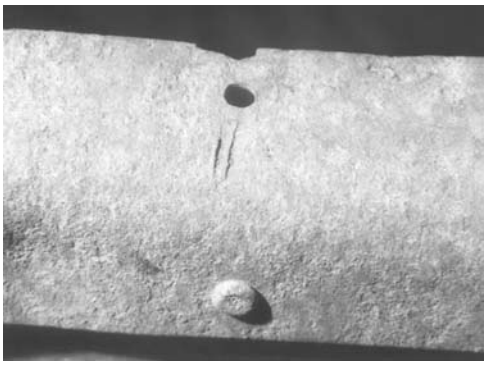
Then in November of 1991 we showed it to some senior employees in the "completions shop" (the facility that tailors the interior furnishing of new business aircraft to a specific customer) at Atlantic Aviation here in Wilmington, Delaware. They immediately recognized the assembly as a "lower dado panel" – a baseboard-like non-structural component commonly used in a category of relatively small aircraft known as "cabin class twins," two-engined airplanes



INSTALLED DADO

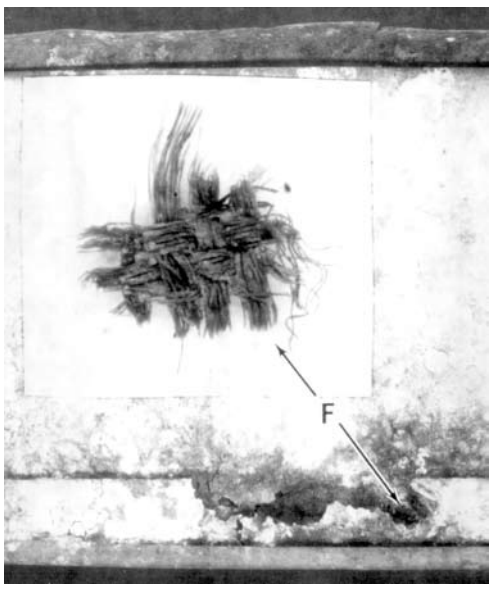
that typically carry between six and twelve passengers in a cabin that is entered via a door in the side.

A dado (pronounced DAY-doh) serves as a juncture between the floor and the fabric-covered interior wall of the cabin, providing protection against kicks and bumps. Artifact 2-1-V-18 was anchored to the floor by means of a right-angle flange. The holes in the flange are not a standard rivet size and the bottom of the flange exhibits what appear to be pry marks immediately adjacent to the holes, leading us to conclude that his particular dado was probably nailed to a wooden floor. The Lockheed Model 10 had a wooden floor.



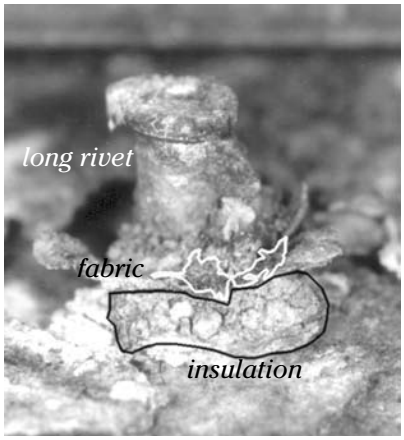
Apparent pry marks on bottom of right angle flange. TIGHAR photo by F. Lombardo

Along the top edge of Artifact 2-1-V-18 was an elongated rivet at the base of which was a small surviving fragment of the original insulation and woven fabric that once covered the entire surface that faced the interior of the cabin. The mottled appearance of the surface may have been caused by residue from the adhesive used to attach the insulation. The fragment of insulation was 1/4 inch thick. The woven fabric was blue. Unfortunately, we cannot perform tests to conclusively identify these materials because the fragments were lost by the National Transportation Safety Board (NTSB) laboratory while they were performing a materials identification analysis of TIGHAR artifacts in 1992. We do know, however, that Lockheed Electras were soundproofed with 1/4 inch "kapok felt" and a material called "Seapak." Further research should provide more details.



Arrow "F" denotes the long rivet tail where the fabric remnants were found. Insert is magnified x20. Photo courtesy NTSB Materials Laboratory.

