ROCKS, BOMBS, AND ASTRONAUTS: AERONAUTICAL TRAINING
ON THE KLAMATH NATIONAL FOREST

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Klamath National Forest has long been used for aeronautical training for multiple governmental agencies. In May 1945, the U.S. Navy created the Siskiyou Rocket and Bombing Range. Over 7,000 acres in size, the range featured a wooden target for practice rockets and bombs. With the conclusion of World War II came the decommissioning of the site, where it remained unutilized for decades. In 1991, Butte Valley National Grasslands was established by the U.S. Forest Service to provide range for livestock and wildlife viewing. On the east side of the forest, NASA and the USGS utilized the Medicine Lake Highlands to conduct intensive training for astronauts in the Apollo program starting in 1965. Their main focus was learning to identify and describe geologic features like those on the Moon. Trainees included Roger Chaffee of the ill-fated Apollo 1 mission; lunar module pilots William Anders, Russell L. Schweickart, R. Walter Cunningham, and Alan Bean; and Harrison “Jack” Schmitt, the first geologist in space and one of the last people to walk on the Moon. Innovative and collaborative use of public lands continues to be a hallmark of the Forest Service, with many opportunities still unrealized.

Use of the National Forests can be broken down into easily identifiable time periods, each reflecting the social changes our society has experienced through time. The mission of the Forest Service has changed little, however, and is summed up in the current motto “caring for the land and serving people.” Often forgotten in the swift travel of time are the diverse utilisations of federal land by other national, state, and local agencies. These collaborations have led to important contributions to the organization’s history through scientific developments and training opportunities. The creation of the National Forests also led to the protection of many unique environments, creating even more opportunities for scientists to advance our knowledge of the Earth.

Within the Goosenest Ranger District of the Klamath National Forest (KNF), two archaeological sites demonstrate unique federal land utilization that stands out in the vast annals of California archaeology. Pumice Crater and the Siskiyou Rocket and Bombing Range do not fall into the typical categories of mining, logging, or prehistoric habitation. Instead, these sites represent the networks created through inter-agency collaboration to develop air and space travel technology and techniques. Had it not been for the Forest Service’s commitment to due diligence in record keeping, the rich historical backgrounds of these sites would have remained buried.

BACKGROUND

The Klamath Forest Reserve was established on May 6, 1905, following the proclamation of President Theodore Roosevelt. The establishment of the reserve, which totaled 1,896,313 acres, had multiple purposes, including the protection of timber lands from logging company monopolies, protection of watersheds, and providing civil service jobs for Siskiyou County residents (Davies and Frank 1992). Farming in the area began in 1906 with the creation of the Butte Valley Land Company. Most farms were abandoned by 1920, and after prolonged drought in the early 1930s, land use shifted to cattle grazing (Fentress 1997).
With the swearing in of Franklin D. Roosevelt as president in 1933, there was “considerable speculation” about what the transition between administrations would bring. All of the National Forests had been operating under Depression-era budgets that limited the profitability of such mainstays as the timber industry. After a meeting in April of the Regional Foresters and Directors, the KNF was notified by the Labor Department that they would be allocated seven 200-man camps as part of the Civilian Conservation Corps (CCC) program. The crews constructed buildings, trails, roads, and other infrastructure for the KNF until the abolishment of the program on July 1, 1942 (Davies and Frank 1992).

