

An enterprising search for clues in Civil War balloon fabric

By Maureen Lynch

Producers of the PBS series *History Detectives* recently acquired what they had been told was a small piece of old balloon fabric from Thaddeus S.C. Lowe's balloon "**Enterprise**." The small swatch was mounted in a frame, pasted to the back which was a typed note: "a piece of Prof. Lowe's Aeronautical balloon '**Enterprise**' taken by Lt. S. Millet Thompson of the 13th N.H.V.I. after it was destroyed upon landing near his camp on the Peninsula in 1862."

They asked my husband Chris Lynch and me to determine if this was true. We had researched other aged balloon fabric. We undertook this challenge voluntarily, setting in motion a long effort that produced a surprising result.

We researched information on the soldier's name on the back of the frame. He was the author of a published diary for the 13th New Hampshire Volunteer Infantry, kept for about three years; this confirmed his service on the Peninsula. The diary mentions two or three balloons on tether in his camp, but nothing about a balloon being wrecked, or retrieving a souvenir from one.

The frame information was suspect — we did not have an unbroken chain of provenance. The current owner had been preceded by a chain of several dealers, with no chance of taking it back to the previous owner, so there was no way to know who typed the information on or how reliable it was.

We were unable to locate any known piece of the **Enterprise**; the closest we found were other Lowe balloons. The Library of Congress holds the Lowe papers in the Manuscripts and Archives Division, but while they had sample pieces from several of the Civil War balloons, including a Confederate balloon, none was from the **Enterprise**. Digital images showed samples of seam stitching and how similar period pieces had held up over time; these all looked darker, except the one with seams present in the piece; this last looked like it might have been taken from lower in the balloon, perhaps the neck.

We determined that the **Enterprise** had been made of silk. Lowe had used twilled muslin in his first balloon and the **City of New York**, and the **Enterprise** was built in between these two balloons. The definitive references were a quote from a newspaper, and an account written by Lowe



Was this fabric fragment from the famous Civil War balloon Enterprise? The question touched off a long search for clues.

himself, describing his flight in the **Enterprise** from Cincinnati.

We consulted with Tom Crouch (Senior Aeronautics Curator at the National Air and Space Museum) and Charles Evans (author of *War of the Aeronauts*). Their consensus was that Lowe had likely used muslin, as he did in the other two balloons. This added support to the possibility the fabric could be from the **Enterprise**.

Under light and magnification, we saw an old coating of a brownish color that darkened the material. In places it had flaked off. A seam or section of overlap ran the length of the material. This overlapped section was darker than the rest of the material, leading us to suspect it had been connected with some type of adhesive that produced the darker color. The backside of the fabric showed a narrow strip of similar material. However, this narrow strip was cut and laid down on the bias — a common repair feature. This

was likely a repair patch performed on an inflated balloon. When warmed, the swatch gave off a particular smell specific to the type of varnish material.

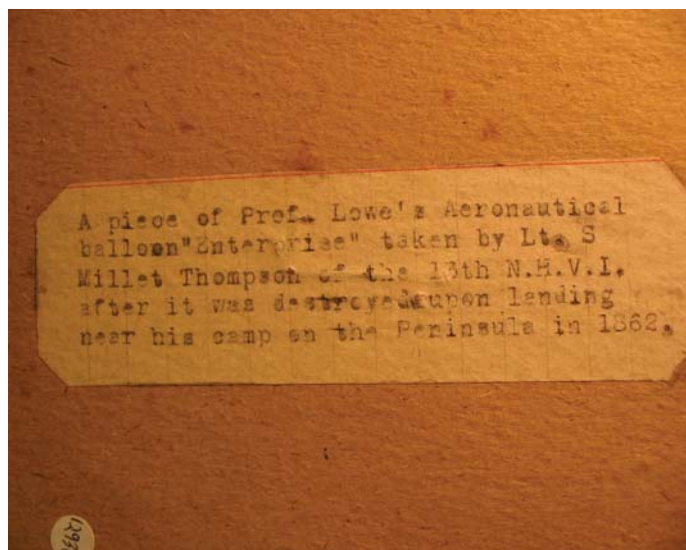
The material itself was a plain weave fabric, not twilled; so this ruled out original material from the other Lowe balloons. But, we wondered, could it have been a repair section from one of them?