This micro-photo clearly shows the remnants of blue fabric and insulation when seen in color; highlighting is provided to compensate for monochrome photo. TIGHAR photo by P. Thrasher



On the type of dado recovered from Nikumaroro the insulation and fabric that covered the face was tucked up under a 1/4 inch 180° flange known as a "veltrim." When installed in a finished aircraft the only visible part of the dado is the thin line of the veltrim.

The metallurgical examinations performed by the NTSB showed that the several components of the dado assembly were made of two different kinds of aluminum.

- 2024 alloy – the standard aircraft structural alloy known in 1937 as "24ST"

and

- an alloy other than 2024

None of the components of the dado is "clad." Cladding is a corrosion-inhibiting process whereby the alloy is sandwiched between two thin layers of pure aluminum. Patented by the Alcoa company, this type of alumium sheet was known as "Alclad." All of the structural aluminum sheet on the Lockheed 10 (and the vast majority of other American stressed-aluminum aircraft of the 1930s and '40s) was Alclad. A dado, of course, is not a structural component and can

be made out of less expensive aluminum but it is also much more susceptible to corrosion.

In 1994, TIGHAR member Frank Lombardo undertook a detailed examination of the dado. Frank was retired from a long career in aircraft radio installation and maintenance and was very familiar with aircraft interiors of the 1940s. His report on his findings and his speculations about the dado are on the TIGHAR website at www.tighar.org/Projects/Earhart/Bulletins/09_15_03Bulletin/09_15_03.html.

One of the first things Frank noticed was that the dado had been attached to the underlying structure of whatever aircraft it came from by means of screws inserted through two mounting holes that are 15 inches apart. The spacing of circumferential frames and bulkheads in stressed-aluminum aircraft is a matter of scale and strength. The smaller the aircraft, and the greater the required rigidity, the tighter the spacing. The nominal spacing of frames in the Lockheed Electra is 15 inches. That, of course, does not mean that the dado must have come from a Lockheed Electra, but it does suggest that it came from an aircraft of that general size, and it supports the earlier statement that dados were used in "cabin-class twins."

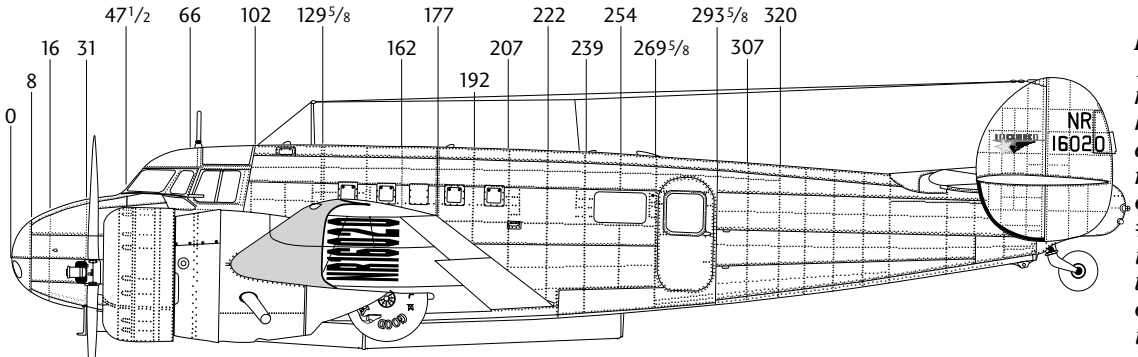
Frank also believed that he had found something the NTSB missed. The laboratory report noted that the space between the riveted-together aluminum components was "filled with corrosion products." Frank, after removing one of the components (something the NTSB did not do) believed that the "corrosion products" were in fact strips of thin ($^1/_{16}$ inch) micarta, an industrial laminate developed by Westinghouse.

To our considerable frustration, we have been unable to find photographs that show the interior of the Earhart Electra after it was repaired following the March 20, 1937 accident. A careful, but by no means exhaustive, search of the engineering drawings for the Model 10 (11 rolls of hard to read microfilm) failed to turn up anything helpful one way or the other.