U.S. involvement in World War II was the primary reason the CCC was abolished, and most of the facilities created by the crews were converted to functions in support of the war effort. In 1942, the War Department appropriated funds for the operation of 350 lookout towers along the Pacific coast as part of the aircraft warning service (Davies and Frank 1992). This group of volunteer airplane spotters formed the civilian arm of the U.S. Army’s Ground Observer Corps (California State Capitol Museum 2016). Continuing in the tradition of civilian support for wartime activities, participants received specialized training and recognition for their efforts, such as commemorative pins and formal dinners. After the Japanese attack on Pearl Harbor in 1941, a palpable fear developed that the West Coast of the continental U.S. might become the next target. An event that supported this fear was an incendiary balloon attack that killed six in Bly, Oregon, on May 5, 1945, the only documented World War II casualties on U.S. soil (U.S. Forest Service 2019). When a proposal was made by the Navy to create more practice areas in the range of Naval Air Station (NAS) Klamath Falls and NAS Seattle, landowners in Siskiyou County, in collaboration with the U.S. Department of Agriculture (USDA), signaled their support for the war effort through the creation of the Siskiyou Rocket and Bombing Range.

**SISKIYOU ROCKET AND BOMBING RANGE**

Sub-marginal lands in Butte Valley were first acquired by the federal government under the authority of the Bankhead-Jones Farm Tennant Act of 1937. After draining Meiss Lake to create farmland, homesteaders in the early nineteenth century extensively plowed and grazed the land. These activities, combined with drought, caused a decline in productivity by the 1930s. In an attempt to stabilize the land, the Soil Conservation Service planted over 4,000 acres of crested wheatgrass. Appropriate grazing practices and associations were then established to promote the dual functions of conservation and range for cattle (U.S. Forest Service 2019).

For a brief time at the end of World War II, over 7,000 acres of underutilized land in Siskiyou County, including National Forest land, were obtained by the U.S. Navy for the purpose of developing a practice bombing and rocket range within the Butte Valley Land Use Project area. The location of the site was significant because it provided aerial gunnery practice east of the Cascade Mountains. Other stations could not operate during the winter because of poor weather conditions (Sebby 2006; TechLaw 1999; U.S. Army Corps of Engineers 2003). The site was developed by the 13th Naval District as part of the range complex for the National Airspace System Klamath Falls, which had 11 previously established range activity areas (TechLaw 1999; U.S. Army Corps of Engineers 2003).

Land identified for the project was acquired from four different owners. Initially, local rancher J. C. Stevenson held 2,040 acres, the Butte Valley Irrigation District held 3,280 acres, the USDA held 960 acres, and the State of California held 760 acres (Headquarters 13th Naval District 1945). Later, all of the public lands were listed as belonging to the United States of America, and more acreage was allocated to the private owners (Bureau of Yards and Docks 1945). The irrigation district was the first to sign on, initially requesting $1 as rent for indefinite use of the land. The lease was revised in June 1945 with a cost of $100 a month for the United States of America to use the land until November 27, 1945 (Bureau of Aeronautics 1945).

Development of the practice range proceeded with the construction of a radio transmitter, two personnel buildings, and a target. The target area
was constructed on a four-foot raised platform approximately one hundred feet in diameter . . . covered with a white cloth in order to make it visible and conspicuous. Radiating for a distance of approximately a mile from the center of the target in two directions [was] a straight line marked on the ground to assist the pilots in making a straight run on the target . . . the target area [was] completely surrounded by adequate fire breaks in compliance with fire protection and prevention measures deemed necessary for this type of installation [U.S. Army Corps of Engineers 2003:4-5].

Within a few weeks, the basic infrastructure was complete and air-to-ground firing, high- and low-level bombing, and strafing began (Sebby 2006; U.S. Army Corps of Engineers 2003). In addition to the climatic advantage of the location, the Siskiyou Rocket and Bombing Range met the specific need for an exclusive rocket practice range. All other U.S. Navy properties were performing strafing (attacking ground targets from low-flying aircraft using mounted automatic weapons) and dive-bombing exercises, precluding practice with rockets (Bureau of Yards and Docks 1945). The Navy anticipated that “actual combat type rockets” would be the next munitions used at the site, but those plans were abandoned once the end of World War II became imminent (Sebby 2006).

