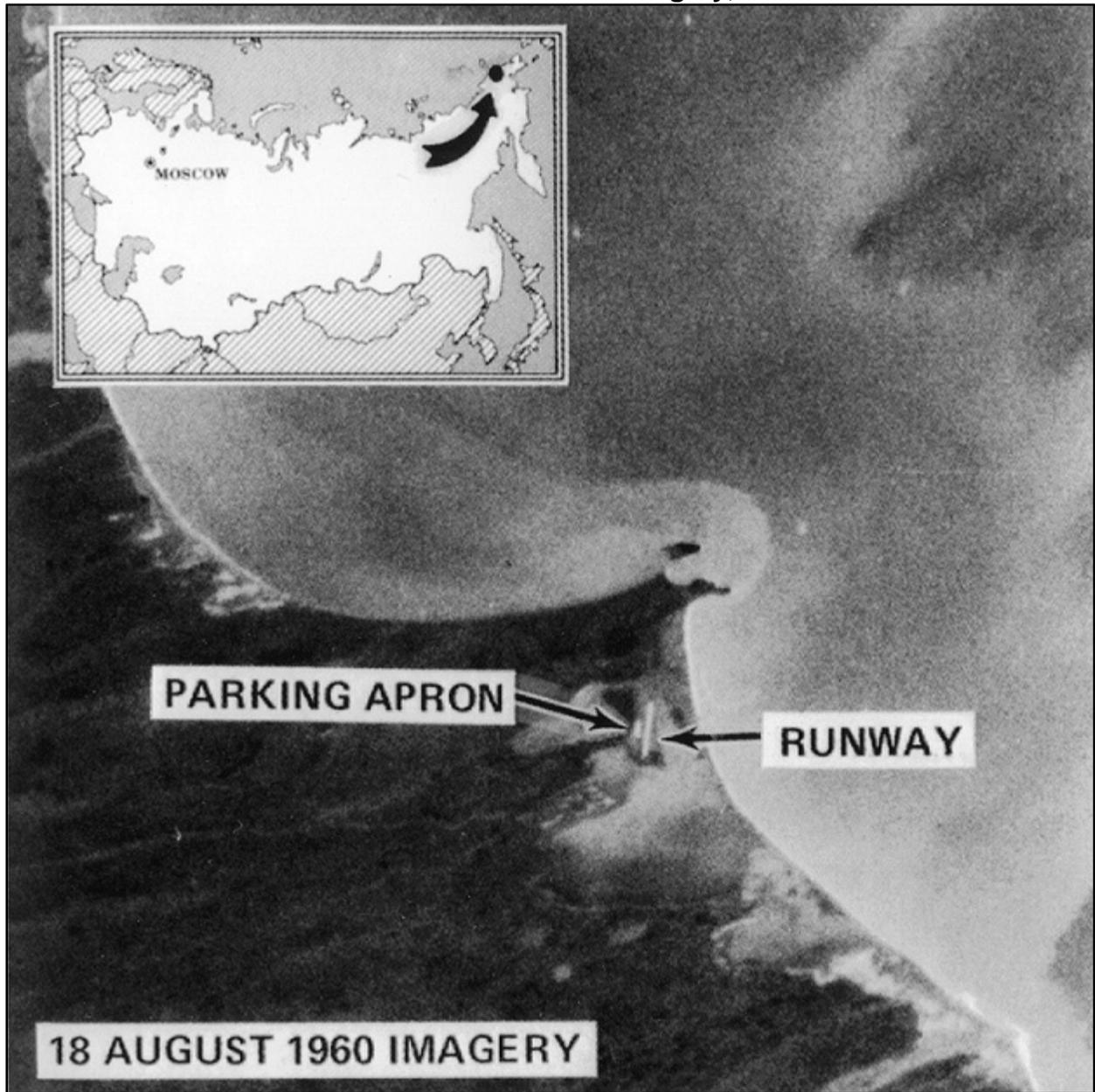


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Photo 4: Corona Satellite Imagery, 1960



(NRO, <http://www.nro.gov/corona/imagery.html>)

