

Elizebeth Friedman: Producing a Key to Understanding Encrypted Communications

Alexa Tollman
Senior Division/Individual Exhibit
Exhibit Word Count: 500
Process Paper: 500

I chose Elizebeth Smith Friedman for my project because her code breaking skills and work as a cryptanalysis changed the course of WWI and WWII and also helped catch rum-runners and crime bosses during Prohibition. Friedman was America's first female cryptanalyst.

Before I started building my project, I decided whether to produce an exhibit or a website. A website allowed more words and description but would entail designing and creating everything on the computer. I decided to do an exhibit, like I did last year, because I love to create things with my own hands. Doing an exhibit taught me to focus on a main idea and add supporting details to tell a complete story. In the process of telling a story about a woman who influenced events during Prohibition, World War I, and World War II. I also learned to cut unnecessary words to keep within the 500 limit.

I searched for newspapers and books on Friedman and her work. I found interviews and primary sources at the George C Marshall library. I read Elizebeth's memoir and articles on her cryptology skills. I gathered pictures and arranged them on gray fabric covered backgrounds that fit into my wooden frame-like exhibit. I rewrote my script and printed it to see how it would look on my board. I laid all my pieces on my middle side, first rearranging them until I was pleased with the arrangement of quotes, pictures, and paragraphs. I laid out my left and right side deciding where to put the subtitles to tell the story effectively. I chose to combine burgundy and gray for my project colors. The gray background creates a chalk black board look. I backed my quotes with gray and white paper to make them stand out compared to my words in single-backed burgundy.

On my table display I placed artifacts similar to what Elizebeth Friedman had on her desk. I displayed a picture of her family, copies of coded Christmas cards that she sent friends, and chalk and a chalkboard that Elizebeth used to decrypt messages. I found some of Friedman's decrypts and translated them to the chalkboard. I added a typewriter like she used to write her stories and manuscripts. I printed out the first page of her memoir and put it in the typewriter. Elizebeth enjoyed Shakespeare so I laid a Shakespeare book on my display. She smoked while she worked so I included an ashtray and a cigarette lighter on the desk. I found a copy of her identification card and added it. I included old notepads and a pencil. These were the tools she used to decipher communications that most saw as unreadable.

Elizebeth Friedman fits the theme because she used her skill and knowledge as a cryptanalysis to provide a key for understanding encrypted messages. She decoded some of the most difficult ciphers at that time. Deciphering these communications helped the government and military during World War I and World War II. She changed history.

Annotated Bibliography

Primary:

Artifacts:

Nation Collection. Sioux County, Nebraska: Typewriter, chalkboard, chalk, ashtray, cigarette lighter, pencil, a Shakespeare book, a portrait frame, and coffee cup.

Correspondence:

"Local Matron Decodes Cryptic Messages for Treasury Department." *Women's Features*. June 8, 1937.

I put this article on my exhibit. It reported a court case in which Elizebeth's cryptanalyst skills brought down a crime-boss.

Bacas, Harry. "Secret Codes and Shakespeare Spice Life of Couple in District." *The Sunday Star-13*. Newspaper. November 3, 1951.

This newspaper article reports the Friedmans meeting with George Fabyan and describes their skills with cryptology. "They spent the next 46 years in that study, including highly important work for the United States Government in World War I and World War II."

Helmick, Leab. "Key Woman of the T-Men." *The Reader's Digest*. 1937.

In this article it gave much information on the Friedmans and how they decoded messages. It explains codebreaking and the Friedmans' work as cryptanalysis.

Documents:

George C. Marshall Library. Online. Cipher Sheets, Elizebeth Friedman letters, and code book.

The George C. Marshall Library is located in Lexington, VA. I used several pieces from the Library on my exhibit, but primarily I used them for information.

George C. Marshall Library. Online. Elizebeth Friedman's memoir.

