

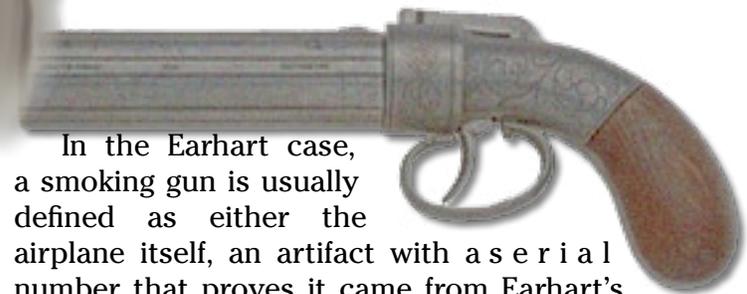
TIGHAR TRACKS

October 2008

Smoking Guns



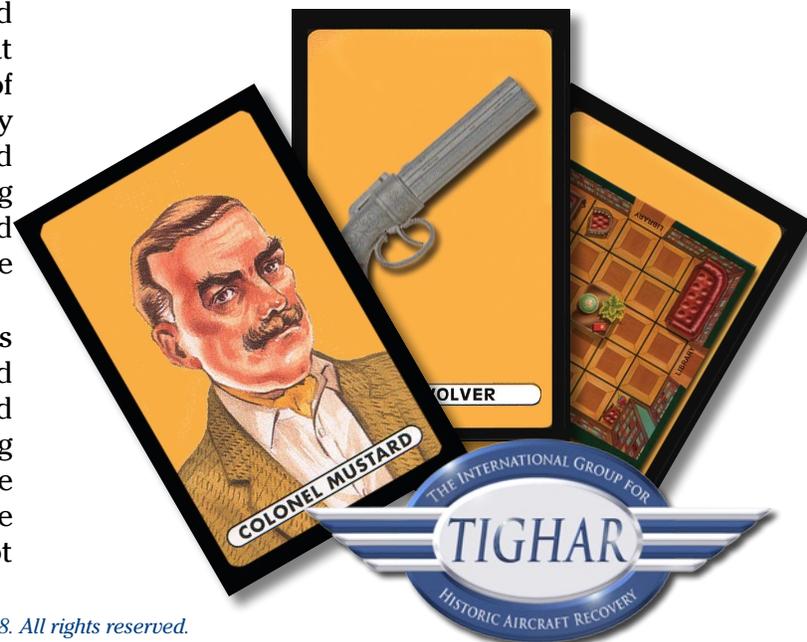
Earhart and Noonan landed the Electra safely at Gardner Island (now Nikumaroro) and sent radio distress calls for the next three nights. Amelia met her end as a castaway at a place near the southeastern end of the atoll we call the Seven Site.



In the Earhart case, a smoking gun is usually defined as either the airplane itself, an artifact with a serial number that proves it came from Earhart's airplane, or human remains that can be DNA-matched to Earhart's or Noonan's living relatives. The airplane is, for the moment, out of reach. We think that what's left of it is in the water off the edge of the reef at a depth we have not yet been able to explore. The other two types of smoking guns, however, may already be in TIGHAR's possession. "Numbers Game" (p. 4) describes recent research successes that point toward a serial number connection. "Archaeological Update" (p. 2) reviews the latest analytical results on artifacts and materials collected at the Seven Site, including the unexpected, although still remote, possibility of DNA.