That is where our dado research stood until the Niku Vp expedition team returned with what are, without a doubt, the remains of at least two more dados found very close to where Artifact 2-1-V-18 was found in 1989. That these artifacts – 2-7-V-1 and 2-7-V-2 – are dados is apparent from the identical rivet size and spacing along the edges, the $^3/_4$ inch inset of the mounting holes, and the presence of a small surviving section of the veltrim. The identification was confirmed by TIGHAR with the help of x-rays taken by conservators at the Maryland Archaeological Conservation Laboratories at Jefferson Patterson Park in southern Maryland. The lab is also taking appropriate measures to conserve the artifacts. TIGHAR is deeply grateful for the generous assistance of the dedicated scientists

Artifact 2-7-V-1, Dado. TIGHAR photo by V. Hunn.

Artifact 2-7-V-2, Dado. TIGHAR photo by V. Hunn.



In the Lockheed Model 10, circumferential frames and bulkheads, known as "stations," are numbered in inches rearward from the nose of the aircraft. Station #222, for example, is 222 inches from the tip of the nose. Note that most of the stations are 15 inches apart.

at this new state-of-the-art facility. You can learn more about the MAC lab at www.jefpatorg/3arch-maclab.htm.

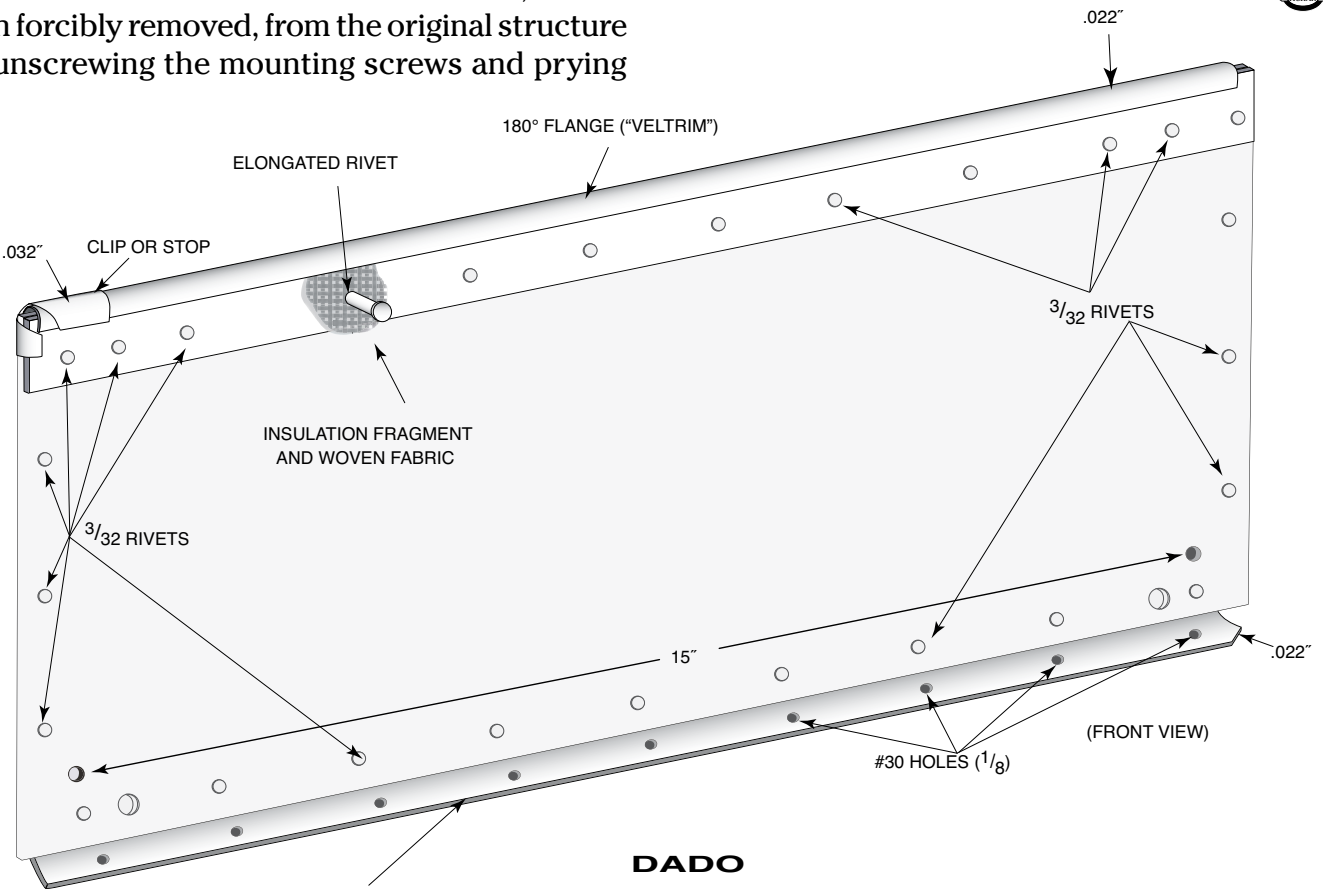
The "new" dados are in much poorer condition than the 1989 find. 2-7-V-1 has been disassembled, pieces cut out, and one edge folded over several times. Because we're missing one finished edge we can't be sure how long it originally was. 2-7-V-2 was mostly buried and is in several pieces. Luckily, it had not been cut up and the finished edges were intact. Through expert recovery technique and good in situ photos, we were able to establish its original dimensions.