I read through her memoir and articles. She wrote about many aspects of her life like going to Chicago to look for a job when the librarian introduced her to a man

named George Fabyan. He took her to his laboratory and taught her how to decode codes that he was sure would reveal the fact that Shakespeare didn't write his stories and poems. Elizabeth discounted the idea.

Books:

Freidman, Elizebeth. Unfinished memoir. George C. Marshall Library. 1930.

“Because of the fact that no historical records of cryanalytic procedures were maintained during the years” of the Coast Guard Unit, she recorded some of her methods of deciphering messages and her work as the unit leader.

Friedman, Elizebeth. College and WWI Journal. George C. Marshall Library. 1913-1918.

This journal contains articles from Elizebeth's college years, as well as her early years at Riverbank as a codebreaker in Geneva, Illinois.

Friedman, William. *Six Lecture Concerning Cryptography and Cryptanalysis (Cryptographic Series)*

The Friedmans laid the foundation for modern concepts of cryptography and cryptanalysis. This text contains a complete historical study concerning cryptography and cryptanalysis.

Photos:

George C Marshall Foundation. I found many of the photos I used on my exhibit at *The George C. Marshall Foundation*. Elizebeth and George Friedman donated their books and manuscripts to *The George C. Marshall Foundation*.

The Library of Congress. Photos of the Friedman's were included on my exhibit.

Secondary:

Books:

Fagon, Jason. *The Women Who Smashed Codes*. New York: Harper Collins, 2018.

This was one of my main sources. It was a well-written story about Elizebeth Friedman and her code-breaking skills.

Mundy, Liza. *Code Girls: The Untold Story of the American Women Code Breakers of World War II*. City of Publication, Publisher, Publication date.

Elizebeth trained many young women to break codes. She was the first director

of the Coast Guard's cryptanalyst unit. These women in this book didn't all work for Elizebeth, but they all learned to break code and read hidden messages.

Smith, Stuart G. *A Life in Code: Pioneer Cryptanalyst Elizebeth Smith Friedman*. North Carolina: McFarland and Company Inc.

This book isn't as good as the one by Fagon, but it does show several codes and explain how Elizebeth broke those codes. I was surprised that Elizebeth actually worked at home to break many codes.

Websites:

Bowers, Chad. "The Cryptanalyst Who Brought Down the Mob." *PBS: American Experience*. January 5th, 2021.

<https://www.pbs.org/wgbh/americanexperience/features/codebreaker-cryptanalyst-who-brought-down-mob/> (Accessed 11 January, 2021.)

The author of this website describes how Elizebeth Friedman faced off with crime bosses, rum runners and drug smugglers and how she succeeded.

"Breaking 'Purple' In William Friedman's Own Words." *George C. Marshall Foundation*. 2020.

<https://www.marshallfoundation.org/blog/breaking-purple-in-william-friedmans-own-words/> (Accessed 30 March, 2021.)

I read about William's point of view of breaking codes and being a cryptanalyst. I also found a photo of the Friedman family about the time William broke "Purple."

"Causes of World War II." *History of World Civilization II*.

<https://courses.lumenlearning.com/atd-tcc-worldciv2/chapter/causes-of-world-war-ii/> (Accessed 28 March, 2021.)

I read about the causes of WWII and how cryptologists changed the result of the War.

Chronicling America: Library of Congress.

<https://chroniclingamerica.loc.gov/lccn/sn83045462/1957-11-03/ed-1/seq-13/#date1=1777&index=0&rows=20&words=Elizebeth+Friedman&searchType=basic&sequence=0&state=&date2=1963&proxtext=elizabeth+friedman&y=0&x=0&dateFilterType=yearRange&page=1> (Accessed 9 February, 2021.)

In *Chronicling America* I was able to find an Evening Star paper from 1957. The article titled "Secret Codes and Shakespeare Spice Life of Couple in District." describes Mr. and Mrs. Friedman's successes as a couple and the story of how they came to meet and break codes.