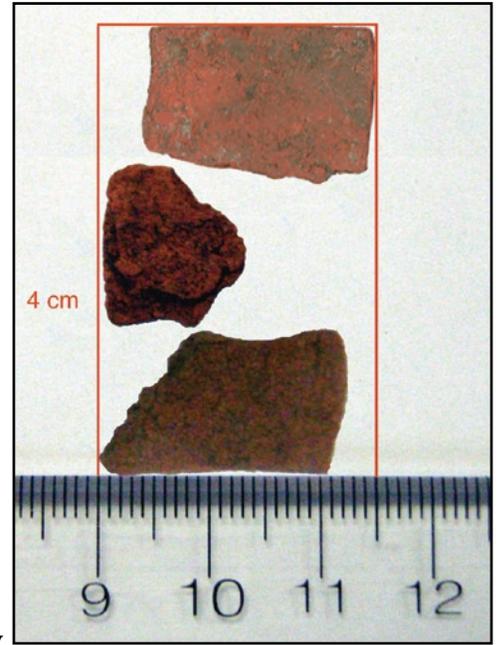
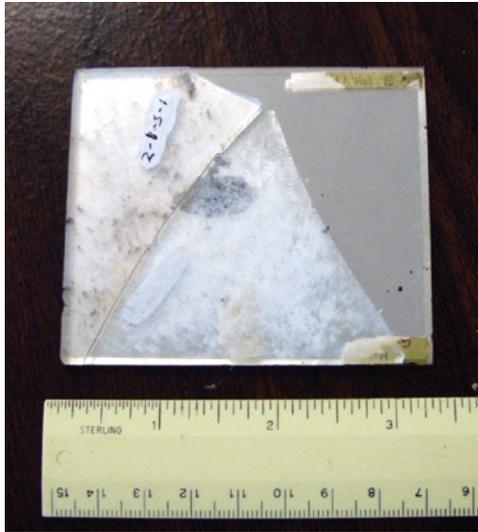
Whether you regard those statements as fanciful fairytales, reasonable hypotheses or established facts depends upon your familiarity with, and your opinion of, the evidence offered to support them. It has often been said that to conclusively solve the Earhart mystery TIGHAR will need to find a "smoking gun," but historical mysteries are rarely solved by the discovery of a single object of apparently unimpeachable provenience. A solution perched atop a single extraordinary artifact is precarious and, by definition, suspect. Reliable solutions to historical puzzles require a broad mosaic of evidentiary support that paints a consistent and credible, although seldom complete, picture of what happened. When individually conclusive pieces of evidence do turn up, their discovery can be purely accidental but is more often the result of good detective work. Simply put, your chances of finding a smoking gun are better if you have already figured out that Col. Mustard committed the murder with the revolver in the library.

In a sound-bite world, smoking guns are shortcuts to widespread acceptance of findings that would otherwise require an investment of more time and effort to understand than most people are willing to make. As investigators, our job is to follow the evidence where it leads, assembling the puzzle piece by piece, watching for and hoping for, but not counting on, a smoking gun to turn up.





ARCHAEOLOGICAL UPDATE



Two pieces of thin ($\frac{1}{16}$ th inch) broken glass, beveled on the manufactured edges, fit together and have been matched to the mirror of a 1930s vintage American woman's compact. Three fragments of red cake-like material are chemically consistent with early 20th century cosmetic and fit within the dimensions of a typical 1930s vintage compact.

A 1930s vintage compact at the Seven Site is highly significant because it is female gender and western cultural specific. The presence of such an artifact greatly reinforces other evidence suggesting

that the castaway was a Caucasian woman of northern European descent. Earhart is known to have routinely carried a compact.

For full reports see: http://www.tighar.org/Projects/Earhart/NikuV/Analysis_and_Reports/Compact/NikuVanalysiscompact.html

and http://www.tighar.org/Projects/Earhart/Bulletins/11_Bonesandshoes.html.

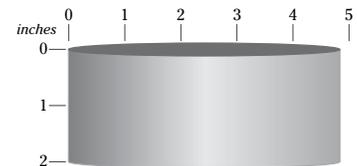
Dr. Sharyn Jones of the Department of Anthropology, University of Alabama at Birmingham, is an expert in Pacific island cultures. She examined and categorized 1,401 animal bones we recovered from two "fire features" at the Seven Site. There were 1,168 fish bones, 78 fragments of turtle bone, 155 bird bones, and one small bone from a medium sized mammal. She also examined photos of deposits of clam shells adjacent to the fire features. We asked Dr. Jones whether the species represented and the way in which they were prepared was more consistent with traditional Micronesian and Polynesian subsistence practices or with those of Westerners. She was unequivocal in her judgment that the person or persons who dined at the Seven Site were not Pacific Islanders.

For Dr. Jones' full report see: http://www.tighar.org/Projects/Earhart/NikuV/Analysis_and_Reports/Faunals/NikuVanalysisfaunals.html.