An added surprise came when we realized that another artifact collected in 1989, 2-1-V-2, is almost certainly a section of yet another dado. The NTSB had identified the material as non-clad 2024 aluminum of the same thickness (.032 inch) as the non-clad 2024 of 2-1-V-18, and it came from near where the original dado was found, but it wasn't until we were faced with the fact that there were multiple dados there in various stages of deconstruction that we made the connection.

Aside from corrosion, all of the damage seen on the artifacts seems to have been caused by adaptive local use rather than by the force of an accident. The dados were disassembled, rather than forcibly removed, from the original structure by unscrewing the mounting screws and prying up the nails from the "back" side of the 90° flange. That is not possible unless the removal of the mounting screws enabled the outer structure to which it was attached to be discarded thus permitting access to the back of the dado. This would seem to suggest that the dados were removed from a section of wreckage rather than from an intact aircraft.

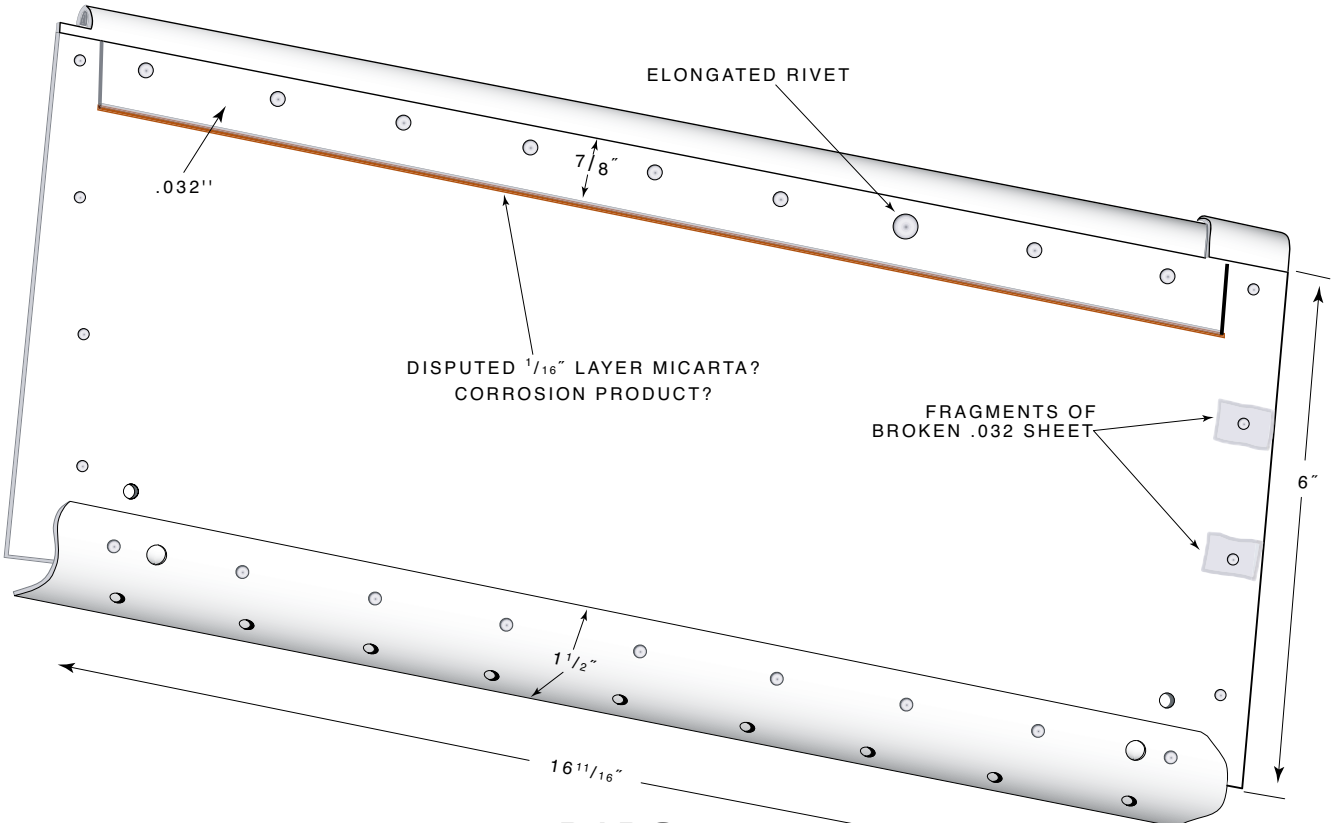
In summary, it appears that sometime between 1939 and 1963, a person or persons who lived and/or worked along the southern shore of the main lagoon passage on Nikumaroro had at least three, probably four, and possibly more dados that came from the wreckage of a relatively small civilian cabin class airplane that had a wooden floor.