Cohen, Mickey. "Elizebeth Friedman." *The Mob Museum*.

https://themobmuseum.org/notable_names/elizabeth-friedman/ (Accessed 20 February, 2021.)

"In the criminal trial of master international rumrunner," Elizebeth was called as an expert witness. This website described many trials related to Elizebeth during the Prohibition era.

"Cryptologic Quarterly."

<https://www.nsa.gov/Portals/70/documents/about/cryptologic-heritage/historical-figures-publications/publications/cryptologic-quarterly/cryptologic-quarterly-2015-01.pdf> (Accessed 8 February, 2021.)

"*Cryptologic Quarterly* is the professional journal for the National Security Agency/ Central Security Service." This talks about William's work as a cryptanalysis and reports the release of the Friedmans papers.

Daley, Beth. "Francis Bacon, Shakespeare and Secret Societies." *Europeana*. January 22, 2013.

<https://www.europeana.eu/en/blog/francis-bacon-shakespeare-and-secret-societies> (Accessed 11 January, 2021.)

This website helped me learn more on the Bacon and Shakespeare controversy and why people didn't believe that Shakespeare wrote his own plays.

Damico, Tony M. "A Brief History of Cryptology." *Inquiries*. 2009.

<http://www.inquiriesjournal.com/articles/1698/a-brief-history-of-cryptography> (Accessed 28 March, 2021.)

On this site I learned about cryptologists and what other types of code cryptologists break.

"Elizebeth Friedman and Prohibition." *George C. Marshall*. 2020.

<https://www.marshallfoundation.org/blog/elizabeth-smith-friedman-and-prohibition/> (Accessed 2 April, 2021.)

I read about Elizebeth's work during Prohibition and how Prohibition impacted life in the 1920s.

"Elizebeth S. Friedman." *National Security Agency Central Security Service*.

<https://www.nsa.gov/About-Us/Current-Leadership/Article-View/Article/1623028/elizabeth-s-friedman/> (Accessed 6 January, 2021.)

As I read through this website I began to have a broader view of Elizebeth and her lifestyle.

"Elizebeth Smith Friedman." *Famous Scientists*.

<https://www.famousscientists.org/elizabeth-smith-friedman/> (Accessed 6 January, 2021.)

This site gave me much information on education, cracking codes in college, breaking codes for the government, and breaking Nazi codes.

"Elizebeth Smith Friedman Personal File." *Internet Archive*.

<https://archive.org/details/ESFPersonnelFile/page/n1/mode/2up> (Accessed 25 February, 2021.)

I was able to find information from Elizebeth's personal file and read her records as a Government employee.

History.com editors. "World War II." *History*. November 16, 2020.

<https://www.history.com/topics/world-war-ii/world-war-ii-history> (Accessed 12 January, 2021.)

Elizebeth Friedman's work in cryptology altered the result of World War II, I researched World War II to learn more about the war and how any cryptanalysis changed the result of war.

Hopkins, Anna. "The forgotten founder of code-breaking: How a Quaker mother of two became a pioneer of government intelligence - taking down Nazi spies, capturing rum runners during Prohibition, and jailing Al Capone's gang - while J. Edgar Hoover took all the credit." *Daily Mail*. 2017.

<https://www.dailymail.co.uk/news/article-5001868/Elizebeth-Friedman-forgotten-founder-code-breaking.html> (Accessed 13 February, 2021.)

The Daily Mail refers to Elizebeth as "a smart, young Quaker mother of two from rural Indiana. It goes on to talk about how successful she has been as a "code-breaker."

"J. Edgar Hoover." *Biography*. 2017.

<https://www.biography.com/law-figure/j-edgar-hoover> (Accessed 30 March, 2021.)

The FBI director that stamped Elizebeth's work with "Top Secret" was J. Edgar Hoover. I read this site to get more information about him as a FBI director and life.