That lone mammal bone really had us puzzled. The best zooarchaeological opinion so far is that it is a cervical (neck) bone from a goat or a sheep, but there were certainly no goats or sheep on the island

when the castaway was picnicking there. We still don't know for sure how the bone got there, but we do have a reasonable hypothesis. One of the artifacts found on the site was an extremely rusty tin can. We now suspect that it held roast mutton. Canned roast mutton often included a few small pieces of bone to improve flavor. We have long suspected that Earhart and Noonan may have discovered the cache of provisions left on the island for the use of possible

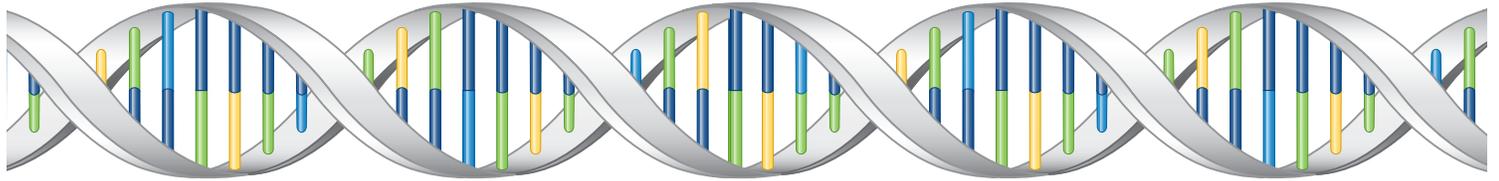


future castaways by the rescuers of the *Norwich City* survivors in 1929. Those supplies might easily have included canned mutton.



An important potentially disqualifying hurdle was cleared recently when the U.S. Naval Academy Non-destructive Testing Lab conducted eddy current tests on M-1 carbine shell casings found in one of the fire features. We know that the M-1 shells date from the 1944 – 46 Coast Guard period. Heat-damaged M-1 shells would mean that the fire also dated from that period rather than from the pre-1940 castaway. A comparison with other M-1 casings scattered around the Seven Site showed no indication of heat damage.

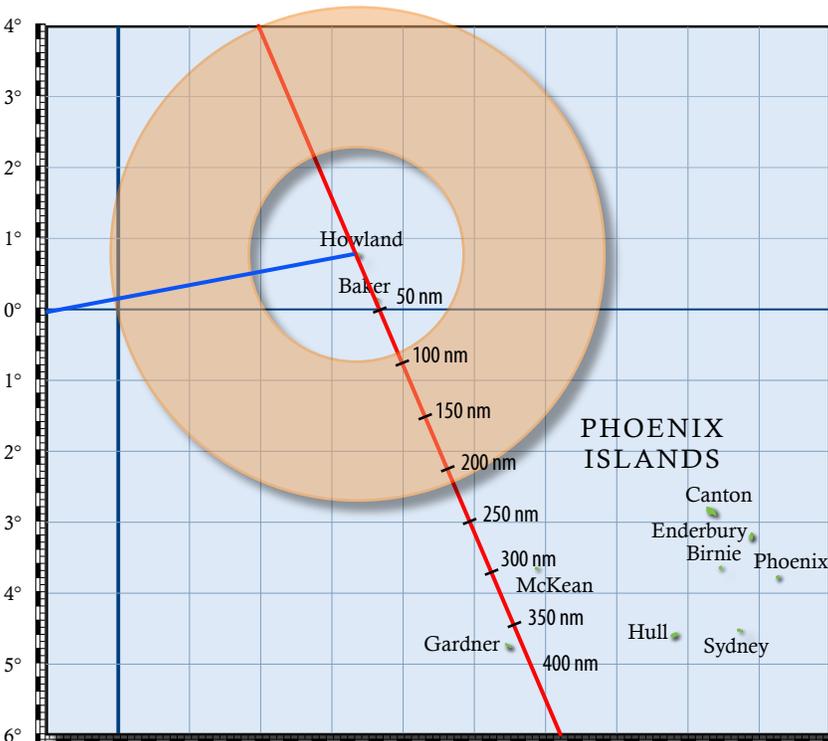
Although we didn't realize it at the time, material was collected at the Seven Site during the 2007 Niku V Expedition that contains human DNA. Laboratory tests are presently under way to determine whether the DNA might reasonably be that of the castaway who died there. If those tests are positive we will proceed with tests to determine whether the DNA matches either Earhart or Noonan. Such a determination would, of course, be monumental. At this time it is still only a possibility and nothing to get excited about ... but as a TIGHAR member and supporter you're entitled to know the status of the work you make possible and share both the exhilaration and the angst of the investigative process.