That's the way it appears right now, but appearances can be deceiving and much more research is needed before we can say with certainty where these artifacts originally came from. That research is already well under way. A specialized TIGHAR research team has begun examining both archival records and surviving examples of Electras and other aircraft. Watch for progress reports on the TIGHAR website (www.tighar.org) and in upcoming issues of *TIGHAR Tracks*.



DADO

ARTIFACT 2-1-V-18

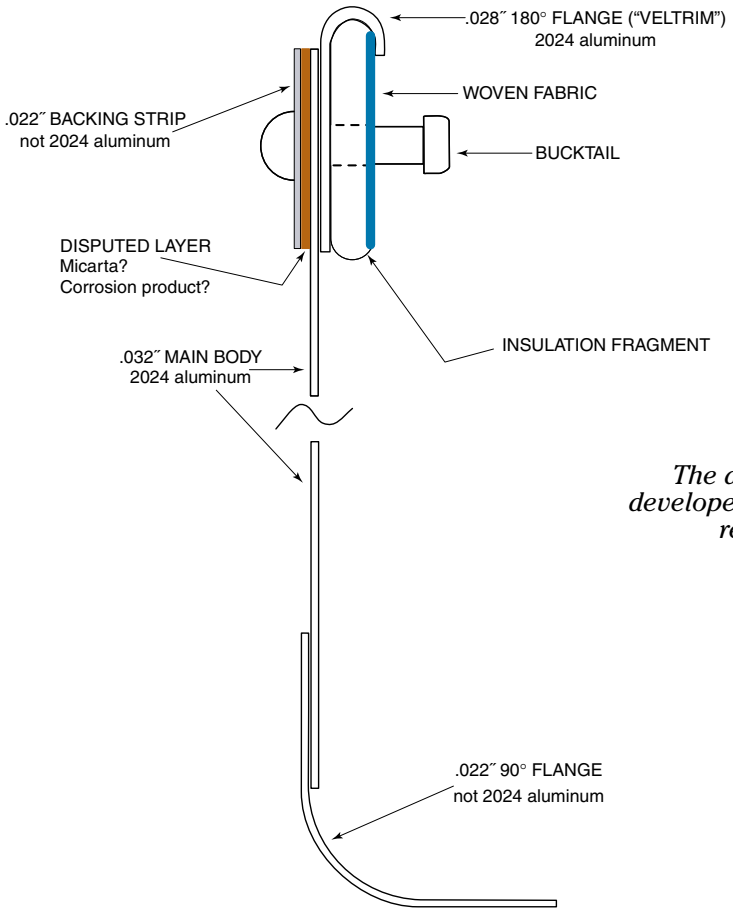


DADO

ARTIFACT 2-1-V-18

(BACK VIEW)

CROSS-SECTION AT ELONGATED RIVET



The drawings on these pages and on page 4 were developed from drawings made by Frank Lombardo, and represent Dado 2-1-V-18 as found in 1989.