Knight, Judson. "Cryptology, History." *Encyclopedia.com*. 2020.

<https://www.encyclopedia.com/politics/encyclopedias-almanacs-transcripts-and-maps/cryptology-history> (Accessed 12 January, 2021.)

This website on cryptology gave me more of an insight on cryptology and Elizebeth's job as a cryptologist.

Lee, Max. "Elizebeth Friedman: Coast Guard Code Breaker." *Boundary Stones*. 2016

<https://boundarystones.weta.org/2016/09/28/elizabeth-friedman-coast-guard-code-breaker> (Accessed 5 January, 2021.)

I learned that the Friedmans moved to Washington as they were recruited to work together as cryptanalysts for the Army Signal Intelligence Service. While working there, Elizebeth only received half pay of what her husband made.

Lerner, Michael. "Prohibition: Unintended Consequences". *PBS*.

<https://www.pbs.org/kenburns/prohibition/unintended-consequences/> (Accessed 11 January, 2021.)

On this site I got a brief overview of Prohibition and its consequences. Prohibition started in 1920 to outlaw the use of alcohol in America. As predicted, it did not go well. Elizebeth broke hundreds of codes between run-runners and bootleggers who operated during Prohibition.

“Military Records: World War II Photos.” *National Archives*.

<https://www.archives.gov/research/military/ww2/photos> 13 January, 2021.

(Accessed 28 March, 2021.)

I gathered more information on World War II and what other cryptologists were doing in this era.

Minster, Christopher. “Why Argentina Accepted Nazi War Criminals After World War II.” *ThoughtCo*. 2021.

<https://www.thoughtco.com/why-did-argentina-accept-nazi-criminals-2136579>

(Accessed 5 April, 2021.)

I read about how and why Nazi were taking over South America and what the South American connection was.

Popova, Maria. “The Woman Who Smashed Codes: The Untold Story of Cryptography Pioneer Elizebeth Friedman.” *Pocket*.

<https://getpocket.com/explore/item/the-woman-who-smashed-codes-the-untold-story-of-cryptography-pioneer-elizabeth-friedman> (Accessed 11 January, 2021.)

On this website I found and used many quotes and letters about Elizebeth Friedman.

Simmons, Gustavus J. “History of Cryptology.” *Britannica*.

<https://www.britannica.com/topic/cryptology/History-of-cryptology> (Accessed 28 March, 2021.)