After much fanfare and a brief air show by the VC-82 squadron, the first fleet units arrived at NAS Klamath Falls in June 1945. Five composite squadrons with 18 VM-2 fighters and nine Grumman TBF Avenger torpedo bombers were the first to complete their training (Figure 1). They were replaced by a CVE air group of 18 Grumman F6F Hellcats and 12 Grumman TBF Avengers (NAS Klamath Falls 1944). Small arms, practice rockets, and practice bombs were used as part of the training exercises. The small arms ammunition likely included 0.30 and 0.50 caliber cartridges, as were typically used by U.S. Navy aircraft during World War II, and 20mm cartridges. Rockets used at the range may have included 2.25-inch sub-caliber aerial rockets (SCARs); 3.5-inch semi-armor piercing aircraft rockets; and 5-inch high explosive high-velocity aircraft rockets (HE HVAR). Practice bombs may have included Mk5, Mk23, and Mk43 miniature practice bombs; 13-lb Mk19 practice bombs; and 100-lb Mk15 series practice bombs (Figure 2). It is likely that Mk4 and Mk5 bomb target signals were also used (U.S. Army Corps of Engineers 2001). NAS Klamath Falls lacked adequate storage for high explosives, and the lack of large impact craters within the target area support the assumption that no explosive ordnance was used at the site. Dimpling present on the landscape was initially thought to be the result of explosive material, but was determined to be a natural occurrence (U.S. Army Corps of Engineers 2003). The line of approach for the target was from the northeast and southwest. Planes approached from both directions, as evidenced by the location of debris within the target area.

After about six months of use, the site was decommissioned due to the surplus of military infrastructure following the conclusion of World War II. NAS Klamath Falls was placed in caretaker status by October 10, followed by the termination of the leases and permits for the land in January and February 1946 (U.S. Army Corps of Engineers 2012).

The Forest Service assumed management of the property, and possible uses for the land were debated for some time. Various options were considered, including selling the land to develop it into a federal prison or local landfill. After pressure from the local community, Cattleman’s Association, and California Fish and Game, the decision was made to designate the area a National Grassland in 1991. The Butte Valley National Grasslands is the 20th National Grassland and the only one within the State of California (U.S. Forest Service 2019). Today, it is managed by the KNF as a multi-use area focused on protecting, enhancing, and promoting the greatest benefit for the public. Besides providing rangeland for cattle, the area is a popular bird watching location and an excellent place to view elk and other wildlife.

Not much attention was given to the military history of the site until the Defense Environmental Restoration Program for Formerly Used Defense Sites ( DERP-FUDS) performed a site visit and inventory in 1999 (TechLaw 1999). The primary goal of the program was to evaluate previously used Department of Defense (DoD) properties for immediate dangers from ordnance and chemical weapons (U.S. Army Corps of Engineers 2003). A brief history of the site, a description of the immediate area, real estate information, and findings of the site inspection led by Jim Stout, KNF Resources Officer, were all compiled in a 2001
Figure 1. Grumman F6F Hellcats. Image publicly accessible at https://wwiiaircraft.files.wordpress.com/2014/02/grumman-f6f-hellcatg.jpg.

Figure 2. Schematics of 3-lb miniature practice bomb, AN-Mk 23 Mod 1. Image from Ordnance Pamphlet 1280, Aircraft Bombs, February 1945, Department of the Navy.
During the 1999 site visit, Stout indicated that ordnance at the site included fragments of an Mk21 500-lb general purpose practice bomb; 3.5-inch rocket motors; an Mk5 miniature practice bomb; non-explosive tips for air-to-surface rockets; machine gun belt links; a 20mm cannon slug from a non-explosive warhead; and a fragment from a cast iron practice bomb (TechLaw 1999).

The DoD Risk Assessment Procedures for Ordnance and Explosives Sites report determined that, while a small percentage of live practice bomb spotting charges may remain on site, the explosive danger for the site remains very low (U.S. Army Corps of Engineers 2012). The report also indicated that no action needed to be taken regarding the presence of materials at the former bombing range. Since there was no need to remove any more of the material, it was preserved in context as artifacts of World War II training activities. They did note, however, that there was an unknown risk from buried shrapnel and recommended a fence or other barrier to limit access to the site.