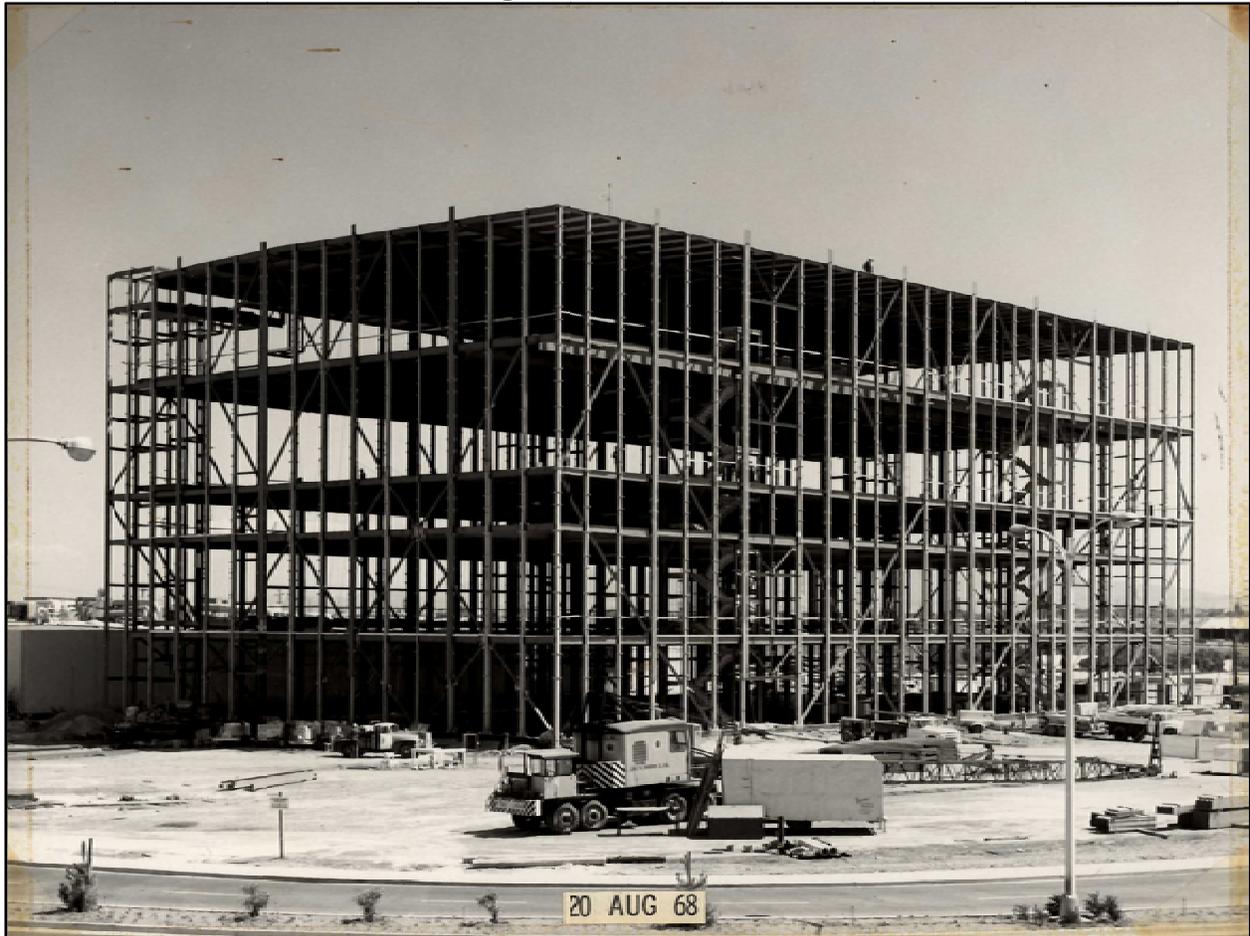
This photograph was taken by a Corona satellite (also known as Discoverer XIV) in August 1960.