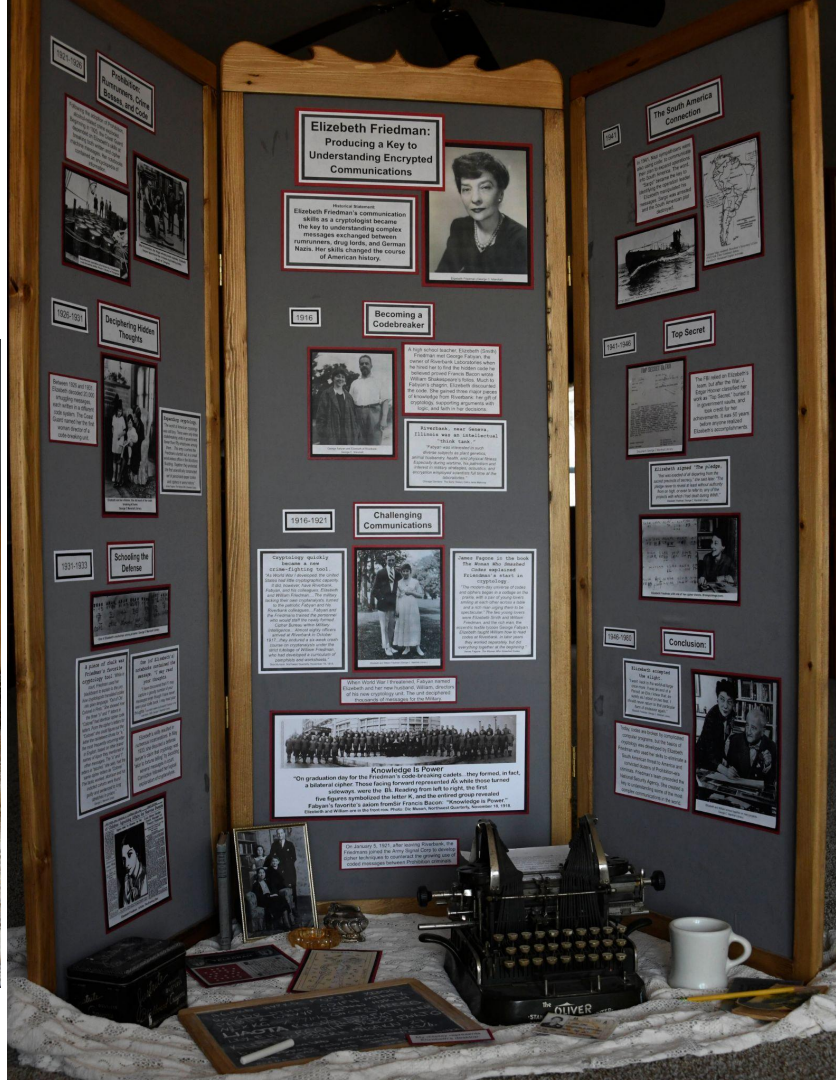
From “History of Cryptology,” I learned more about cryptology during World War I and II. I read about how cryptology has evolved and how it began.

Worrall, Simon. “Codebreaker Elizebeth Friedman Smashed Nazi Spy Rings.” *National Geographic*. 2018.

<https://www.nationalgeographic.com/news/2017/10/elizabeth-friedman-codebreaker-nazi-spy-fagone/> (Accessed 5 January, 2021.)

National Geographic describes Elizebeth’s work in World War II and more about Elizebeth’s struggles during this time, trying to raise two kids of her own and decrypt messages for the FBI.

Full Exhibit and Display



Left Top Panel

1921-1926

Prohibition: Rumrunners, Crime Bosses, and Code

Following the adoption of Prohibition, alcohol-related crime exploded. Beginning in 1925, the Coast Guard depended on Elizebeth's skills at breaking both written and cipher machine messages. Her notebooks contained an encyclopedia of information.



Rum-Runner operation shut down by Friedman's code-breaking skills. Photo: Library of Congress



After Prohibition, the illegal whiskey trade exploded. Elizebeth helped apprehend the criminals by breaking codes.
Library of Congress

Left Top Panel Text

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Left Center

1926-1931

Deciphering Hidden Thoughts

Between 1926 and 1931, Elizebeth decoded 20,000 smuggling messages, each written in a different code system. The Coast Guard named her the first woman director of a code-breaking unit.



Elizebeth and her children. She did much of her code breaking at home.

George C Marshall Library.

Expanding cryptology.

"The world of American cryptology was still tiny. There were only three codebreaking units in government, fewer than fifty employees among them... The army is where the Friedmans started out, in a small windowless office in the Munitions Building. Together they protected the first scientifically constructed set of pencil-and-paper codes and ciphers in army history."

James Fagone. *The Woman Who Smashed Codes.*

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James Fagone. *The Woman Who Smashed Codes.*

Left Bottom Panel Photo

George C Marshall Library
The Evening Star



Left Bottom Panel Text

1921-1926 Schooling the Defense

Elizebeth's skills resulted in numerous incarcerations. In May 1933, she disputed a defense lawyer's claim that cryptology was "akin to fortune telling" by decoding several messages in court. Conviction followed her logical explanation of cryptanalysis.

