Telstar 1: How an Image of the American Flag Changed the World

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Process Paper

For my National History Day project, I created a project on Telstar 1 and depicted its many impacts on modern communications and global relations. This topic fascinated me because I am interested in both radio communications and space-related technology. Before beginning my research, I was unaware that Telstar 1 opened the door to instantaneous global communications through satellite technology. Because of this, I thought it would be interesting to research this topic.

I began my research by reading through some secondary sources on the Telstar 1 satellite. Then, for important quotes and other crucial information I could not gather from secondary sources I consulted primary sources; I used many primary sources to aid in my research including newspaper articles from *The New York Times* that were written around the time of Telstar 1's launch. I also found a photograph of the satellite and a picture of the American flag that was broadcast using Telstar 1 and constituted the first live transoceanic television broadcast. Although he is not a primary source, I concluded my research by interviewing Mr. Michael Simons, the director of the National Electronics Museum in Linthicum, Maryland. He provided me with a detailed overview of the communications the satellite provided as well as the impacts it had on both popular culture and satellite technology.

If I could change something about the way I approached my National History Day project, I would have begun gathering research earlier. I started my research about two and a half weeks before the rough draft of my project was due for my history class. Looking back, I should have started two weeks earlier because I found it difficult to gather all the information and work on a rough draft in such a short period of time.

I decided to write a paper for this project because I feel confident in my ability to write papers and felt that I could best describe Telstar 1's impact using this medium. I struggled to find many photographs relating to Telstar 1, so it would have been difficult for me to create an appealing website, documentary, or exhibit. I have, however, provided a couple important images in the appendix of my paper.

The theme of National History Day this year is communication in history: the key to understanding. My project fits inside this theme because it discusses the revolutionary communications Telstar 1 provided that were a prelude to modern instantaneous long-distance communications that we take for granted today. My project also discusses how this technology has contributed to the betterment of domestic and foreign relations and allows for countries tens of thousands of miles away from each other to communicate with nearly no delay.

Only sixty years ago, the fastest way to send video across the ocean was by airplane.[1] What once took numerous hours was shortened to mere seconds with the launch of the first active communications satellite in 1962. Being the first of its kind, Telstar 1 relayed telephone, telegraph, and television signals across the Atlantic Ocean, connecting the United States and Europe. The satellite marked the beginning of an era of instantaneous long distance communications, and it paved the way for countless other satellites of its kind that, today, carry communications across the globe at all times of the day. The characteristics of the Telstar 1 satellite allowed for ground-breaking communications that impacted modern satellite technology and domestic and foreign relations.

Built by Bell Telephone Laboratories (Bell Labs) for the American Telephone and Telegraph Company (AT&T) and launched by the National Aeronautic and Space Administration (NASA), Telstar 1 first orbited on July 10, 1962.[2] The satellite's purpose was to relay, or receive and retransmit, telephone, television, and telegraph radio signals.[3] Shaped like a sphere with a diameter of less than a meter, Telstar 1 used transistors and solar cells—key ingredients that were only made possible because of previous groundbreaking discoveries and inventions at Bell Labs.[4] Its solar panels were mounted around its circumference and harnessed the energy of the sun to power the satellite. (See Appendix I.) Because Telstar 1 spun on its axis as it orbited, mounting its solar panels in this manner meant that some panels were always in sunlight, unless the entire satellite was hidden in the Earth's shadow.[5]

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[1] "The First Active Orbiting Communications Satellite," *Nokia Bell Labs*, Accessed November 30, 2020, https://www.bell-labs.com/about/history-bell-labs/stories-changed-world/first-active-orbiting-communications-satellite/.
[2] Brian Dunbar, "July 12, 1962: The Day Information Went Global," *NASA*, Accessed November 30, 2020, https://www.nasa.gov/topics/technology/features/telstar.html.
[3] Michael A. Earl, "The Many Firsts of Telstar," *Castor*, Accessed November 30, 2020, http://www.castor2.ca/07_News/headline_071512.html.
[4] "The First Active Orbiting Communications Satellite."
[5] Michael Simons, Personal, October 23, 2020.