Questions for Photo 4:

1. Please identify the subject of this photograph and how it was taken.
2. Refer back to Reading Number 2. What happened to the film following retrieval from space?

3. Refer back to Reading Number 2, how much film was returned from the first successful Corona mission in August 1960? How many pages of text were written to describe the images received?
4. Describe some differences between the 1960 aerial image provided by the Corona Program, and aerial images today.

Photo 5: Building 1003 Under Construction, 1968



(Onizuka AFS)

Questions for Photo 5:

1. How many stories does Building 1003 feature? Identify the location of the mezzanine. If necessary, refer to Reading 3.
2. How many flights of stairs are located between the third and fourth stories of the building? Why are there so many flights of stairs? If necessary, refer to Reading 3.
3. Why was this building constructed, and what are some of the activities that occurred in this building? Refer back to Reading 3 if necessary.

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Photo 6: Satellite Scheduling



(Source: Onizuka AFS)

Despite the fact that the satellites themselves involved cutting-edge technology, the method of tracking them was far less technologically advanced. In 1959, the US Air Force Satellite Test Center in Sunnyvale was established to support the Corona Program. Since that time, numerous satellite programs have been developed and were supported from the US Air Force Satellite Test Center. During the closing ceremony at Onizuka AFS in June 2010, Lieutenant General John Sheridan remarked that the “facility here in Sunnyvale has supported an amazing 3.4 million satellite operations over the past years¹.”

Prior to the 1990s, all satellite scheduling was plotted by hand, using colored tape to represent different spacecraft on approximately 50 foot long rolls of butcher-paper. The satellite controllers would be in contact with the various tracking stations who would alert the controllers of the satellites position by telephone, and changes in location would be indicated on the butcher-paper by re-locating pieces of tape.

The early 1990s also represented a key year for satellite scheduling, with the advent of a computerized scheduling system.

¹ Bauer, Senior Airman Steve. July 29, 2010. "Onizuka AFS Closes, Operations Move to Vandenberg." Available at: <http://www.vandenberg.af.mil/news/story.asp?id=123215531>

Questions for Photo 6:

1. What do the numbers in the photograph represent? If necessary, refer to Reading Number 2.
2. Do you think the job of the schedulers would be stressful? Why, or why not?

Putting it all Together

In this lesson, students learned about the development of reconnaissance satellites during the Cold War, and the integral role Onizuka Air Force Station (AFS) played in supporting the satellites. Activities 1-3 will help students apply what they have learned. In addition, Activity 4 provides a simplified overview of Section 106 of the National Historic Preservation Act (NHPA) which will help students understand why this lesson plan was created.

Activity 1: Oral Histories

Have students interview their relatives or community members who remember Onizuka Air Force Station (AFS) from its inception throughout the Cold War. Suggested questions could include:

- Were they aware of the activities that took place at Onizuka AFS?
- What did they think occurred at Onizuka AFS?
- Did they know that reconnaissance satellites were supported from Onizuka AFS?
- Did they know that the Space Shuttle was supported from Onizuka AFS?
- Did they, or do they know anyone who worked at Onizuka AFS?
- Did they ever visit Onizuka AFS?

After the interviews are completed, have students discuss them in class. Students should consider donating the oral histories to a local library or historical society to preserve them for future generations.

Activity 2: Evolution of Satellite Imagery

Have students review Photograph 4, which is a satellite image from the first successful Corona mission in 1960 that shows Mys Shmidta Air Field in the Soviet Union. In addition, have students review other satellite images taken from Corona satellites that are available online at the following website: <http://www.nro.gov/corona/imagery.html>.

Compare the early photographs taken during the 1960s with satellite photographs available today by going online and using Google Maps or Google Earth. Ask the students to try to find locations by searching large areas, rather than by typing in exact addresses, to simulate how Corona photo analyzers would have had to view and interpret satellite images. Suggested locations to have students try to find include:

- Air field in Mys Shmidta, Russia (Depicted in photographs taken by the first Corona satellite)
- Pentagon in Washington, DC
- Onizuka AFS
- Their house
- Identify locations of airports in the United States or other countries by scanning the satellite imagery for indications of aircraft activity, such as runways, planes, and control towers.