A subsequent evaluation by the DoD in 2011 requested collection of soil samples to test for chemical containments. Eight locations within the site were sampled, with three additional locations sampled from outside the project area as standards. Six of the locations within the site had already been surveyed for archaeological remains, and the sampling strategy was determined to have no adverse effect. Soil analysis results indicated the presence of selected metals in all eight samples, and no explosive compounds in any of the samples. The Goosenest District archaeologist also completed 15.6 miles of qualitative reconnaissance, corroborating the presence of metal debris and an earthen berm (Goetz 2011; U.S. Army Corps of Engineers 2012).

Although the Siskiyou Rocket and Bombing Range was used for less than a year, various visits to the site indicated that some amount of munitions debris remained. Based on these observations, the District archaeologist arranged a field visit to the site on November 20, 2018. The primary objectives were to determine the density of debris at the site, attempt to locate remains of the wooden target and earthen berm, photograph and document debris, and gather GPS data. The expectation was that little would be visible, but in fact a large amount of material is still present at the site. SCARs are easily identified by their similarity to pieces of water pipe (Figure 3) and practice bombs by their distinctive tail fins and rounded noses (Figure 4). A feature consisting of a scatter of milled lumber of various lengths with associated practice bomb debris is likely part of the target platform. The earthen berm is obvious enough that it was possible to walk the entire circumference to gather GPS data. Future site visits are planned so that the site can be more thoroughly recorded.

NASA TRAINING AT PUMICE CRATER

The year 2019 marks the 50th anniversary of Apollo 11, the first mission to successfully land people on the Moon. Thousands of hours of training contributed to the success of this mission and many earlier forays into outer space. While flight training was a large component, it may come as a surprise to many readers that astronauts in the Apollo program also spent hundreds of hours learning about geologic formation processes and sample collection techniques. The Medicine Lake Highlands of California, adjacent to Lava Beds National Monument, was one of many areas used as a geologic field trip location for the program in 1965 and 1967. Several well-known astronauts from the Apollo program utilized the Pumice Crater and Crater Glass Flow geologic unit of the Medicine Lake Volcanic complex, on the KNF, as part of their preparation for exploration of the lunar surface.

The National Aeronautics and Space Administration (NASA) was established in 1958 with the purpose of maintaining a civilian space program and conducting research in aeronautics and aerospace (Bilstein 1996). Scientific exploration of space first began with balloons and sounding rockets, with plans for future scientific studies using unmanned spacecraft. The general dialogue and pace of space exploration changed dramatically when Yuri Gagarin, a cosmonaut from the Soviet Union, orbited the Earth on April 12, 1961 (Phinney 2015). In response to this historical event, President John F. Kennedy addressed a joint session of Congress on May 25, 1961, to announce the national goal of “landing a man on the Moon and returning him safely to Earth” by
Figure 3. SCAR and practice rocket debris observed during the 2018 site visit.

Figure 4. Practice bomb debris observed during the 2018 site visit.
the end of the decade (John F. Kennedy Presidential Library and Museum 1961). The latter stages of Project
Mercury, Project Gemini, and Project Apollo, which would later be known as the Apollo program, were
designed to execute this goal (NASA History Office 2013).

Although President Kennedy’s goal was politically polarizing for NASA scientists, those working at
the Manned Spacecraft Center (MSC) in Houston brought up an important consideration as the focus and pace
of research shifted. Max Faget, the Director of Engineering, pointed out that “it wouldn’t look very good if
we went to the Moon and didn’t have something to do when we got there” (Compton 1989). As discussions
progressed, it also became clear that lunar mapping and crater studies already underway through the United
States Geological Survey (USGS) would provide the best foundation for on-the-ground study of the Moon
(Phinney 2015). Eugene Shoemaker, also from the USGS, submitted a proposal for geological field investiga-
tions in 1965 that defined an investigation of the Moon’s surface that included making observations of the
landscape, taking photos of the terrain, and collecting samples of rock, soil, and dust (Shoemaker et al. 1965).