The orbit of Telstar 1, featuring a two-hour-and-forty-minute period (how long it takes to complete one orbit), an apogee (maximum height) of 6,000 kilometers, and a perigee (minimum height) of 1,000 kilometers, was set up so the satellite would be in line of sight above the Atlantic Ocean for an extended time.[6] The Andover Earth Station in Maine and the Pleumeur-Bodou Telecom Center in Brittany, France tracked Telstar 1 while it was in line of sight using swiveling microwave antennas.[7] After the launch of Telstar 1, the satellite first came into line of sight of the Andover station on its sixth orbit and remained in line of sight with Andover for fifty-six minutes.[8] During each orbit, Telstar 1 could only relay communications across the Atlantic for twenty minutes.[9]

Telstar 1 was the first *active* communications satellite, meaning it amplified and retransmitted received signals back to Earth.[10] Radio signals become weaker the further they propagate, so Telstar 1 amplified the weak signals it received and retransmitted a signal ten billion times stronger.[11] By the time the signal reached Earth, it was weak once again. Therefore, it was amplified again by the receiving station.[12]

Before the dawn of Telstar 1, television signals were impossible to send across the oceans because they could not bend around the curvature of the Earth.[13] Existing television radio signals were broadcasted in the Very High Frequency (VHF) and the Ultra High Frequency (UHF) ranges.[14] Because VHF and UHF signals travel in straight lines, stations hidden below the horizon could not receive transmitted signals of these frequencies. Though some radio signals

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[6] Earl, "The Many Firsts of Telstar."
[7] Dunbar, "July 12, 1962: The Day Information Went Global."
[8] Richard Witkin, "Live Images Transmitted Across Ocean First Time," *The New York Times*, July 11, 1962, https://timesmachine.nytimes.com/timesmachine/1962/07/11/80409441.html? pageNumber=1 (accessed November 30, 2020).
[9] "The First Active Orbiting Communications Satellite."
[10] Dunbar, "July 12, 1962: The Day Information Went Global."
[11] Witkin, "Live Images Transmitted."
[12] *Ibid.*
[13] *Ibid.*
[14] Earl, "The Many Firsts of Telstar."

can be reflected around the Earth using the Earth's ionosphere, a signal with a VHF or UHF frequency passes straight through the ionosphere and is not reflected.[15] High Frequency (HF) signals can be reflected by the ionosphere, but due to technical limitations, television cannot be broadcast using HF frequencies.

The high demand for telephone and television channels and technical issues with using the ionosphere and transoceanic cables made developing a satellite network the best option for long-distance communications.[16] In the 1960s, there were only 550 different international telephone channels by means of cables.[17] Television signals, however, required the bandwidth of 600 channels, meaning international cable television was impossible with existing infrastructure.[18] Engineers could have developed new cables with more available channels, but it is expensive to run cables that are thousands of miles long across the oceans.[19]

On Telstar 1's seventh orbit around the Earth, the satellite mediated its first phone call.[20] The call took place between AT&T chairman Fred Kappel in Maine and Vice President Lyndon B. Johnson in Washington D.C.[21] This phone call was significant because it was the first time a phone signal was amplified and retransmitted via satellite.[22] Prior to Telstar 1, phone signals could simply be reflected by passive satellites acting as mirrors in the sky, not amplified.[23] These communications were unreliable because of the immense signal losses this incurred.

On July 11, 1962, one day after its launch, the satellite was used to broadcast a television signal across the Atlantic Ocean for the first time.[24] The broadcast included a live image of the

[15] *Ibid.*
[16] Witkin, "Live Images Transmitted."
[17] Rowe Findley, "Telephone a Star," *National Geographic*, May, 1962, https://www.beatriceco.com/bti/porticus/bell/pdf/nat_geo_telstar_ocr.pdf (accessed November 30, 2020).
[18] *Ibid.*
[19] *Ibid.*
[20] Witkin, "Live Images Transmitted."
[21] *Ibid.*
[22] *Ibid.*
[23] Michael Simons, Personal.
[24] Witkin, "Live Images Transmitted."

American flag fluttering in the wind, while the songs "America the Beautiful" and "The Star Spangled Banner" were played in the background.[25] (See Appendix II.) It was received well by the Pleumeur-Bodou Telecom Center in Brittany, France,[26] demonstrating the possibilities of satellite communications and initiating an era of instantaneous global communications.