How easy or difficult is it to find locations without typing in an exact address or location? In general, describe the differences between the 1960s-era satellite photographs and today's satellite photographs. Have students discuss their findings with the class. Students may also print out past and present images, and create a display which compares the historic and current satellite images.

Activity 3: Satellites Today

Corona satellites were the first satellites to return images from space in 1960, and provided thousands of images of the Soviet Union and other communist countries throughout the Cold War. Between 1960 and today, satellite technology has evolved considerably, and is now commonly used for multiple applications. Divide the students into groups and discuss some of the ways in which satellites are used today. Suggested uses include weather forecasting, GPS units for cars, television, radio, communications, and military applications, among others. After the class has established a list of satellites, divide the list among the groups, and have each group research the history of selected satellites. Some questions to assist in research efforts include:

- Who was responsible for development of the satellite?
- What was the satellite used for?
- What year was it first developed?
- What year was it first launched into space?
- Is the satellite currently in space?
- Was the satellite supported from Onizuka AFS?

Have each group of students prepare a brief PowerPoint presentation with photographs or create a poster. The presentation should include a brief history and images of the satellite.

Activity 4: Understanding Section 106

Section 106 of the National Historic Preservation Act (NHPA) requires federal agencies to take into account the effects that their federally funded activities have on historic resources that are included in, or eligible for, the National Register of Historic Places. The Simplified Section 106 Flow Chart on the following page provides an overview of the key elements of the Section 106 process to review with the class. For additional information on Section 106, please consult the website of the Advisory Council on Historic Preservation, overseers of the process at: <http://www.achp.gov/work106.html>.

Following review of the flow chart, there are two brief readings about Onizuka Air Force Station (AFS). Review the readings with the students, and then divide them into groups to answer the questions and discuss as a class how Section 106 applies to Onizuka AFS.

Simplified Section 106 Flow Chart

Establish if there is an **Undertaking**

An **undertaking** is defined as a project, activity, or program funded in whole, or in part under the direct or indirect jurisdiction of a Federal agency.



Identify **Historic Properties**

Historic properties are defined as prehistoric or historic districts, sites, buildings, structures, or objects included in, or eligible for inclusion in the National Register of Historic Places.



Assess **Adverse Effects**

An **adverse effect** is found when an undertaking may alter, directly, or indirectly, any of the characteristics of a historic property that may qualify it for inclusion in the National Register of Historic Places. Examples of adverse effects include:

- Physical destruction of or damage to all or part of the property.
- Alteration to all or part of a property that is not consistent with the Secretary of the Interior's Standards for Treatment of Historic Properties.
- Removal of a property from its historic location.
- Change of the character of a property's use or physical features within the property's setting that contribute to its historic significance.
- Introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features.
- Neglect of a property that leads to its deterioration.
- Transfer, lease, or sale of a property out of Federal ownership or control.



Consult to Resolve Adverse Effects



Develop **Memorandum of Agreement**

A **memorandum of agreement** is the document that records the terms and conditions agreed upon to resolve the adverse effects of an undertaking on historic properties.

Application of Section 106 for Onizuka AFS: Part 1

In 2005, Onizuka AFS was selected for closure in accordance with the federal Defense Base Closure and Realignment Act (DBCRA) of 1990, commonly known as Base Realignment and Closure (BRAC). In 2009, the Air Force Center for Engineering and the Environment (AFCEE) and the California State Historic Preservation Office (SHPO) concurred that the US Air Force Satellite Test Center Historic District is eligible for listing in the National Register of Historic Places under Criterion A and Criteria Consideration G for its national, state, and local significance as a satellite reconnaissance facility associated with crucial intelligence-gathering activities during the Cold War. Buildings 1001, 1002, 1003, 1004, 10031, and 10032 contribute to the district. The installation was transferred out of federal hands in 2011.

Questions:

1. Identify the undertaking.
2. Does the undertaking have the potential to cause effects?
3. What historic property might be affected by the undertaking?
4. Do you think there would be an adverse effect?