As early as 1892, Meteor Crater near Flagstaff was seen as an earthly analog to lunar geologic features,
thanks to USGS Chief Geologist Grove Karl Gilbert (Schaber 2005). Based on what could be seen from Earth,
it was unclear whether the craters and hills of the Moon were comprised of deposits of granular material or if
they were formed through volcanic activity (Regan 2015; Shoemaker et al. 1965). Both scenarios hosted their
own set of challenges, so as research and planning shifted to choosing ideal lunar landing sites, Dr. Aaron
Waters, a USGS volcanologist, was consulted. The focus on identifying landing sites directed attention to
plains regions of the Moon, which were expected to be more predictable landing areas than the distinctive
craters. To support this research, in 1963, the City of Flagstaff, Arizona, and the Forest Service offered land
to the USGS for a lunar-observing telescope and headquarters building (Schaber 2005). This building would
later become the USGS Branch of Astrogeology, and would play a central logistical role in the development
of Apollo mission objectives.

From 1964 to 1967, NASA implemented a geologic training program for astronauts assigned to lunar
missions built from research conducted by the USGS in Flagstaff (Lofgren et al. 2011). The astronauts
chosen for the Apollo missions were seasoned U.S. Navy pilots with no formal training in scientific
procedures. Working with geologists, the goal of the program was to train astronauts in general geological
collection and identification techniques through classroom lectures and field trips. The field trips took place
all over the U.S., including Hawaii, Oregon, New Mexico, Nevada, Texas, California, and (primarily)
Arizona (Figure 5). Field trip scoping focused on locations that would provide the trainees with exposure
to different types of craters and volcanic activity. Initially, the field trips were just guided tours of each
location involving USGS geologists, NASA personnel, photographers, the astronauts, public relations staff,
and local reporters. Later trips were more involved, requiring the astronauts to use special equipment to
record geological observations, similar to what they would be asked to accomplish on the Moon (Regan
2015). Due to the nature of the intense and varied training the astronauts received, the scheduling of the
geological trips was difficult, and often the same location would be visited several times with different
groups of astronauts.

Pumice Crater and Crater Glass Flow, the geologic unit on the KNF where the Astronaut Crater site is
located, are part of the larger Medicine Lake Volcano complex. Crater Glass Flow is a cinder cone that was
fed by a vent about 1,100 years ago. Subsurface dikes enabled the flow of magmatic material and pressure
away from the central volcano. Magma at the top of the dike created surface cracks and erupted explosively,
spewing pumice into the air (Fink and Pollard 1983). Aerial photos of the site show the rhyolitic lava that
originally traveled through the dike, and the large accumulation of pumice that formed as magmatic pressure
spit material into the air as the lava emerged (Figure 6).

Multiple sets of Apollo program astronauts traveled to the Medicine Lake Highlands with field
geologists to learn how to identify volcanic features, describe how they form, and document them (Beattie
2001; King 1989; Shoemaker et al. 1965). William Phinney, former Associate Curator of Lunar Samples for
NASA, compiled an expansive report in 2015 on the history of the geological trainings, including dates,
locations, and participants. According to his report, on August 30, 1965, Ted Foss of the MSC (now the
Lyndon B. Johnson Space Center) provided briefings on the geology of Medicine Lake, focusing on sampling
Figure 5. Dr. Eugene Shoemaker (pointing with hammer) lectures to a group of astronauts at Meteor Crater. Image from Cline Library Special Collections and Archives at Northern Arizona University, Flagstaff, the Paul Switzer Collection, publicly accessible at https://library.nau.edu/speccoll/exhibits/daysofarchives/lunar.html.