Other videos, including those of President John F. Kennedy, French singer Yves Montad, and various sports matches, were among the first live videos to be broadcast through Telstar 1.[27] ABC, NBC, and CBS all aired these live television broadcasts, interrupting shows that regularly played at that time.[28] On July 23, 1962, Walter Cronkite with CBS was seen on live television in the United States and Europe. In this broadcast, the Golden Gate Bridge and the Statue of Liberty could each be seen live on the same screen. This was one of the most famous programs to be aired over Telstar 1.[29] The television signal "had remarkable definition and the voices were exceptionally clear."[30]

As Telstar 1 was an experimental satellite, signals broadcast through the satellite could not be received by antennas at people's houses. Instead, signals were received by large antennas at stations in Maine, France, and Great Britain. From these stations, the television signals were sent via cables to people's homes.[31] Satellite television quickly took off after Telstar 1 demonstrated that live intercontinental television was possible. Just five years after the satellite's launch, in 1967, worldwide satellite television was available.[32]

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[25] *Ibid.*
[26] "Satellite in Orbit Beams TV From U.S. to Europe; Pictures Clear in France," *The New York Times*, July 11, 1962, https://timesmachine.nytimes.com/timesmachine/1962/07/11/80409440.html?pageNumber=1 (accessed December 6, 2020).
[27] Dunbar, "July 12, 1962: The Day Information Went Global."
[28] Jack Gould, "TV: Telstar and World Broadcasting," *The New York Times*, July 11, 1962, https://timesmachine.nytimes.com/timesmachine/1962/07/11/80410058.html?pageNumber=71 (accessed November 30, 2020).
[29] Earl, "The Many Firsts of Telstar."
[30] Jack Gould, "TV: Telstar and."
[31] Earl, "The Many Firsts of Telstar.
[32] *Ibid.*

Not only was Telstar 1 used for broadcasting entertainment, but it also performed logistical functions. It was used to synchronize clocks in the United States and England, and proof of this was demonstrated at 1:51:50 P.M. on August 15, 1962.[33] Telstar transceiving stations in Andover and Goonhilly Downs, England recorded synchronous time with an error of ten millionths of a second.[34] Synchronous time is the backbone of all modern communications networks.

In December of 1962, after months of astonishing the world with its capabilities, Telstar 1 indicated it was experiencing problematic levels of radiation.[35] This issue was most likely caused by high levels of radiation in the Earth's Van Allen belts.[36] These belts are naturally composed of radiation created by the Earth's magnetic field and the presence of sunlight, solar winds, and solar flares.[37] As its orbit was located inside these belts, part of Telstar 1's purpose was to collect data on them.[38] However, the satellite was not designed well enough to withstand these enormous levels of radiation, so it malfunctioned and became disabled. Additionally, on July 9, 1962, one day prior to the launch of Telstar 1, the United States military detonated nuclear bombs in the upper regions of Earth's atmosphere, and this operation is believed to be partly responsible for Telstar 1's malfunction.[39] AT&T was able to restore the satellite to functionality, but two months later, on February 21, 1963, Telstar 1 malfunctioned again, and this time, it was damaged beyond repair.[40] Telstar 1, though no longer functional, still orbits Earth today.[41]

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[33] "Telstar Checks Clocks to Millionths of Second," *The New York Times*, August 28, 1962, https://timesmachine.nytimes.com/timesmachine/1962/08/28/90565361.html?pageNumber=13 (accessed November 30, 2020).
[34] *Ibid.*
[35] Earl, "The Many Firsts of Telstar."
[36] *Ibid.*
[37] *Ibid.*
[38] *Ibid.*
[39] *Ibid.*
[40] *Ibid.*
[41] Handelberg, "Telstar: The Satellite That Sent the World into the Information Age."

Telstar 1 has greatly impacted the world. Fifty-eight years ago, President Kennedy said that Telstar 1's international communications, "while only a prelude, already throws open to us the vision of an era of international communication," foreshadowing the multitude of communicative developments that would follow.[42]

On May 7, 1963, Telstar 2 was launched to a higher altitude of 11,000 kilometers. This altitude increased the amount of time the satellite could be used for broadcasting on each orbit and decreased the satellite's exposure to radiation in the Van Allen belts.[43] Since the 1960s, there have been twenty-four iterations of Telstar satellites, the most recent of which is Telstar 19 VANTAGE, launched into space on July 22, 2018.[44] Rather than lasting for a few months like Telstar 1, modern Telstar satellites retain functionality for fifteen to twenty years.[45]