Application of Section 106 for Onizuka AFS: Part 2

In 2010, AFCEE and the California SHPO concurred that the transfer of the installation out of federal hands constitutes an adverse effect to the district. As a result, AFCEE and the SHPO initiated consultation to determine how to resolve the adverse effects to the district. Although the buildings would not be preserved, it was agreed their history should be recorded. Therefore, a Historic American Building Survey (HABS) Level II-type documentation report was prepared to document the district. This type of report includes a description of the physical features of the buildings, history of the buildings as they relate to the surrounding area, copies of original plans of the buildings, and photographs of the interior and exterior of the buildings. The report is on file at the California SHPO in Sacramento, and is available for review upon request.

In addition, this lesson plan was also prepared to ensure that the history of Onizuka AFS is taught in the Sunnyvale school system. The lesson plan is based upon information included in the HABS Level II-type documentation. In addition, it is anticipated that the Department of Veterans Affairs (VA) will occupy Building 1002, and will develop a display that highlights the history of Onizuka AFS. This will further ensure that the history of the installation is preserved and publicized.

Questions for Discussion

Do you think the report, lesson plan, and display are appropriate ways to resolve adverse effects?

Can you think of anything else that could have been done to resolve adverse effects?

Supplementary Information

By studying the US Air Force Satellite Test Center, students learn about the Cold War, and the vital role played by reconnaissance satellites and Onizuka Air Force Station (AFS) during the conflict. The following list of websites provide additional research materials and information associated with the Cold War, reconnaissance satellites, and other programs supported at Onizuka AFS, such as the Space Shuttle Program.

National Reconnaissance Office (<http://www.nro.gov/corona/facts.html>)

The National Reconnaissance Office (NRO) maintains a website about the Corona Program which offers a history of the program and images taken by Corona satellites.

Central Intelligence Agency (<https://www.cia.gov/library/center-for-the-study-of-intelligence/csi-publications/csi-studies/studies/96unclass/corona.htm>)

The Central Intelligence Agency (CIA) maintains a website which offers information about the Corona Program, including articles and images about the program.

The National Security Archive (<http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB54/>)

The National Security Archive maintains a website that offers articles and copies of primary government documents relating to Cold War reconnaissance efforts, including the Corona Program. The website offers students the opportunity to review documents with redacted sections that remain classified.

The Cold War Files (<http://www.wilsoncenter.org/coldwarfiles/index.cfm?fuseaction=home.flash>)

The Cold War International Historic Project established this interactive website that offers information about the Cold War, geared toward high school students.

The Soviet Archives Exhibit (<http://www.ibiblio.org/expo/soviet.exhibit/entrance.html>)

The Library of Congress maintains this website that offers information about Soviet-American relationships during the Cold War, and also provides primary Soviet documents.

National Air and Space Administration (http://www.nasa.gov/mission_pages/shuttle/main/index.html)

National Air and Space Administrations' (NASA) website offers historical and current information on the Space Shuttle Program.

Cold War Museum (<http://www.coldwar.org/>)

The Cold War Museum provides a timeline of information about the Cold War, including the Corona Program.

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Answers for Teachers

Locating the Site

Map 1: Northern California

1. Locate Sunnyvale and describe its location within the state of California.

Answer: Sunnyvale is located southeast of the city of San Francisco in Santa Clara County.

2. Locate Onizuka AFS and surrounding industries and businesses.

Answer: Onizuka AFS is located in Sunnyvale, California, in the vicinity of Moffett Air Field and Lockheed Missiles and Space Division, and east of Stanford University.

3. Why do you think that it would be beneficial for the US Air Force Satellite Test Center to be located near Lockheed Missiles and Space Division and Stanford University?

Answer: Onizuka AFS was constructed to serve as the command and control center for the Corona Program. The US Air Force and CIA worked closely with Lockheed Missiles and Space Division to develop the Corona Program, therefore, the close proximity was beneficial. In addition, proximity to Stanford University could have been beneficial because its graduates could have potentially provided a highly-skilled civilian (or even military) workforce.