The 3105 Donut

Recent software advances have made it possible to computer model the propagation properties of the *Electra's* transmitting antenna to an unprecedented degree of accuracy. As a result, the long-held assumption that the closer the plane was to Howland Island the the stronger the signal heard by the Coast Guard would be, has been shown to be incorrect. A peculiarity in the antenna's

transmission pattern meant that if the plane was closer than about 80 nautical miles there was less than a 10% chance that *Itasca* would hear Earhart on 3105 kilocycles at maximum strength as recorded in the cutter's radio log. Chances are the *Electra* was at least 80 and perhaps as much as 210 nautical miles from the ship at the time of the last transmission.



*At 08:43-55 local time Itasca heard Earhart say, "We are on the line 157 337. Will repeat message. We will repeat this on 6210 kcs. Wait. We are running on line north and south." The message came in at maximum strength. Given a newly discovered anomaly in the propagation pattern of the aircraft's transmitting antenna, to have even a 10% chance of being heard at maximum strength, the *Electra* had to be somewhere within the "donut" shown. If on the line southeast of Howland, the plane was much closer to Gardner Island (Nikumaroro) than previously assumed.*

Historical research has turned up yet another piece of evidence that appears to connect Nikumaroro to the lost flight, but ... before we begin ... on a piece of paper jot down two numbers of any length. Any two numbers.

Now, set the paper aside and turn the page.

NUMBERS GAME

None of the airplane parts and scraps of aluminum we've found in Nikumaroro's abandoned village is marked with a serial number, but then, very few components of Earhart's Electra had serial numbers. There was, however, an artifact found on Nikumaroro that carried not one, but two apparent serial numbers that may be linked to the mystery. It was not an airplane part and it was not found by TIGHAR. (See previous page. You did write down and put aside two numbers of your own choosing ... right?)

In a radio message to his superiors dated September 23, 1940, British Colonial Service officer Gerald Gallagher wrote:

Some months ago [a] working party on Gardner discovered [a] human skull – this was buried and I only recently heard about it. Thorough search has now produced more bones (including lower jaw) part of a shoe, a bottle, and a sextant box. ... Sextant box has two numbers on it 3500 (stenciled) and 1542 – sextant being old fashioned and probably painted over with black enamel. ...

(You can see where this is going. If you haven't written down your two numbers by now, don't bother. It's too late. You already have too much information.)

What made Gallagher think that the sextant had been painted with black enamel is not known, but it seems probable that there were flecks of black enamel paint present in the box. British authorities in Fiji saw the numbers on the sextant box as potential clues to the castaway's identity but no one, including Harold Gatty, could make sense of them. The famous Australian aerial navigator was in Fiji at the time. He was shown the box and his opinion was recorded in a note to the official file. "Mr. Gatty thinks that the box is an English one of some age and judges that it was used latterly merely as a receptacle. He does not consider that it could in any circumstance have been a sextant box used in modern trans-Pacific aviation."

Gatty's opinion is understandable. The box found with the bones was of a type used for mariner's sextants but aerial navigators used a different instrument. Taking celestial observations from an aircraft requires a way to assure that the instrument is being held level with the earth's horizon. Specialized aeronautical "bubble octants" accomplished this with an air bubble that operated on the same principle as

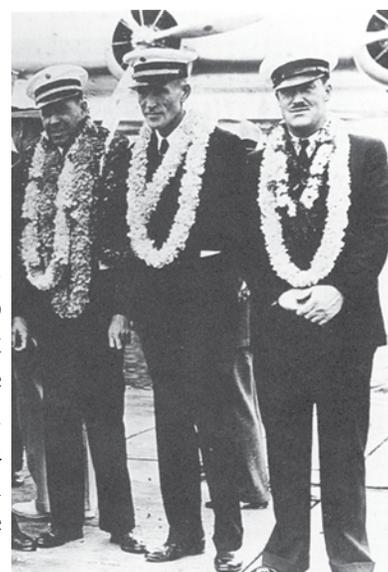
a carpenter's level. Boxes for bubble octants were very different in size and shape than nautical sextant boxes.



Left, bubble octant and box; right, mariner's sextant and box.

Gatty may have been less dismissive had he been aware of a letter Earhart's navigator, Fred Noonan, wrote to his mentor Lieut. Comm. P.V.H. Weems on May 11, 1935 in which he described the equipment and techniques he used in surveying trans-pacific routes for Pan American Airways. Buried amid discussions of chronometers and protractors is the statement "Two sextants were carried – a Pioneer bubble octant and a mariner's sextant. The former was used for all sights; the latter carried as a 'preventer.'"