Figure 6. Aerial view of Pumice Crater and Crater Glass Flow, part of the larger Medicine Lake Volcano complex. Source: Google Maps.
and field checking (Phinney 2015). It was common for pre-briefings on the geology of the field trip location to take place the evening before the crew arrived at their destination. While mostly technical in nature, the field trips allowed the pilots a chance to get to know each other, as well as the USGS and NASA staff that would be guiding their activities on the lunar surface (Lofgren et al. 2011). It is easy to argue that these encounters helped humanize the experience of preparing for space travel. It also humanized the hundreds of scientists and administrative staff that made these missions a success.

The first field trip to Medicine Lake was led by Dr. Aaron Waters. Roger Chaffee was part of this training session, which took place September 1 through 3, 1965. He was joined by William Anders, Allan Bean, and Russell “Rusty” Schweickart. All four pilots were members of Astronaut Group 3 (NASA 2013). A second field trip was led by Charles Anderson from the USGS, from September 8 through 10, 1965 (Regan 2015). Official NASA records indicate that several other members of Astronaut Group 3 attended this second session, including Charles Bassett, R. Walter Cunningham, and Clifton “C.C.” Williams, Jr. (Johnson Space Center 2019; Phinney 2015). Donald Beattie, a NASA engineer at the time, provided a specific description of who attended this second training in his book Taking Science to the Moon (Figure 7). For whatever reason, it does not match NASA’s records:

... in September 1965 I participated in one of the astronaut training trips to Medicine Lake, California, a site near several small, complex volcanic features... This was the second two-day trip astronauts made to the area, and those on this particular trip were Russell ‘‘Rusty’’ Schweickart and Roger Chaffee. Roger was soon to be named to the crew selected to fly Apollo 1, scheduled to be the first manned flight of a Saturn rocket [Beattie 2001:171-172].

Beattie’s mention of Chaffee is significant, as the Apollo 1 mission would meet a tragic fate. On January 27, 1967, a fire in the cabin of the spacecraft during a launch rehearsal test killed all three astronauts in the primary crew and completely destroyed the command module. Command Pilot Virgil “Gus” Grissom, Senior Pilot Edward White II, and Pilot Roger Chaffee had little time to react as a small electrical fire, combined with a pure oxygen atmosphere, caused the many combustible materials in the cabin to incinerate. The exterior release hatch was impossible to open due to the high pressurization of the command module, preventing engineers from opening the hatch in time to save the crew (Ertel et al. 1978). The high media visibility of the race to the Moon made the deaths of the astronauts a national tragedy. It also led to many changes to equipment and protocols utilized by American astronauts, including changing the pure oxygen atmosphere to a mixed one (Moskowitz 2012).

Several years later, one last field trip was made to the Highlands from June 25 through 27, 1967. Participants included members of Astronaut Groups 4 and 5. Group 4 was known as the “Scientist Astronauts” and included Harrison “Jack” Schmitt, the first geologist to be trained by NASA as an astronaut. He was involved in the geologic training sessions at the Astrogeology Center in Flagstaff beginning in 1964 (Johnson Space Center 2019; King 1989). Schmitt “observed that the enthusiasm for field exercises was not as great as he thought it could be,” encouraging more experienced and charismatic instructors to join the project (Phinney 2015). Through his involvement with the training program, Schmitt was ultimately able to convince the prospective astronauts that if they were more engaged in the trainings, they were more likely to be assigned to an Apollo flight mission (Wilhelms 1993).