Map 2: US Air Force Satellite Test Center Historic District

1. Locate the historic district, how many buildings does it include?

Answer: The district includes eight buildings, six of which are considered contributing.

2. Why do you think some buildings might not contribute to the district?

Answer: The non-contributing buildings are minor support buildings and didn't play significant role in satellite support throughout the Cold War.

Determining the Facts: Readings

Reading 1: Beginnings of the Cold War and Development of Satellite Reconnaissance Systems

1. Why do you think U-2 reconnaissance missions were dangerous? What are the advantages to having un-manned satellite reconnaissance missions?

Answer: The U-2 aircraft flew at a high altitude, which in and of itself, presented dangers to pilots. In addition, the Soviet's could potentially track and take down a U-2 aircraft with missiles.

2. Why did the launch of *Sputnik I* change the way the US Air Force viewed its own satellite programs?

Answer: The launch of *Sputnik I* by the Soviet Union made the United States realize that their capabilities were lagging behind. In addition, it was feared that if the Soviets could launch a satellite into space, they might also be able to launch a nuclear missile attack at the United States. Therefore, it became a necessity for the United States to launch a satellite into space to demonstrate to the Soviets and the American public that the United States also had that capability. In addition, the United States realized they also needed to develop reconnaissance satellites in order to gauge the Soviet's weapons capabilities.

3. Why do you think it might have been better to send film back down to earth to be developed and analyzed, rather than transit from space via television scans, during the time the Corona Program was developed in the 1960s?

Answer: Satellite technology was in its infancy in the 1960s, and film images generally offered a greater resolution than those transmitted via television scan.

4. What kinds of private contractors were involved with development of the Corona Program? Why do you think the military used private contractors rather than government employees to assist in the development of these programs?

Answer: Private contractors who helped develop the Corona Program included Lockheed Missiles and Space Division, who developed the spacecraft that launched and housed the satellite; Fairchild Camera Company, and later Itek Corporation, who developed the cameras; and Eastman Kodak, who developed the film. As satellites continued to evolve, additional private contractors were likely hired by the US Air Force to carry out this mission. Using private contractors provided the US Air Force and other US military organizations with greater intellectual and financial capacity to research and develop new technologies.

5. What was the Corona Program's cover story? Why do you think the decision was made to classify the Corona Program? Do you think such a cover story would be effective?

Answer: The Discoverer Program was created as a cover-story for the Corona Program, and was identified as a scientific research program, with the goal of sending monkeys, and later humans, into space. The US Air Force and CIA were aware that it would be impossible to conceal the actual launch of a satellite from the public. However, the true purpose of the satellites could be concealed. Having created a cover story, the US Air Force could continue to research, develop, and ultimately successfully launch and retrieve photographic images from the Corona satellites without the general public or Soviet's being aware of the United States' actual capabilities.

Reading 2: Development of the US Air Force Satellite Test Center and the First Successful Corona Missions

1. Who did the US Air Force acquire the land from to construct the STC, and how much did land acquisition cost? Why do you think it cost what it did?

Answer: The US Air Force acquired the land from Lockheed Martin Aircraft Corporation at a cost of one dollar. The land was part of the Lockheed Missiles and Space Division Complex, a subsidiary of Lockheed Aircraft Corporation. Lockheed Missiles and Space Division was a prime US Air Force contractor that developed spacecraft associated with satellite programs, including the Corona Program. In addition Lockheed contractors worked in tandem with US Air Force and CIA personnel

to support the Corona Program. It would be mutually beneficial for Lockheed Missiles and Space Division and the US Air Force Satellite Test Center to be in close proximity to one another. The cost was likely so inexpensive because Lockheed Missiles and Space Division recognized that they would benefit financially from their contracts with the US Air Force rather than the sale of land.

2. Why do you think the US Air Force designed Building 1001 without windows?

Answer: Building 1001 housed the command and control center for the Corona Program, a classified reconnaissance satellite program. Therefore, it is likely that the US Air Force opted to design the building without windows to eliminate visibility of their operations, and to provide a greater level of security to the building.