Although Telstar 1 could not communicate world-wide, later satellites were capable of mediating communications between two opposite ends of the globe.[46] On April 6, 1965, the Intelsat 1-F1 satellite, built by the Communications Satellite Corporation, was launched into a geosynchronous orbit around the Earth, meaning that the satellite completes one orbit in exactly one day, so it is in the same general area in the sky at all times.[47] This orbit allowed the Intelsat 1-F1 to be used for communication all the time, and due to its high altitude, the satellite could be used from more locations, as it was in line of sight with more locations on the globe at the same time.[48] In addition, the Syncom 3 satellite made it possible for people in the United States to

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[42] "Joint Effort on Telstar Is Praised by President," *The New York Times*, July 12, 1962, https://timesmachine.nytimes.com/timesmachine/1962/07/12/82054549.html?pageNumber=12 (accessed November 30, 2020).
[43] Earl, "The Many Firsts of Telstar."
[44] Derek Richardson, "Telstar 19V Communications Satellite Orbited by SpaceX Falcon 9," *SpaceFlight Insider*, Accessed November 30, 2020, https://www.spaceflightinsider.com/organizations/space-exploration-technologies/telstar-19v-communications-satellite-orbited-by-spacex-falcon-9/.
[45] Earl, "The Many Firsts of Telstar."
[46] *Ibid*.
[47] *Ibid.*
[48] *Ibid*.

watch the 1964 Tokyo Olympics live.[49] This astonishing feat occurred only two years after Telstar 1 and is a demonstration of the capacity of satellite communication.

Not only did the Telstar 1 satellite influence technology, but it also influenced pop culture. The satellite was well-known in 1962 and was admired by a large portion of the population. Because of this, Telstar 1 inspired the writing of the song "Telstar" by The Tornados in 1962. This was the first and has been the only song containing only instrumentals to rise to the number one position on the weekly song charts in both the United States and the United Kingdom in the same week.[50] The ubiquitous black-and-white soccer ball pattern was also influenced by Telstar 1. This design was introduced in 1962 as the official soccer ball design of the 1962 World Cup in Mexico. Prior to this World Cup, soccer balls were generally all brown.[51] The black-and-white pattern was intended to mimic the appearance of Telstar 1: the black pieces scattered in a white background resembled the solar panels scattered on the satellite's white background.[52]

The development and use of Telstar 1 required a great deal of cooperation and contributed to the betterment of global relations. Within the United States, the satellite heralded much cooperation between private American corporations and a government agency.[53] Being an endeavor of AT&T but contracted out to Bell Labs and ultimately launched by NASA, multiple American companies as well as NASA came together in a joint effort to revolutionize communications and establish a society that would later depend on this advanced technology. Furthermore, the Telstar 1 mission was the first mission to be sponsored by a private company

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[49] "How Did Satellite Technology Take Off?" *Carnegie Technologies*, Accessed November 30, 2020, https://www.carnegietechnologies.com/news-updates/how-did-satellite-technology-take-off/.
[50] *Ibid.*
[51] Michael Simons, Personal.
[52] *Ibid.*
[53] "Joint Effort on."

and launched into space by NASA,[54] and it paved the way for future private space ventures, such as SpaceX today.[55]

On an international scale, because of the difficulty for two nations to communicate via satellite television, cooperation was key.[56] For world-wide television to exist, broadcasting industries of participating countries must have developed close relations and must have cooperated extensively.[57] International television broadcasting via Telstar 1 was difficult because of the time differences across time zones, especially since the satellite must have been in line of sight of both the transmitting and receiving stations for international broadcasting to work, and because of the immense differences in the technological standards between the nations, the immense power required to send signals, and the differences in available radio frequencies in those nations.[58] This required cooperation led to the development of good relations between American broadcasting corporations and the European Broadcasting Union.[59] President Kennedy commended the work done on Telstar 1 and the cooperation it required.[60]

In addition to furthering cooperation, Telstar 1 also led to the betterment of global relations. As President Kennedy said at a press conference that was being simultaneously broadcasted across the Atlantic through Telstar 1, international satellite communication "is bound to increase the well-being and security of all people—here and those across the oceans."[61] Furthermore he said, "we must grasp the advantages presented to us by the communications satellite to use this medium wisely and effectively to ensure greater understanding among the