Dr. Ivor Preiss, professor emeritus at Rensselaer Polytechnic Institute, is one of the top experts in such work. His studies involving x-ray spectrometry led to research on art objects and historical artifacts. He agreed to help us.

We scheduled tests at RPI and also made an appointment with a textile expert at the New York State Peebles Island Resource Center (a conservation lab for the NY State Department of Park, Recreation and Historic Preservation) north of Albany.

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Our request was simply to look at the fabric and tell us what our sample was made of. Textile expert Sarah Stevens took one look at it and said “cotton.” To confirm this, she took a loose thread that had unraveled off the fabric edge, put it on a glass slide, added a drop of dye to enhance microscope viewing, and put it under the microscope. The tell-tales showed that this thread had a tight twist to it, with shorter fibers comprising the thread. The twist to the thread was what bound the shorter plant fibers together, and com-



prised the cotton thread. Silk, by contrast, was an animal protein and as such, was made of long, strong filaments which lay flat – like a straw which is flattened.

Under the microscope, she showed me this appearance on my sample of silk balloon fabric I’d also brought. There was no twist to the filament, but I could see the twist in the thread of the Thompson fabric. Sarah pulled out a small magnifier, and looking at the material added that the threads were “s” twist (direction of the twist’s slant) in both warp and weft directions. She confirmed that it was plain weave, not twilled.

I headed over to RPI next. I had found the two references to the **Enterprise** being made of silk. Did this preclude any chance of the fabric being from the **Enterprise**? Not necessarily – I also found on page 122 of Evans’ book the notation that all federal balloons were equipped with *both reinforced cotton and silk* for repairs on them as needed in the field. This piece showed evidence of being a patch, so even if it was muslin, it could have come from a silk balloon. However, the timeline still didn’t fit – the **Enterprise** was put up in storage as soon as Lowe had the first couple of the seven balloons on hand. Besides not putting the wear and tear on his own equipment, the new balloons were better marked with patriotic motifs, to prevent getting shot at by federal troops. But the possibilities of the **Enterprise** being cotton had made supposition much more palatable to the PBS producers.

I packed up the additional balloon fabric samples, photo images of gas generating equipment, some portraits of Lowe and others as well as images of various balloons of the period, and a reprint of Wise’s book, “A System of Aeronautics.”

When we met the production team from History Detectives, they were focused on a small selection they had secured from the Library of Congress. They began to run through their questions, culminating in a discussion of the **Enterprise**’s cotton envelope. When the producer was finished, I said, “The **Enterprise** was made of silk.” The production team gasped.

“I have two sources saying it was silk, and none saying it was cotton,” I explained. “From a historiography standpoint, even if I can blow off the secondary source, that still leaves the primary, and I’ve no grounds to dispute his own words.” We called Chris and his conclusion was the same; silk is silk. With no grounds to second-guess Lowe, we had to take it as literal in meaning.

Over at RPI, Dr. Preiss was waiting in the lab.

He’d run the traces on two other samples, – a small snippet of the **Atlantic** silk balloon of John La Mountain’s from 1859, and a similarly miniscule bit from Silas Brooks’

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cotton muslin balloon of 1890 from the New England Air Museum. We were looking for similarities in the varnish to help date it or place it (the **Atlantic** was more likely to look like the Thompson material, if the varnish was comparable).

Dr. Preiss's eyebrows raised when he scanned the graph on the computer monitor. Pointing to a small bump to the right of the scan of the **Atlantic** fabric, he said, "That's odd, what's that doing there? That's gallium – but it's not a common material. You rarely see it, except for the Adirondacks and the Lake George basin area; the upper Hudson Valley. You might expect to see it in glacial till up here."

"The **Atlantic**, which this comes from, was built in Lansingburgh, New York in 1859," I said. "And, it crash-landed on the shores of Lake Ontario on its maiden flight out of St. Louis!"

His face lit up. "Wow – that's pretty cool!" We looked at the traces for similarities, but there appeared to be little in the way of telltales for the varnishes on them, when compared to the plain muslin and pure linseed oil baselines from the day before. Still, both showed traces of lead, which would be from any mordant used to set a color to the fabric, assorted minerals (from the ground into the plant's tree sap which yielded the linseed oil and thinner), and iron. This was doubtless from the gas generating procedures used back then, which involved pouring acid over iron filings to cause a reaction which broke down water into oxygen and hydrogen; the hydrogen was set free and was channeled into the balloon after forcing it through a couple of interim steps to cool it and precipitate out impurities.