More popular than the lectures about geology was practicing the Moon Game. This exercise was performed at many of the field trip sites, including the Medicine Lake Highlands (King 1989). It involved dividing the group into pairs, placing each pair in an area with only basic information about their location, and then having them walk through a preplanned traverse as if they were on the Moon (Phinney 2015). Early missions in the Apollo program tested two- and four-hour walking excursions, but these later grew to 20 hours over the course of three days. Each traverse consisted of a sequence of designated stations covering the area of interest. Astronauts were trained to spend 30 to 50 minutes at each station, constantly relaying information to the Mission Control support team through two-way radios (Lofgren et al. 2011). On the Moon, all of these activities would require leaving the spacecraft (they were designated extra-vehicular activity or EVA), so time frames and objectives had little room for improvisation.
In training and on successful lunar missions, rock samples were collected using tongs, a special rake, scoops, and a shovel. Drive tubes were used to collect soil cores, and all samples were placed into Teflon bags and vacuum-sealed containers. All these techniques were practiced in the field, except for trials with equipment like the Primary Life Support System (PLSS) and the lunar module, which were performed at the “Rock Pile” at the Manned Space Center (MSC) in Houston (Phinney 2015).

Learning to collect rock and soil specimens was important, but the most time was spent on photography. Each astronaut who planned to perform an EVA was equipped with a chest-mounted Hasselblad 500EL camera. The orientation of the camera meant that there was no viewfinder, so they had to learn how to take focused pictures of samples and features relying on muscle memory. Adding to the challenge was the fact that the cameras operated using emulsion film, requiring protocols for transporting the undeveloped film without accidentally exposing it to the ever-present sun. Five pictures were taken of every sample, and each picture required the use of a gnomon, a small tripod that indicates the orientation of the ground surface in relation to the sun (Figure 8). This tool was also equipped with a color calibration chart to assist with photo analysis back on Earth (Lofgren et al. 2011).
Four of the six astronauts who trained at Pumice Crater went on to fly in Apollo missions. Sadly, Clifton Williams and Charles Basset died in separate plane crashes before they were assigned to a mission crew. In 1968, Walter Cunningham was the Lunar Module Pilot for Apollo 7, the first United States mission to carry a crew into space. They accomplished their goal to demonstrate the capabilities of the command and service modules, as well as completing the first live television broadcast from space. William Anders flew on Apollo 8 in December 1968, along with Jim Lovell and Frank Borman. They were the first crewed spacecraft to orbit the Moon. During their time in orbit, Anders took the now famous Earthrise photograph (Figure 9), which shows the earth rising over the horizon of the Moon. Russell Schweickart went on to fly on Apollo 9, demonstrating the use of the Lunar Module for the first time in space.

All these space flights were precursors to the first Moon landing, which was accomplished by the crew of Apollo 11 on July 20, 1969 (Launius 2014). This was followed by the second manned Moon landing of Apollo 12 on November 14, 1969. After landing within the southeastern corner of the Ocean of Storms, Alan Bean became the fourth person to walk on the Moon. While Apollo 11 provided a monumental accomplishment for the United States, its focus was on the successful landing on the Moon, leaving Apollo 12 to complete more scientific data collection. Bean and Conrad spent 31 hours on the surface of the Moon collecting samples.
of rock, sand, and dust. They also set up equipment to measure the Moon’s seismicity, magnetic field, and solar wind flux. They took photographs, mapped the lunar surface, and retrieved parts from Surveyor III. Apollo 12 returned to Earth on November 24 carrying 75.48 pounds of lunar geologic samples, including basalt samples with ages between 3.1 and 3.3 billion years (NASA 1970).

After significant pressure from the scientific community, NASA assigned geologist Harrison Schmitt to Apollo 17. The benefits of training scientists to become astronauts had not occurred to NASA until they witnessed the success of their pilots retrieving lunar geologic samples. Schmitt was one of the geologists charged with training the astronauts in geologic sample collection, not only designing the training, but walking them through the exercises at the field sites. After a successful lunar landing, Eugene Cernan and Schmitt spent three days on the surface of the Moon, the longest of any mission. They collected 741 individual rock and soil samples, including a deep drill core that stretched three meters below the lunar surface. The total geologic payload came in at nearly 245 pounds (Lunar and Planetary Institute 2019). Apollo 17, launched in December 1972, was the last mission to the Moon, leaving Cernan and Schmitt the last humans to step foot on its surface.