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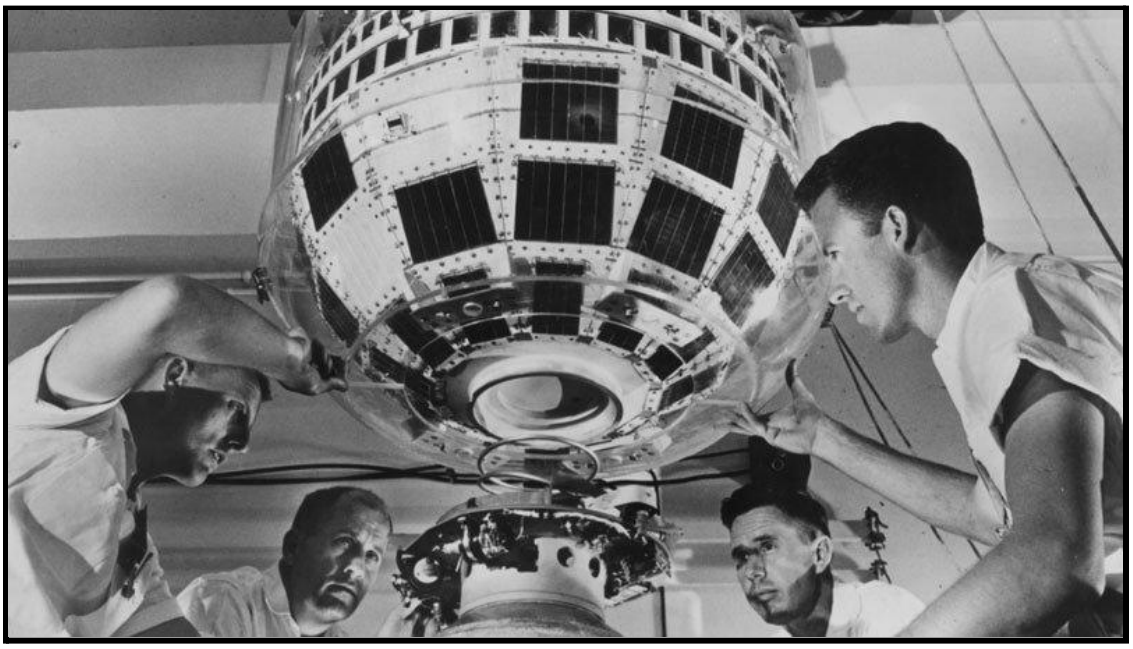
[54] Dunbar, "July 12, 1962: The Day Information Went Global."
[55] Handelberg, "Telstar: The Satellite That Sent the World into the Information Age."
[56] Jack Gould, "TV: Telstar and."
[57] *Ibid.*
[58] *Ibid.*
[59] *Ibid.*
[60] "Joint Effort on."
[61] Dunbar, "July 12, 1962: The Day Information Went Global."

peoples of the world."[62] There is no doubt that this technology has benefited global relations: it has allowed for instant communication as well as the timely broadcasting of news from around the world.

Telstar 1 revolutionized communications, greatly impacted satellite technology, and contributed to the betterment of cooperation, both within and outside of the United States. Live transoceanic television, while at one point, deemed impossible, was made possible by the yoga ball-sized satellite and was soon expanded by a network of more advanced satellites. Aside from technological advances, it birthed an era of domestic and foreign relations. Satellite technology changed our perception of the world and continues to impact our daily lives today. None of this would have been possible without Telstar 1's revolutionary feat.

[62] "Joint Effort on."