A piece of chalk was Friedman's favorite cryptology tool. "While in court, Friedman used her blackboard to explain to the jury how cryptologists translated codes into plain language. "Out of Old Colonel in Pints." She showed how the three "o" and "l" letters in "Colonel" had identical cipher code letters. From the cipher's letters for "Colonel" she could figure out the letter the racketeers chose for "e," the most frequently occurring letter in English, based on other brand names of liquor they mentioned in other messages. The "o" and "l" letters in "alcohol," she said, had the same cipher letters as "Colonel." The tactic worked. Morrison and his indicted cohorts were found guilty and sentenced to long stretches in prison."

George C. Marshall Library

One (of Elizebeth's) notebooks contained the message, "I may read your thoughts." "I have discovered that if I may capture a goodly number of your messages even though I have never seen your code book, I may read your thoughts." A penciled notation by Elizebeth Friedman in her code book--1925. George C Marshall Library

Elizebeth Friedman: Producing a Key to Understanding Encrypted Communications

Historical Statement:

Elizebeth Friedman's communication skills as a cryptologist became the key to understanding complex messages exchanged between rumrunners, drug lords, and German Nazis. Her skills changed the course of American history.



Elizebeth Friedman (George C. Marshall)

Center Top Panel Text

Elizebeth Friedman: Producing a Key to Understanding Encrypted Communications

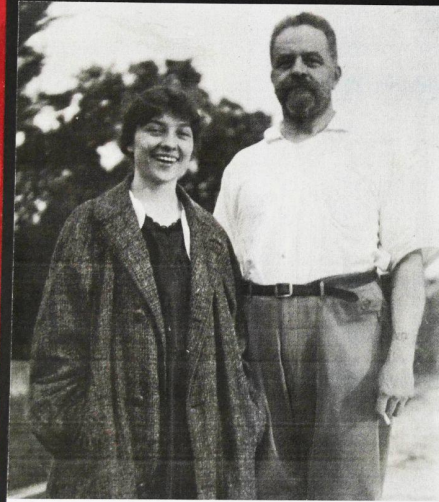
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Center Panel 2

1916

Becoming a Codebreaker



George Fabyan and Elizebeth at Riverbank.
George C. Marshall.

A high school teacher, Elizebeth (Smith) Friedman met George Fabyan, the owner of Riverbank Laboratories when he hired her to find the hidden code he believed proved Francis Bacon wrote William Shakespeare's folios. Much to Fabyan's chagrin, Elizebeth discounted the code. She gained three major pieces of knowledge from Riverbank: her gift of cryptology, supporting arguments with logic, and faith in her decisions.

**Riverbank, near Geneva,
Illinois was an intellectual
"think tank."**

*"Fabyan was interested in such
diverse subjects as plant genetics,
animal husbandry, health, and physical fitness.
Especially during wartime, his patriotism and
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Chicago Gardens: The Early History Cathy Jane Maloney

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Center Panel Three

1916-1921

Challenging Communications

**Cryptology quickly
became a new
crime-fighting tool.**

"As World War I developed, the United States had little cryptographic capacity.

It did, however, have Riverbank, Fabyan, and his colleagues, Elizebeth and William Friedman....The military lacking their own cryptanalysts, turned to the patriotic Fabyan and his Riverbank colleagues....Fabyan and the Friedmans trained the personnel who would staff the newly formed Cipher Bureau within Military Intelligence... Almost eighty officers arrived at Riverbank in October 1917...they endured a six-week crash course on cryptanalysis under the strict tutelage of William Friedman, who had developed a curriculum of pamphlets and worksheets."

Dick Munson, Northwest Quarterly, November 18, 1918.



Elizebeth and William Friedman (George C. Marshall Library.)

**James Fagone in the book
*The Woman Who Smashed
Codes* explained
Friedman's start in
cryptology.**

"The modern-day universe of codes and ciphers began in a cottage on the prairie, with a pair of young lovers smiling at each other across a table and a rich man urging them to be spectacular." The two young lovers were Elizebeth Smith and William Friedman, and the rich man, the eccentric textile tycoon George Fabyan. Elizebeth taught William how to read codes at Riverbank. In later years they worked separately, but did everything together at the beginning."