3. Describe the steps taken to launch and retrieve the Corona satellites.

Answer: The satellites were launched from Vandenberg AFB, and the launch and subsequent orbit, was supported from the STC in conjunction with tracking stations. Upon receipt of the eject command, the spacecraft released the SRV, which contained the camera and film, and began its descent to earth. At approximately 50,000 feet from earth, the SRV's parachute would open. At this point, the 6594th Recovery Control Group would attempt to retrieve the SRV in the air utilizing a C-119 *Flying Boxcar* equipped with grappling hooks.

4. Explain the perceived missile gap, and how images taken by Corona satellites changed perceptions regarding it.

Answer: Following the launch of *Sputnik I* in 1957, the United States feared that the Soviet Union had an immense stockpile of ICBMs, and that the threat of attack was imminent. However, images taken from Corona satellites proved that this was not true, and the United States was able to gauge the actual capacity of the Soviet Union, and plan accordingly.

5. Why do you think the crew was unaware of the true nature of what they recovered?

Answer: Due to the classified status of the Corona Program, the US Air Force and CIA limited the number of personnel aware of its true mission, to cut down on the chances of leaking information.

6. Explain why the DoD classified all military space launches in 1962.

Answer: DoD realized that to classify some programs, while releasing information about the others, would simply serve to highlight the classified programs. In addition, so much information was available and reported on that the Soviet Union was able to obtain a reasonably clear understanding of US satellite capabilities, despite not necessarily having information about specific systems. Therefore, the US Air Force opted to classify all programs.

Reading 3: Development of Building 1003 and its Role in the Space Shuttle Program

1. What are some features that made Building 1003 unique?

Answer: Building 1003 was 104 feet high, and only featured four stories, each of which were approximately 25 feet high to house the necessary equipment to maintain satellite operations. Similar

to Building 1001, Building 1003 did not have any windows, which illustrates the classified nature of the operations it housed.

2. Why was Building 1003 originally constructed, and what purpose did it serve?

Answer: Building 1003 was constructed to support the MOL Program, although the program was cancelled for financial reasons while the building was still under construction. Following construction, the building housed MCCs and supported multiple classified satellite programs in conjunction with Building 1001. In addition, in the 1980s, Building 1003 provided support for the Space Shuttle Program.

3. The Space Shuttle first carried a military payload in 1982, and the first dedicated military space shuttle flight occurred in 1985. What was the difference between these two shuttle flights?

Answer: The first flight to carry a military payload in 1982 also served other functions, whereas in 1985, the shuttle was launched specifically to convey a classified military satellite into space. Newspapers speculated that it was a communications satellite.

4. Why was Building 1004 constructed, and why was its function so important to the installation?

Answer: Building 1004 was constructed to serve as the power plant for the installation. The STC served as the command and control center for all US Air Force satellites, including classified reconnaissance satellites during the Cold War. A constant and reliable source of power was critical to ensure that equipment needed to support satellites remained operational.

5. Why was the installation re-named Onizuka AFS in the 1980s?

Answer: The installation was re-named Onizuka AFS to honor Space Shuttle *Challenger* astronaut Lieutenant Colonel Ellison S. Onizuka. Onizuka was killed along with the crew of the Space Shuttle *Challenger* when the shuttle exploded after launch in 1986. Onizuka served in the US Air Force from 1970 until his death in 1986, trained at the installation, and was involved with multiple shuttle missions. Therefore, the US Air Force opted to rename Sunnyvale AFS in his honor.

Visual Evidence: Images

Photo 1: Building 1001, 1959 and Photo 2: Onizuka Air Force Station, 2000s

1. How would you describe the original appearance of Building 1001 and the surrounding area?

Answer: The building is in its final stages of construction, and features concrete walls with no windows. It is surrounded by undeveloped land, parking lots, and at least two buildings associated with Lockheed Missiles and Space Division are visible.

2. Based on Reading Numbers 1 and 2, what activities happened in Building 1001?

Answer: Building 1001 was constructed to serve as the command and control center for the Corona Program. As new satellite programs were developed, they were also supported from the building.