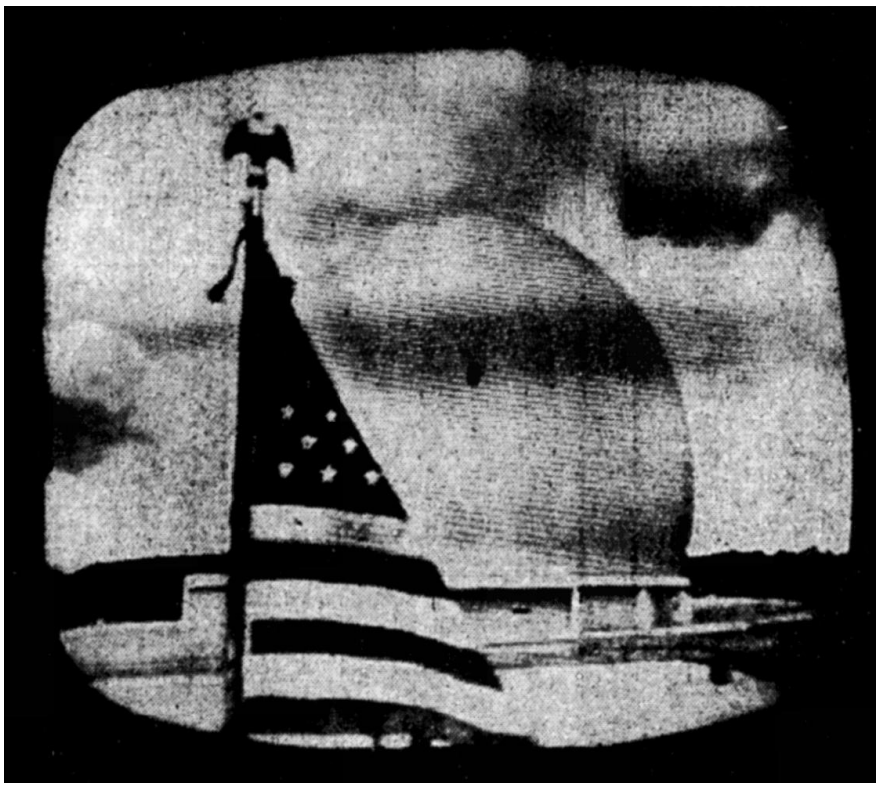
Appendix I



This image shows the mounting of the Telstar 1 satellite on the rocket that launched it into orbit. The satellite was ball-shaped and had its solar panels mounted around its exterior. Mounting the solar panels all the way around the satellite like this ensured that some solar panels would always be facing the sun.

"The First Active Orbiting Communications Satellite," *Nokia Bell Labs*, Accessed November 30, 2020, https://www.bell-labs.com/about/history-bell-labs/stories-changed-world/first-active-orbiting-communications-satellite/.

Appendix II



This is an image of the first live broadcast through Telstar 1. The American flag is shown fluttering in the wind with the Andover Earth Station in Maine shown in the background. "The Star Spangled Banner" could be heard during this broadcast as well. This broadcast was received with great excitement in France.

"Satellite in Orbit Beams TV From U.S. to Europe; Pictures Clear in France." *The New York Times*. July 11, 1962. https://timesmachine.nytimes.com/timesmachine/1962/07/11/80409440.html?pageNumber=1 (accessed December 6, 2020).

Annotated Bibliography

Primary Sources

Gould, Jack. "TV: Telstar and World Broadcasting." *The New York Times*. July 11, 1962. https://timesmachine.nytimes.com/timesmachine/1962/07/11/80410058.html?pageNumber=71 (accessed November 30, 2020).

From this newspaper article, I learned about the first communications provided by Telstar 1. This article was published one day after Telstar 1's launch. This source also discussed the difficulties of international communication because of differing time zones, differing technological standards, and differing availability of radio frequencies.

"Joint Effort on Telstar Is Praised by President." *The New York Times*. July 12, 1962. https://timesmachine.nytimes.com/timesmachine/1962/07/12/82054549.html?pageNumber=12 (accessed November 30, 2020).

This newspaper article from *The New York Times* was useful because it discussed President John F. Kennedy's view on the immense cooperation Telstar 1's development and utilization required. This source provided me with information on this cooperation as well as a quote by President Kennedy about how satellite communications benefit foreign relations.

"Satellite in Orbit Beams TV From U.S. to Europe; Pictures Clear in France." *The New York Times*. July 11, 1962. https://timesmachine.nytimes.com/timesmachine/1962/07/11/80409440.html?pageNumber=1 (accessed December 6, 2020).

This source provided the picture of the American flag that can be seen in Appendix II. This is a very important image, but it was not in any of my other primary sources. From this source, I learned that this image was received well in France.

"Telstar Checks Clocks to Millionths of Second." *The New York Times*. August 28, 1962. https://timesmachine.nytimes.com/timesmachine/1962/08/28/90565361.html?pageNumber=13 (accessed November 30, 2020).