James Fagone, *The Woman Who Smashed Codes*.

George C Marshall
Library

When World War I threatened, Fabyan named Elizebeth and her new husband, William, directors of his new cryptology unit. The unit deciphered thousands of messages for the Military.

Center Panel Three Text

1916-1921 Challenging Communications

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Center Top



Knowledge Is Power

“On graduation day for the Friedman’s code-breaking cadets...they formed, in fact, a bilateral cipher. Those facing forward represented As while those turned sideways. were the Bs. Reading from left to right, the first five figures symbolized the letter K, and the entired group revealed

Fabyan’s favorite’s axiom from Sir Francis Bacon: “Knowledge is Power.”

Elizebeth and William are in the front row. Photo: Dic Munson, Northwest Quarterly, November 18, 1918.

Northwest
Quarterly
Dic Munson

On January 5, 1921, after leaving Riverbank, the Friedmans joined the Army Signal Corp to develop cipher techniques to counteract the growing use of coded messages between Prohibition criminals.

Center
Bottom
Panel
Text

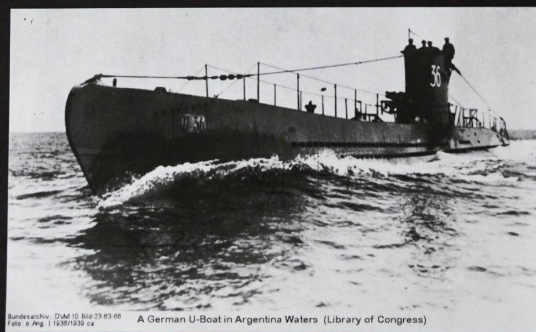
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Right Top Panel

1941

The South America Connection

In 1941, Nazi sympathisers were also using code: to communicate their plan to expand operations into South America. The word, "Sargo" became the key to identifying the operation leader. Elizebeth manipulated his messages. Sargo was arrested and the South American plot destroyed.



Bundesarchiv - DFM 10 Bild 23 63 06
Foto: B. Ang. 1 10/19/1938 ca. A German U-Boat in Argentina Waters (Library of Congress)



German Map, undated, President's Secretary's Files (PSF) Safe Files: Germany Index, Franklin D. Roosevelt Digital Archives.

George C Marshall Library

Top Secret

Document: George C Marshall Library

Elizbeth Friedman, George C. Marshall Library

Elizbeth Friedman with one of her cipher sheets. Brainpickings.com

Right top Panel Text

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Right Middle Panel Text

1941-1946 Top Secret The FBI relied on Elizebeth's team, but after the War, J. Edgar Hoover classified her work as "Top Secret," buried it in government vaults, and took credit for her achievements. It was 50 years before anyone realized Elizebeth's accomplishments.

Elizebeth signed "The pledge,

"that was exacted of all departing from the sacred precincts of secrecy," she said later. "The pledge never to reveal at least without authority from on high, or even to refer to, any of the projects with which I had dealt during WWII." Elizebeth Friedman, George C. Marshall Library

Right Bottom Panel

Conclusion: Today, codes are broken by complicated computer programs, but the basics of cryptology was developed by Elizebeth Friedman who used her skills to eliminate a South American threat to America and convicted dozens of Prohibition-era criminals. Friedman's team preceded the National Security Agency. She created a key to understanding some of the most complex communications in the world.

Elizebeth accepted the slight.
"I went back to the world-at-large once more. It was an end of a Period, an Era. I knew that, as surely as I stood on two feet, I should never return to that particular endeavor again." **Elizebeth Friedman, Memoirs, George C Marshall Library.**

1946-1980

Conclusion:

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Elizebeth Friedman, George C. Marshall Library

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(Elizebeth and William worked together on many projects.
George C. Marshall Library)