## HELIOGRAPH

DESCRIPTION: The heliograph was a communications device used to transmit messages over long distances. It uses a mirror attached to a surveying device to direct a beam of light to a receiving station. Sunlight is used as the light source. Messages could be sent in any direction during daylight hours. If the sun was in front of the sender, the sun's rays were reflected directly from the sender to the receiving station. If the sun was behind the sender, a secondary mirror was used to reflect the rays toward the receiving station. A keying system was used to generate the flashes required to transmit messages using the Morse Code. The distance that the signals could be seen depended on several variables. A clear line of sight was required and because of the curvature of the earth, the heliograph stations were located on the highest convenient point. The clarity of the sky and



Heliograph at Fort Bowie Visitor Center

the size of the mirrors were also significant factors. The maximum range was about 10 miles for each inch of mirror diameter. Under normal conditions using the naked eye, a flash could be seen for about 30 miles, much farther using a telescope. The speed at which messages could be sent was dependent on the proficiency of both the sender and the receiver.

EARLY HISYORY: A forerunner to the heliograph, the heliotrope, was developed by Professor Carl Friedrich Gauss of the University of Gottingen in Germany. The heliotrope was used to direct a controlled beam of sunlight to a distant station to be used as a survey marker. Its use led to the concept of using it for telegraphic communications. Sir Henry Christopher Mance of the British Army Signal Corps became familiar with heliotropes while he was stationed at Karachi, then part of British India, when they were used during the Great India Survey. He developed the first heliograph that was accepted for use by the British Army. It was light in weight (about 7 pounds) and could be easily carried and operated by one man. It was first used during wartime in 1877 during a military expedition conducted by the British-Indian government. The heliograph quickly caught on and was soon in use for military communications by other countries. During the era before radios, the heliograph was often the only means of communication that could span long distances with a lightweight portable instrument. In the United States, it was first used by the U.S. Army Signal Corps in 1878 in Montana when Nelson A. Miles (then a U.S. Army Colonel) established a series of heliograph stations between Fort Keogh and Fort Custer, a distance of 140 miles.

APACHE WAR USE: The Chiricahua Apache Reservation was closed in 1876 and an attempt was made to relocate all of the Chiricahua Indians to the San Carlos Reservation. Many of the Indians were unhappy with the conditions at San Carlos and would periodically breakout and return to their traditional homeland of Southern Arizona and Mexico. The army would pursue them in an attempt to return them to the reservation. After the last breakout by Geronimo and Naiche and their followers, the band was tracked down in the Sierra Madre Mountains of Mexico

and Naiche and Geronimo in a meeting with General Crook 25 –27 March 1886 agreed to surrender once more. However, before crossing the border back into the United States, the Apaches got spooked by threats that the group would be hanged and went on the run again. This led to General Crook's reassignment to another command and on 12 April 1886, General Miles replaced General Crook in the effort to capture this last band of Chiricahua Apaches. General Miles, based on his experience with the heliograph in Montana, considered it to be an excellent way to communicate with his forces who were trying to track down Geronimo and immediately requested support from the U. S. Army Signal Service in establishing a heliograph system. Lieutenants Fuller (for the Arizona portion of the system) and Dravo (for the New Mexico portion) were assigned to oversee the operation. Thirty-four heliographs were located at various Army posts and shipped to Arizona. Fourteen heliograph stations were established in Arizona and thirteen in New Mexico with the first one being established on 26 April at Fort Huachuca on Huachuca Peak with the designation of Heliograph Station #7. Signalman C. F. von Herrmann was assigned to establish the station and develop a training program to train all subsequent Signalmen. The headquarters for the system was established at Fort Bowie with that station designated as Station #1. Bowie Peak became Station #2. Station #8 was initially activated on Baldy Peak in the Santa Rita Mountains but was soon relocated to "Little Baldy Peak" (subsequently named Josephine Peak) because it had the necessary lines of sight and was easier to access. The following heliograph sites were in operation in September 1886 at the time of the final Apache surrender. The Arizona and New Mexico heliograph sites were linked together via the Arizona controlled site at Stein's Pass.

Arizona Heliograph Sites	New Mexico Heliograph Sites
# 1 Fort Bowie	Alma (Camp Maddox)
# 2 Bowie Peak	Siggen Ranch
# 3 White Ranch (Sulphur Springs)	Lydia Springs (Mule Springs)

# 4 Swisshelm Mountains White House
# 5 Antelope Springs Pinos Altos
# 6 Rucker Canyon Fort Bayard
# 7 Fort Huachuca Camp Henely
# 8 Little Baldy Peak Deming

# 9 Tubac Hschita Mining Camp

#10 Bisbee Canyon Hillsboro
#11 Stein's Pass Bluff Lake Valley
#12 Fourr Ranch (Cochise Stronghold) Fort Cummings
#13 Fort Crittenden Lockhart's Well

#14 Bowie Station

The typical manning of a station was eight men consisting of operators, guards and couriers. Records kept by Lt. Fuller indicated that during the campaign against Geronimo, 2,264 messages had been sent by Arizona stations alone. Station #2 at Bowie Peak dispatched 334 messages.

One of the prime purposes of the stations was to observe and report the presence of any Apaches in the area. How effective was the system in tracking the movement of the Apaches? There was only one occasion where the system was directly involved in the interception of an Apache band by the Army. On 5 June 1886, the Heliograph Station at Antelope Springs observed a band of Apaches moving south toward Mexico. The sighting was flashed to Fort Bowie and Fort Huachuca and relayed to Captain Lawton at Calabasas. Four detachments were sent in pursuit and Lt. Robert Walsh of the 4<sup>th</sup> Calvary surprised the raiders in the Patagonia Mountains and captured their stock and equipment. The assessment made by Lt. Stephan Fuller, the architect of the system, stated: "From the time that the heliograph was put in a particular section of the country, it was noticed that the Indians were never again seen in the vicinity...". After the final surrender of the Chiricahua Apaches, General Miles attributed the use of the heliograph as the deciding factor in the surrender. However in the view of this writer, it was not the use of the heliograph but the use of Apache scouts (initiated by General Crook and continued by General Miles) who were intimately familiar with all of the hiding places in the Sierra Madre Mountains that convinced Naiche and Geronimo that it was useless to continue.

SUBSEQUENT USE: After the surrender of Geronimo, the heliograph was still used as a communications device by the army. The system established by General Miles was significantly expanded as depicted in the Heliograph System Diagram. The use of the heliograph was also adopted by other agencies. The U.S. Forest Service started to use it for forestry protection in 1909 and developed a very portable 4.5-pound system for forestry use. The use of the heliograph by various military forces continued until recent times. The heliograph was standard equipment for Australian and British armies until the 1960s. It was even used by Afghan forces during the Soviet invasion of the 1980s.



The Army's Heliograph System after it was expanded following the Apache's surrender.

Photograph of a display at Fort Bowie

Prepared by T. Johnson in January 2013 from various web sites, a handout of the National Park Service and the Journal of Arizona History article "*General Miles' Mirrors*" by Bruno J. Rolak. Heliograph system photo by T. Johnson. Updated by T. Johnson in September 2014.

**Additional Information:** GVHC File No. 99