This newspaper article from *The New York Times* includes the only information on one of Telstar 1's lesser-known feats: synchronizing clocks across the ocean with a time error of ten microseconds. Therefore, this article aided in my understanding of Telstar 1's purpose and capabilities.

Witkin, Richard. "Live Images Transmitted Across Ocean First Time." *The New York Times*. July 11, 1962. https://timesmachine.nytimes.com/timesmachine/1962/07/11/80409441.html?pageNumber=1 (accessed November 30, 2020).

This newspaper article from *The New York Times* discusses the communications Telstar 1 provided as well as facts about the satellite's orbit. From this source, I also learned about the transmitting and receiving stations in Maine, England, and France and the reason behind why Telstar 1 was an active satellite.

Secondary Sources

Dunbar, Brian. "July 12, 1962: The Day Information Went Global." *NASA*. January 30, 2018. https://www.nasa.gov/topics/technology/features/telstar.html.

This source provided an overview of different aspects of Telstar 1. It discussed the development, technical aspects, and launch of the satellite as well as its first broadcasts, including the live broadcast of the American flag. I also learned about Telstar 1's purpose of studying the Van Allen radiation belts. Finally, from this source, I obtained a quote by President Kennedy about the satellite's role in the development of good international relations.

Earl, Michael A. "The Many Firsts of Telstar." *Castor*. July 18, 2012. http://www.castor2.ca/07_News/headline_071512.html.

From this source, I learned about the communications Telstar 1 provided, technical facts about the satellite, and the radiation problems it encountered in the Van Allen belts. This source also discussed later Telstar satellites as well as more advanced communication satellites that arose after Telstar 1.

Findley, Rowe. "Telephone a Star." *National Geographic*. May, 1962. https://www.beatriceco.com/bti/porticus/bell/pdf/nat_geo_telstar_ocr.pdf (accessed November 30, 2020).

This article, published in *National Geographic* in May, 1962, discussed why creating a network of satellites was necessary for transoceanic television. I learned that using underwater cables or the ionosphere each introduced issues for developing a global television network.

"The First Active Orbiting Communications Satellite." *Nokia Bell Labs*. Accessed November 30, 2020. https://www.bell-labs.com/about/history-bell-labs/stories-changed-world/first-active-orbiting-communications-satellite/.

This webpage, located on the Bell Labs website, describes how long Telstar 1 could be used for communications on each orbit. It also informed me that Bell Labs invented transistors and solar cells, both of which were used by Telstar 1. Finally, from this source, I learned that the satellite led the way to other satellites that could be used for longer-distance communications.

Handelberg, Kristian. "Telstar: The Satellite That Sent the World into the Information Age." *Medium*. October 30, 2018. https://medium.com/@ksevt/telstar-the-satellite-that-sent-the-world-into-the-information-age-acdefa121671.

This webpage taught me about Telstar 1's impact on corporate cooperation in the United States and its impact on popular culture. I also learned that, even though the satellite no longer functions, it is still in orbit around the Earth.

"How Did Satellite Technology Take Off?" *Carnegie Technologies*. Accessed November 30, 2020. https://www.carnegietechnologies.com/news-updates/how-did-satellite-technology-take-off/.

This source discussed many uses of satellite communications. In particular it taught me about the Syncom 3 satellite, which allowed people in the United States to watch the 1964 Tokyo Olympics live. This source also included information about non-technological impacts Telstar 1 had on the world, such as on the writing of the song "Telstar" by The Tornados.

Richardson, Derek. "Telstar 19V Communications Satellite Orbited by SpaceX Falcon 9." *SpaceFlight Insider*. July 22, 2018. https://www.spaceflightinsider.com/organizations/space-exploration-technologies/telstar-19v-communications-satellite-orbited-by-spacex-falcon-9/.

This source discussed the most recent iteration of Telstar satellites: the Telstar 19 VANTAGE. I used this source so I could write about how, after nearly sixty years, Telstar satellites continue to be developed and launched.

Simons, Michael. Personal, October 23, 2020.

I interviewed Michael Simons, the director of the National Electronics Museum in Linthicum Maryland. He researched Telstar 1 and gave me a detailed overview of the communications the satellite provided as well as the impacts it had on both popular culture and satellite technology. Specifically, I learned about how the official soccer ball of the 1962 World Cup was influenced by Telstar 1 and the reasoning behind the positioning of the satellite's solar panels.