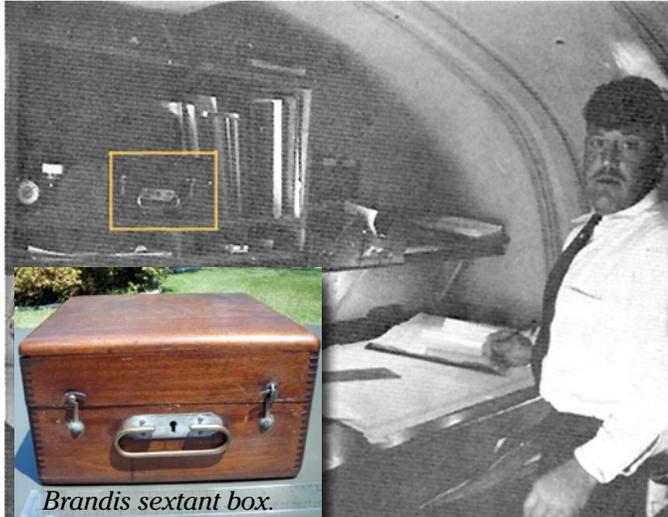
L to R, Pan American Captain Ed Musick, Navigation Officer Fred Noonan, Engineering Officer Vic Wright, Honolulu, April 17, 1935 after California/Hawaii survey flight.



Carrying a mariner's sextant as a back up to the bubble octant would make little sense unless the sextant had been modified with a bubble for aeronautical use, and there is some evidence that it was. A photograph of the navigator's station aboard a Pan American Martin M-130 flying boat shows a bubble octant on a shelf beside a box for a mariner's sextant. The Pan Am crew member in the photo is Flight Engineer Victor Wright. Wright flew all of the early trans-Pacific surveys with

Noonan. The sextant box on the shelf in the photo can be reasonably assumed to have belonged to Fred. It could well be the same box that was later found on Gardner Island. A rash assumption? There's more to the story.

*Martin M-130
"China Clipper."*



Brandis sextant box.

Navigation Room, Martin M-130.

The distinctive hardware on the front of the box shows it to be a Navy Surveying Sextant made by F. E. Brandis and Sons of Brooklyn, NY. Brandis was one of several manufacturers who produced sextants for the U.S. Navy during and immediately following WWI. In the spring of 1919 the Navy's Bureau of Aeronautics was preparing to attempt the first aerial crossing of the North Atlantic with three giant Navy Curtiss (NC) flying boats. The problem of celestial navigation during the long flight was addressed by another student of P.V.H. Weems, a young Lieutenant by the name of

"Byrd" sextant. Brandis Navy Surveying Sextant with bubble modification for aeronautical use.

Richard E. Byrd. Byrd successfully modified several standard Brandis sextants with a bubble device.*

Byrd patented his modification and, in 1921, by then Lt. Comm. Byrd negotiated a royalties contract with Brandis for factory-produced Byrd Sextants. The following



year, controlling interest in Brandis was purchased by the Pioneer Instrument Company which, in 1928, became a division of Bendix Aviation Corp. Production of Brandis sextants ceased in 1932 by which time Pioneer had developed the aeronautical bubble octant Noonan referred to in his letter to Weems. Obsolete Brandis instruments were sold as surplus to retailers like Negus Instruments of New York. It is, therefore, hardly surprising that Noonan's back-up "preventer" in the mid-1930s would be a Brandis, and it is the Brandis brand that points toward the box found by Gallagher.



Maker's number on sextant arc.



Naval Observatory number on sextant arc.



Brandis maker's number (black ink) and Naval Observatory number (stamped into wood) on sextant box.

Each Brandis Navy Surveying Sextant carried a chronological "maker's number" etched in tiny numbers on the arc of the instrument and also stenciled on the inside of the box. As sextants entered the Navy inventory they were checked for accuracy by the Naval Observatory in Washington, DC where they received an N.O. number hand-etched in large numbers on the arc and, in some cases, also stamped into the wood of the box. So Navy-surplus Brandis sextants had two numbers – a maker's number and a Naval Observatory number. More significantly, Brandis sextant boxes were marked with the stenciled maker's number and, at least in some cases, a stamped-in N.O. number.