Overall, the Apollo program had six manned missions that collected geological samples from the Moon (Apollo 11, 12, 14, 15, 16, and 17). Of the 32 astronauts in the program, 24 flew in space and 12 walked on the Moon (NASA 2009, 2011). Thanks to their extensive preparations, the astronauts were able to collect a total of 842 pounds of lunar samples. Scientific study of the lunar samples has provided a better understanding of the composition of the Moon, a basic chronology of geologic events, and an insight into the Moon’s origin. As the only lunar samples directly collected by humans, they are still being studied five decades later. They have led to advances in technology not just for studying geologic materials, but also for future missions to the Moon (Bartels 2019).
In a philosophical sense, Schmitt’s enthusiasm for making geologic exploration accessible and helping to integrate it into NASA mission objectives was rewarded by the successful trips to the Moon. "The success of all the Apollo missions demonstrated the effectiveness of all the geologic training both early and later mission specific, the astronauts received. . . . Neil Armstrong’s foot on the Moon was the culmination of years of work by thousands of skilled people" (Regan 2015:39). In 1960, NASA’s Manned Spacecraft Center awarded the USGS a Certificate of Appreciation after the Apollo 11 mission was completed, recognizing the agency’s many contributions to the Apollo program (Figure 10).

Today, the Pumice Crater site is managed by the Goosenest Ranger District of the KNF. A light-use hiking trail provides access to the site where interpretive signs discuss the unique geologic makeup of the area. Although NASA and the USGS brought potential astronauts to the Medicine Lake Volcanic complex on multiple occasions, there are no archaeological signs of their presence at Pumice Crater. Their explorations into the volcanic landscapes of the United States likely did not require more than a notebook and pen.

CONTRIBUTIONS TO HISTORY

From the standpoint of national history, both the Siskiyou Rocket and Bombing Range and Astronaut Crater attest to the Forest Service’s commitment to collaborating with other agencies within and outside the federal system. These partnerships served the needs of a select set of special programs, as well as the public as a whole. Civilian support for the war effort and space exploration was fostered through the commitment of the Forest Service to support these national goals.

Siskiyou Rocket and Bombing Range retains many of its archaeological components, and it remains relatively untouched except for seasonally ranging cattle. This is largely due to the management of the former bombing range being reassigned to the Goosenest District in 1954 (Davies and Frank 1992 2019). Unlike other lands acquired through the Bankhead-Jones Act, the Butte Valley Land Use Project remained...
a purchase unit instead of being designated a National Grassland until 1991 (U.S. Forest Service 2019). The high integrity of the site makes it an excellent candidate for future archaeological research into World War II training activities.

Comparisons between a 1931 photo of Pumice Crater and photos from today show that the site has changed little (Peacock 1931). In 2012, the KNF designated the site as the Pumice Crater and Crater Glass Flow Geologic Area, creating a 1.3-mile-long recreational trail along the rim of the main feature (Klamath National Forest 2012). Multiple interpretative signs were installed to describe the geologic activity that led to its creation and its relationship to the larger Medicine Lake Volcano complex. A previous attempt was made to designate the site as a national natural landmark for the National Park Service but was never completed. The historical research that has since been completed for the site has led to its designation as a priority heritage asset for the Ranger District. In 2019, a Youth Conservation Corps Crew successfully rehabilitated and improved the recreational trail. The ultimate goal for the historical research on the site will be the preparation and successful nomination of the site to the National Register of Historic Places.

Every archaeologist knows the importance of a 50th anniversary, and with the 50th anniversary of the Moon landing, we move forward together into a brave new world of looking at space exploration from a historical perspective. None of these investigations would be possible without the firm footing in World War II research that many historical archaeologists have dedicated their lives to. Aeronautics continues to expand its reach, and as modern automated space exploration continues to develop, the knowledge of our history as innovators and explorers in the realm of outer space will surely be a valuable asset.

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