Fiji Bone Search II

A second round of on-site investigation in Fiji for the bones and artifacts sent there from Nikumaroro in 1941 has answered many questions and raised more. TIGHAR members Marty Moleski and Roger Kelley spent from May 15 to June 17 in Suva, Fiji examining records and conducting interviews. Marty went on to spend several days in New Zealand doing further research in the archives of the British Western Pacific High Commission now housed at the University of Auckland. Marty's full report of the trip is available on the TIGHAR website at www.tighar.org/Projects/Earhart/Bulletins/07_15_03Bulletin.html, but a few excerpts will serve to show the depth of the work accomplished.

The British records that TIGHAR found in 1997 trace the finding and analysis of the skeletal remains and other material from the spring of 1940 through August of 1941. … The problem we face now is that there is no mention in the file at all of what was done with the evidence after the examiners closed the case in August of 1941. In the absence of evidence, we can only guess what might have happened:

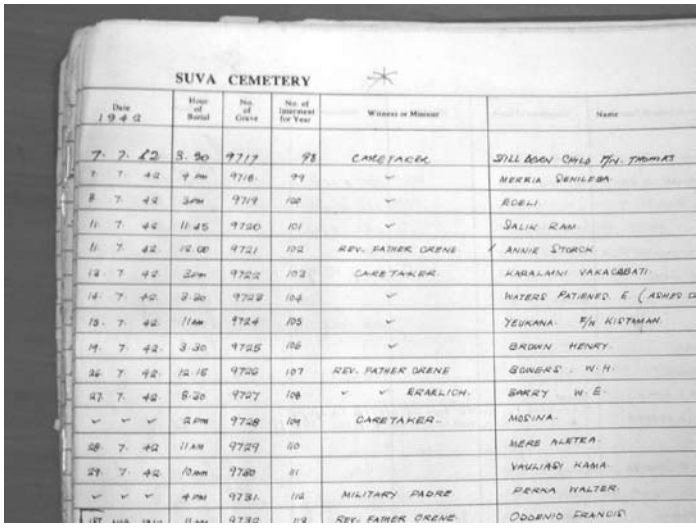
1. Someone may have destroyed the evidence surreptitiously.
2. Someone may have kept some or all of the evidence as a curiosity.
3. The material may have been given to another institution for safekeeping.
4. The material may still be in government custody.

There are many variations on each of these hypotheses. At every meal and in every report that we made to TIGHAR, Roger and I toyed with the range of possibilities of what might have happened. We think we made some progress in ruling out some lines of inquiry, but in the final analysis, we remain perplexed and frustrated at our inability to close the question.

Roger did a very thorough search of the burial and cremation records, all of which are maintained by the Bureau of Prisons. …

If someone had used these ordinary channels for burial, the records should show an unnamed person of unknown gender who died on Gardner Island. Because people might have given the bones a name, Roger also looked carefully for any combination of Amelia, Earhart, Putnam and Gardner. He did find an Amelia who was buried in 1939, but no matter how hard we tried to imagine a scenario, we could not bring ourselves to believe that the Bureau of Prisons would have entered a burial date more than a year before the bones were brought to Suva. The way the records are kept pretty much precludes that kind of back-dating. Roger even toured four cemeteries, but there were hundreds of graves with virtually illegible stone markers and hundreds of unmarked depressions in the grounds as well, probably representing older grave sites.

A sample of the burial records Roger perused. TIGHAR photo by R. Kelley.