Gallagher: "Sextant box has two numbers on it 3500 (stenciled) and 1542 – sextant being old fashioned and probably painted over with black enamel. ..."

Brandis sextants were usually painted with black enamel. But what of the numbers? Does 3500 make

**The "Byrd Sextant" carried aboard the NC-4 is currently in the Smithsonian collection*

sense as a Brandis maker's number and could 1542 be a Naval Observatory number? TIGHAR researchers have tracked down records for eleven Brandis Navy Surveying Sextants and donated the funds for TIGHAR to acquire three examples.

Here are the instruments and boxes we've documented:

Brandis 3227/ N.O. 845
Brandis 3336/ N.O. 4773
Brandis 3511/ N.O. 1585
Brandis 3527/ N.O. 1599
Brandis 3987/ N.O. 1584
Brandis 4279/ N.O. 2531
Brandis 4946/ N.O. 2785
Brandis 5292/ N.O. 2975
Brandis 5296/ N.O. 2977
Brandis 5620/ N.O. 2939
Brandis 5760/ N.O. 4705

Note that the N.O. numbers, although undoubtedly chronological by date of assignment, are not necessarily sequential with the maker's numbers.

Let's formulate a hypothesis that the 3500 Gallagher reported as being stenciled on the box was a Brandis maker's number and that the 1542 otherwise marked on the box was a Naval Observatory number. Now let's test the hypothesis by seeing whether those numbers fit in the documented sequence.

Brandis 3227/ N.O. 845
Brandis 3336/ N.O. 4773
Brandis 3500/ N.O. 1542 (hypothetical)
Brandis 3511/ N.O. 1585
Brandis 3527/ N.O. 1599
Brandis 3987/ N.O. 1584
Brandis 4279/ N.O. 2531
Brandis 4946/ N.O. 2785
Brandis 5292/ N.O. 2975
Brandis 5296/ N.O. 2977
Brandis 5620/ N.O. 2939
Brandis 5760/ N.O. 4705

Obviously, they do. Let's try another test.



Sextant box in the collection of the National Museum of Naval Aviation.

There are hand-written numbers on the bottom of sextant box known to have been owned by Noonan and now in the collection of the National Museum of Naval Aviation. The box is not a Brandis box, the sextant in it is not a Brandis, and the numbers on the instrument have no relation to numbers on the box, but the box has been modified with cut-outs that are not necessary for the sextant it now contains. Do the numbers fit in the Brandis sequence? Did this box once hold another Brandis sextant?

Brandis 3227/ N.O. 845
Brandis 3336/ N.O. 4773
Brandis 3500/ N.O. 1542 (hypothetical)
Brandis 3511/ N.O. 1585
Brandis 3527/ N.O. 1599
Brandis 3547/ N.O. 173 (hypothetical)
Brandis 3987/ N.O. 1584
Brandis 4279/ N.O. 2531
Brandis 4946/ N.O. 2785
Brandis 5292/ N.O. 2975
Brandis 5296/ N.O. 2977
Brandis 5620/ N.O. 2939
Brandis 5760/ N.O. 4705

That's two for two. Now let's test the "null hypothesis" that any pair of random numbers would fit the documented sequence just as well as the numbers reported by Gallagher and the numbers on the box known to be owned by Noonan. Get out that piece of paper and see how well your numbers fit.

Let me guess. Not so good. Right?

So what do we have here? A smoking gun? Not quite. We're trying but, so far, we've been unable to find documentation to prove that Brandis 3500 was assigned N.O. number 1542 or that it was owned by Fred Noonan. Research continues. What we can say for certain at this point is that Fred Noonan appears to have owned a sextant box that fits Gallagher's description of the box found with the castaway's bones. To paraphrase Merle Haggard, "It's not a smoking gun, but it's not bad." 



ANNOUNCING THE



INSTITUTE FOR AVIATION HISTORY

Preserve, Explore, Inspire

TIGHAR is expanding. Effective January 1, 2009 we'll become The TIGHAR Institute for Aviation History. Capitalizing on our 24 years of experience advocating for responsible aviation historic preservation and our pioneering work in science-based aviation historical investigation, we'll be putting new emphasis on education, both for the general public and for children.