3. How would you feel working in a windowless building like this? Why would you feel this way?

Answer: There is no incorrect answer to this question.

4. What are some of the changes that have taken place between the original 1959 photo and the 2006 photo?

Answer: Multiple buildings have been constructed at the installation, many of which obscure Building 1001, leaving only the roof somewhat visible in the aerial photo. The surrounding area also appears to have been considerably more developed.

Photo 3: US Air Force Fairchild C-119 *Flying Boxcar*, 1960

1. Describe what is happening in this photograph. If necessary, refer back to Reading 2.

Answer: A US Air Force Fairchild C-119 *Flying Boxcar* has captured a Corona SRV returning from space. The SRV is attached to a parachute, and the plane has caught it with a grappling hook. The SRV likely contains film that was taken of the Soviet Union from space.

2. How many people would likely have been on board the C-119 *Flying Boxcar*, and what were their roles? If necessary, refer back to Reading 2.

Answer: It is likely that between 8-10 people would have been on board the aircraft, including the pilot, co-pilot, navigator, winch operator, flight engineer, load master, and additional airmen.

Photo 4: Corona Satellite Imagery, 1960

1. Please identify the subject of this photograph and how it was taken.

Answer: This is a satellite photograph of an airfield in the Soviet Union. It was taken by a Corona satellite in 1960.

2. Refer back to Reading Number 2. What happened to the film following retrieval from space?

Answer: The film was developed and analyzed by photo interpreters.

3. Refer back to Reading Number 2, how much film was returned from the first successful Corona mission in August 1960? How many pages of text were written to describe the images received?

Answer: The first successful mission returned 20 pounds of film which documented over 1,650,000 square miles of the Soviet Union. Photo analyzers prepared approximately 130 pages of text explaining the images.

4. Describe some differences between the 1960 aerial image provided by the Corona Program, and aerial images today.

Answer: Satellite technology continues to improve, and provides higher-quality, color images. In addition, originally aerial photographs from satellite technology were classified and were only seen by top-level military, civilian, and government personnel. Today however, satellite aerial imagery is commonplace, and is freely available on the internet.

Photo 5: Building 1003 Under Construction, 1968

1. How many stories does Building 1003 feature? Identify the location of the mezzanine. If necessary, refer to Reading 3.

Answer: Building 1003 featured four stories, and also included a mezzanine between the second and third stories. In the photograph, the mezzanine is apparent because the space between the floor and ceiling is considerably less than in the other four stories.

2. How many flights of stairs are located between the third and fourth stories of the building? Why are there so many flights of stairs? If necessary, refer to Reading 3.

Answer: The photograph indicates that there are three flights of stairs between the third and fourth stories. The height of Building 1003's four stories was higher than typical buildings. Therefore, three flights of stairs were required between the two stories. The third and fourth stories were higher than usual to provide adequate space to accommodate mechanical equipment necessary to support multiple satellite programs.

3. Why was this building constructed, and what are some of the activities that occurred in this building? Refer back to Reading 3 if necessary.

Answer: Building 1003 was originally constructed to house the MOL Program. While the building was still under construction, the program was cancelled. The building was completed, and instead housed multiple MCCs to support satellite programs. Many of the programs were classified. However, it is known that the Space Shuttle Program was supported from Building 1003.

Photo 6: Satellite Scheduling

1. What do the numbers in the photograph represent? If necessary, refer to Reading Number 2.

Answer: The numbers stand for individual satellite programs.

1. Do you think the job of the schedulers would be stressful? Why, or why not?

Answer: There is no incorrect answer to this question.

Putting it all Together

Activity 4

1. Identify the undertaking.

Answer: The undertaking is the transfer of Onizuka AFS out of federal hands.

2. Does the undertaking have the potential to cause effects?

Answer: Yes.

3. What historic property might be affected by the undertaking?

Answer: The US Air Force Satellite Test Center Historic District.

4. Do you think there would be an adverse effect?

Answer: Yes.

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