SUVA CEMETERY

Date 1942	Hour of Burial	No. of Grave	No. of Interment for Year	Witness or Minister	Name
7. 7. 42	8.30	9717	98	CARETAKER	STILL BORN CHILD T/N. THOMAS
7. 7. 42	4 pm	9718	99	"	NEERIA DENILEBA
8. 7. 42	3pm	9719	100	"	ROBU
11. 7. 42	11.45	9720	101	"	SALIK RAM
11. 7. 42	12.00	9721	102	REV. FATHER GRENE	ANNIE STORCH
13. 7. 42	3pm	9722	103	CARETAKER	KARALAINI VAKACABATI
14. 7. 42	2.30	9723	104	"	WATERS PATIENCE E (ASHES O
15. 7. 42	11am	9724	105	"	YEUKANA F/N KISTMAN
14. 7. 42	3.30	9725	106	"	BROWN HENRY
26. 7. 42	12.15	9726	107	REV. FATHER GRENE	BOWERS W. H.
27. 7. 42	8.30	9727	108	" " ERASLICH	BARRY W. E.
" " "	2 pm	9728	109	CARETAKER	MOSINA
28. 7. 42	11 am	9729	110		MERE ALETEA
29. 7. 42	10.am	9730	111		VAVLIASI KAMA
" " "	4 pm	9731	112	MILITARY PADRE	PERNA WALTER
[illegible]	11 am	9732	113	REV. FATHER GRENE	ODDENIO FRANCIS

The easiest interpretation of the bones file – and the one most consistent with our evaluation of the quality of colonial record-keeping – is that Sir Harry just decided to hold on to the things collected from Gardner for the time being. There are many turning points in the history of the WPHC and the colonies when a later High Commissioner or Colonial Secretary may have decided to place everything in the hands of some other institution. Perhaps this later generation of civil servants did not have access to the bones file or did not know themselves how to find it in their archives; perhaps the material was judged to be of no particular value or interest to the WPHC and therefore did not win the full attention of the staff. The longer the time lag after 1941, the easier it is to imagine that something like this might have happened.

It is difficult to decide whether there is any hope of finding the things collected on Gardner and shipped to Suva so long ago. It is not hard to imagine that someone somewhere destroyed or stole some or all of the material. Such things happen every day. It is harder to believe that the bones, sextant box, shoe parts and corks still exist in official custody, needing only the right "Open Sesame!" to be revealed. But we have not exhausted the work that could be done in Auckland, Tarawa or Honiara. It might even be valuable to go over the ground once again in Fiji, concentrating on the court system, government records and the history of the Central Medical Authority, whose records are bafflingly incomplete in Suva and (apparently) non-existent in Auckland. The key to unlock the mystery may still be hidden in the Western Pacific.

Martin X. Moleski, S.J., Ph.D.

Above: Marty and Roger at the arport in Fiji.

Left: Government House in Suva, Fiji, where much of their search was focused.

HARD EVIDENCE

Fifteen years ago a single paragraph appeared on the back of a "*TIGHAR Tracks* Extra" news sheet mailed to TIGHAR members in August 1988:

> **A new Amelia Earhart theory** is generally received with a sigh and a glance at the ceiling. So when we say "We've seen documentation that justifies an expedition to the Pacific" we can hardly believe it ourselves. TIGHAR members Tom Willi and Tom Gannon of Florida have spent years researching a fresh approach to the problem, and recently presented their case before TIGHAR's Executive Committee. Their work shows exhaustive original source research, application of extensive training and expertise, and (most unusual in Earhart research) no suggestion of conspiracies, capture, or cover-ups. The theory looks so good and reasonably easy to investigate that we can't go public with it, but we'd welcome inquiries from potential sponsors.

"Reasonably easy to investigate…" – my, my, my – were we ever that young? Sponsors did step forward and of course we did go public with the theory that the Earhart flight ended on Nikumaroro. Fifteen years, eight Pacific expeditions, four overseas research trips, and a few million dollars later it's fair to ask whether it has all been worth it. Are we any closer to solving the Earhart mystery today than we were when we said, "We've seen documentation that justifies an expedition to the Pacific" and is that call to action still valid?

Perhaps the best measure of our success is the "hard evidence" – contemporaneous documents, verifiable photographs, and identifiable artifacts – that has come to light as a direct result of TIGHAR's efforts. We have done innumerable studies, re-assessments and interpretations of existing information; and we have collected many recollections and anecdotes that have fueled the search for verifying documentation, but it is new hard evidence that moves the investigation forward.