Watch for a complete overhaul of the TIGHAR website with new features such as –

- an interactive timeline of Amelia Earhart's final flight.
- the TIGHAR Theatre with rare aviation films and mini-documentaries of TIGHAR expeditions.
- the Ameliapedia, a Wikipedia-style database that will be the go-to source for information about the Earhart mystery.

Most importantly, the new “TIGHAR for Teachers” division will offer educational resources and programs that will help educators teach critical thinking, math, science and history in the context of a real-life mystery.

This is about giving back. It's about putting the wealth of knowledge and material we've collected over the years to work for the benefit of present and future generations.

You'll be hearing much more about the TIGHAR Institute and we're counting on your continued support to make it the success it deserves to be. 🐾





Review & Update

In late July 2007, unusual erosion patterns in a beach in North Wales revealed the presence of a WWII Lockheed P-38 Lightning. In September, local resident and aviation historian Matt Rimmer contacted TIGHAR and in early October a seven-person TIGHAR team conducted an on-site archaeological survey. We identified the aircraft as 41-7677, a P-38F of the 49th Fighter Squadron, 14th Fighter Group, Eighth Air Force. 2nd Lt. Robert F. Elliott landed the Lightning in the surf on September 27, 1942 after a double engine failure caused by fuel exhaustion. Sixty-five years later, we found the aircraft to be in remarkably good condition. As the oldest unrestored P-38 in existence and an Eighth Air Force combat veteran the aircraft is both generally and individually historic. Because the wreck lies within sight of famous Harlech Castle we dubbed her the Maid of Harlech and made a commitment to do all we can to see that she is responsibly recovered, conserved and displayed, preferably at one of the UK national museums. Soon after the TIGHAR survey was completed, the beach conditions reverted to their former pattern and the aircraft was once more buried in sand and hidden from view.

In November, Matt Rimmer, now a member of TIGHAR, obtained a recovery license from the UK Ministry of Defense and later that month, at a meeting of national museum curators, the Royal Air Force Museum announced its desire to add the P-38 to its collection. The museum's intention to recover the aircraft was reaffirmed in January of this year when a TIGHAR delegation met with a senior RAF Museum official in London. TIGHAR Executive Director Ric Gillespie, Texas A&M University conservator Peter Fix, and Manhattan-based structural engineer Al Baycora offered their assistance but were assured that the RAF Museum had the capability and expertise to do the job. Throughout the spring and summer, Matt Rimmer and local Welsh authorities maintained a watch on the site during periods of low tide to make sure it remained safe from the elements and from potential looters.

After researching the logistics and cost of recovering the P-38, the RAF Museum decided that the job is more than they are able to undertake

and, effective September 1, officially withdrew from involvement. TIGHAR's commitment to the Maid of Harlech, however, remains unchanged. While we continue to search for a suitable museum partner to help us save the aircraft, we're developing an emergency recovery/conservation plan in case the erosion patterns once again shift and the P-38 again becomes exposed.

Removing the aircraft safely from the beach environment will take some careful planning, especially since Harlech Beach and its complex dune system have been designated a Site of Special Scientific Interest. But with an aircraft that has spent many decades immersed in salt water the real challenges start after the recovery has been accomplished. Unless promptly subjected to the proper treatment, the aluminum and steel will quickly deteriorate. Our hope is that the Maid can be brought to the Center for Maritime Archaeology and Conservation (CMAC) facility on the campus of Texas A&M University in College Station, Texas where it can be conserved under the expert eye of CMAC Assistant Director Peter Fix.

In researching and funding the recovery/conservation plan TIGHAR is proud and grateful to have the support of the 49th Fighter Squadron Association. 

UPDATE

Like the Maid of Harlech, the Douglas TBD-1 Devastator torpedo bomber slated for recovery and conservation for the National Museum of Naval Aviation is safe for now.

The aircraft rests on the bottom of Jaluit lagoon in the Marshall Islands, protected from the elements by 125 feet of water and from looters by the extreme remoteness of its location.

Having surveyed the aircraft in 2004 and evaluated it for recovery in 2006, the next step is to chart a safe route for the recovery vessel to and from the wreck site. The only available nautical charts cover only a small portion of the lagoon and are based on a Japanese survey dating from the 1920s. We're hoping to be able to arrange for airborne LIDAR (Light Detection and Ranging) technology to map the lagoon but if that doesn't come about the plan is for a TIGHAR team to chart the route using multi-beam sonar. That expedition is planned for March 2009, funding permitting. 