Gas generating procedures used back then involved pouring acid over iron filings to cause a reaction

The iron trace was stronger on the 1890 Silas Brooks balloon fabric, but this was to be expected; this balloon saw a much longer useful life than the **Atlantic**. Although the **Atlantic** was cut up and rebuilt a number of times over its career, the sample we were testing was salvaged from the original wreck outside of Jeffersonville, New York so it was from a balloon that had seen only one inflation.

Dr. Preiss then mounted our sample fabric in the x-ray spectrometer, and started a new graph. As a set of twin peaks began to climb in the center of the screen, he frowned. Pulling out his chemist's slide rule, with the atomic energies and other info from the periodic table. "Zinc! What's that doing there?" The trace was very strong; far too much to have been a metallic oxide added for drying the original varnish.

My face lit up as I explained that any time the balloonists back then couldn't get iron filings for generating hydrogen gas (by combining with sulfuric acid and water), zinc was the next best thing. Iron was much cheaper – in fact, the federal balloon corps got its iron for free from the Washington Navy Yard. This sample had loads of zinc.

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In the field, gas generation was supposed to have one or two washes either through ice or lime (chemical cooling) to bring down the gas temperature (freshly generated hydrogen was quite hot) and get rid of sulfuric acid vapor. Balloon fabric doesn't take kindly to it over time. But if the generator equipment and hoses are improperly hooked up – or if one is in a hurry and removes one or both of the two cooling stages – the vapor can get in. Looking at this trace, if that much heavy metal found its way into the balloon's interior, one can imagine how much more of the lighter acid vapor got in – hence, the weakening of the fabric and need for repairs (patching). That this piece was itself a patch section of fabric indicates this heavy trace was not the result of a single incident, though it is suspected that much of this may have come from a single exposure. It is unlikely a balloon would have lasted long under this much gas contamination.

Zinc and iron are indicative of field operation – not city gas mains. There were also traces of iron on the Thompson fabric trace, indicating that both metals had been used for field operation. Extrapolating the exposure time of the Thompson trace to the Silas Books sample, it's clear that the Brooks piece has a comparable amount of iron present in the cotton fabric. But the Thompson fabric's trace is overwhelmed by the amount of zinc present.

We inferred that either something went very wrong on the last inflation the Thompson fabric saw, or that this balloon fabric had a hard, short life. Either scenario is consistent with what was described on the back of the frame, and with what is known of the service of the federal fleet of balloons. Last, the presence of zinc is unusual for inflation, given its higher cost. This tends to rule out civilian use when costs would be kept down by ordering the cheaper iron filings. Commercial or scientific work was customarily scheduled some time in advance. Zinc was substituted when inflation was a necessity and could not be rescheduled -- pointing to military use.

In our previous research of balloon operations, we found only one reference to catastrophic failure such as the back

of the frame describes. This was James Allen's tether work in the badly deteriorated balloon Washington, near Mechanicsville, on May 31, 1863. After two days' tough reconnaissance work in windy conditions, the balloon's "rotten seams" finally ruptured and the balloon exploded about 200 feet up.

This anecdote fit the description of the incident cited on the frame, but this failure did not happen on the Peninsula, and it was at least a year later. No other accounts describe any major failures of equipment like this though lesser repairs could have yielded a souvenir such as the Thompson fabric. While official records indicate that all seven federal balloons were present and accounted for at the end of the war, they do not say what condition the balloons were in.

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Our conclusion, after examining the Thompson fabric, testing it and researching it, was that this was 19th century balloon fabric, but not from the Enterprise. Since we were unable to substantiate the information provided on the back of the frame, the rest of the information is suspect and thus we are left only with the material itself. In context with other samples we have seen, our best estimate is that this from one of the seven federal balloons. Which one is not known.

There is strong evidence that this fabric did in fact come from a military balloon of the period. The American Civil War was the only one going on at the time. Circumstantial evidence points to this being one of the federal balloons.

This analysis is ours alone; we have not yet seen the documentary. They will make their own conclusions on behalf of the owner of the fabric fragment. At least they were getting paid!