DOCUMENTS

The Chater Letter

This eight page letter, written days after the disappearance by the general manager of Guinea Airways, details Earhart's stay in Lae, New Guinea and answers many essential questions about her preparations for the fateful flight to Howland Island. It was found and brought to TIGHAR's attention in 1991 specifically as a result of press reports about our second expedition to Nikumaroro.

Lockheed Reports and "Daily Express" Records

Found in obscure technical archives by TIGHAR researchers, Lockheed Report 465 "Flight Tests on Lockheed Electra Model 10E" dated November 16, 1935; and Lockheed Report 487 "Range Study of Lockheed Electra Bimotor Airplane" dated June 4, 1936, provide engineering data which, when combined with the real-world performance record of the only other airplane like Earhart's – Lockheed 10E special NR16059 dubbed "Daily Express" – and specific fuel management recommendations given to Earhart by Lockheed engineers, establish that the Earhart flight should have had more than enough fuel to reach Nikumaroro.

The Bones Files

Long-discounted rumors that bones thought to be Earhart's had been found on Gardner Island (Nikumaroro) prior to World War Two proved to be true when TIGHAR researchers discovered original British files in Tarawa and in England detailing the incident and its aftermath. This discovery revealed an entirely new and previously unknown chapter in the Earhart mystery.

Betty's Notebook

This original hand-written transcription of what is believed to be a genuine distress call from Amelia Earhart in the days following her disappearance may be the most poignant glimpse into the tragedy ever to come to light. The woman who heard the transmission and made the notations as a fifteen year-old girl came forward in 2000 because the situation she heard Amelia describing matches TIGHAR's hypothesis. The notebook prompted an exhaustive study of all 184 alleged receptions of distress calls from Earhart. The results of the soon-to-be-published study leave little doubt that the Earhart aircraft did not go down at sea.

PHOTOGRAPHS

Aluminum Debris Field. Forensic imaging of two aerial mapping photos taken of Nikumaroro's main lagoon channel in 1953 corroborates numerous reports by former island residents of the presence of scattered aircraft debris on the reef in those years.

The Castaway Camp. Analysis of a 1941 U.S. Navy aerial photo of Nikumaroro's northeastern shoreline corroborated wartime Coast Guard accounts of a cleared area and man-made objects on that remote part of the atoll. On-the-ground investigation has revealed a rich archaeological site that is believed to be the location where the bones of a castaway were found in 1940 (see "The Bones File" above).

ARTIFACTS

Dados. The island's abandoned village has, in 1989 and in 2003, yielded the remains of three and probably four "dados" which appear to be components from a wooden-floored civilian aircraft of the general size and specifications of a Lockheed Electra (see "Dados Galore," page 3).

Part Number 40552. A cut section of polymethylmethacrylate (Plexiglas) found in the village during TIGHAR's 1996 expedition matches the material, color, thickness and specific curvature of Lockheed Part Number 40552 the cabin windows of Earhart's Lockheed 10E Special.

Aircraft Skin. A roughly two by three foot section of the external aluminum skin of an aircraft was found during TIGHAR's 1991 expedition in the wash-up line from a recent storm. Although the rivet pattern is not an exact match to any known aircraft, all of the many discernable features of the artifact are consistent with the Lockheed Electra and suggest that it is from a repair to a relatively small aircraft that was torn apart by the surf.

RAIDERS OF THE LOST LOCKHEED?

Popular culture has encouraged a mythic view of archeology in which searches for lost treasures end in immediate gratification. Indiana Jones always finds the prize on the first trip, but the pattern of TIGHAR's Earhart investigation does not fit the myth. What it fits is the two-steps-forward, one-step-back painstaking and painful pattern of successful scientific inquiry. The hard evidence listed above, important as it is, amounts to clues, not proof. Some of the pieces that now look like part of the puzzle may eventually have to be thrown out, and further research may well reveal that pieces we already have are more important than we previously knew.

Over the years, the picture of what happened at Gardner Island has grown steadily clearer and we've long since reached the point where the simplest and least outrageous explanation for the clues that have been found is that the Earhart flight ended there. There is every reason to believe that further work on the island will discover more artifacts and information that will bring us a better understanding of what became of the airplane and its crew – and that's exactly what we intend to do.