

History of the White Mountain Research Station and the Crooked Creek Facilities¹

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Nello Pace³

Research during World War II at the U.S. Naval Ordnance Test Station, Inyokern, California, led to the development of infrared-seeking missiles, which by 1948 required high-altitude field tests of the heat sensors. A small frame building was built at Crooked Creek (3,094 m [10,150 ft]) in 1948 for use as living quarters for those doing the field testing of sensors, and an observing site was established nearby at an elevation of 3,231 m (10,600 ft). A pre-existing network of old mining roads, e.g., to the Eva Belle Mine, Big Prospector Meadow, and Mexican Mine, was improved to provide four-wheel drive access to the Crooked Creek and the 3,993-m (13,100-ft) level White Mountain Peak areas, and a commercial telephone land-line was installed. All of these construction projects were carried out by the U.S. Navy (Ordnance) under special use permits issued by the U.S. Forest Service.

Between 1948 and 1950, the Crooked Creek facilities were manned and operated the year around. In addition to classified research, several unclassified research projects were initiated in 1948: Cosmic-ray studies by Professors W. B. Fretter and R. B. Brode, Department of Physics, UCB, and C. D. Anderson, Department of Physics, California Institute of Technology (CIT); velocity of sound at altitude by Professor V. O. Knudsen, L. P. Delsasso, and R. W. Leonard, Department of Physics, UCLA; and the study of the astronomical "seeing" qualities of the atmosphere above the White Mountains by Professor F. Zwicky, Department of Astronomy, CIT, and Dr. W. O. Roberts of the High Altitude Observatory, Boulder, Colorado. This latter research confirmed the notion held nearly 20 years earlier by Ira Sprague Bowen, Professor of Physics, CIT (and later Director of the Mount Wilson and Palomar observatories), that the unusually low humidity, coupled in the White Mountains with high land elevation, offered great potential for an astronomical observatory—42 percent of the Earth's atmosphere lies beneath White Mountain Peak. Nearly another 30 years passed before Acting Director of White Mountain Research Station (1977 to 1979) William J. (Jack) Welch, Professor of Electrical Engineering and Computer Sciences and Director of the Radio Astronomy Laboratory (UCB and Hat Creek), and the University of California, made a bid to build the Keck 10-meter Telescope that the University wished to be located in the White Mountains—a wish that was not to be realized.

¹Much of the history of Crooked Creek, from approximately 1948 to 1973, is taken from "A History," by Professor Nello Pace, in *25 Years of High-altitude Research, White Mountain Research Station*, published by the University of California White Mountain Research Station, 1973.

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Also in 1948, as an Assistant Professor of Physiology, UCB, and former Head of the Physiology Department of the U.S. Naval Medical Research Institute, Bethesda, Maryland during World War II, Dr. Nello Pace began studying possible sites for a high mountain biological research facility. A high-altitude research facility was needed not only to permit physiological studies of chronic hypoxia on sea-level natives taken to high altitude, but studies were also needed of native living species that have successfully adapted to the high-mountain environment over many generations. Factors of importance were year-round access, a rich native flora and fauna characteristic of the high-mountain environment, and the nearness to established academic centers of research located at sea level where base-line physiological studies could be conducted. It was obvious to Professor Pace that economics dictated a site within the contiguous continental United States. The Colorado Rockies were ruled out because of their distance from sea-level research laboratories and institutions and because of the severity and length of the winter season. The structure atop Mount Whitney was built originally in 1912 by C. G. Abbot of the Smithsonian Institution for solar observation and could be used for high-altitude research. The U.S. National Park Service indicated that utilization of the building was feasible; however, at the suggestion of officials of the Sierra Club, Dr. Pace turned his attention to the White Mountains. The uniquely favorable features of the White Mountain region prompted Dr. Pace to collaborate with Professor S. F. Cook, Department of Physiology, UCB, in order to submit a research proposal to the Office of Naval Research seeking to establish a high-altitude laboratory near what would later become known as Mount Barcroft,⁴ north of Crooked Creek and the U.S. Naval Ordnance Test Station. In July of 1950, the proposal was approved by the Office of Naval Research. It was also learned at that time that testing of the infrared sensors by U.S. Naval Ordnance had been completed, the U.S. Navy was to abandon the Crooked Creek test site, and that the Navy's facilities at Crooked Creek were to be dismantled and removed. Professor Pace and Dr. W. V. Consolazio, Head of the Physiology Branch of the Office of Naval Research, reached an agreement with the Navy Ordnance to transfer the buildings and equipment at Crooked Creek to the Office of Naval Research. The Office of Naval Research in turn authorized the University of California to continue operating the Crooked Creek facilities and to proceed with the development of the Barcroft research facilities. On September 1, 1950, the property transfer papers were signed, and the University of California began operation of the White Mountain Research Station for the Office of Naval Research, as a national facility open to any scientific investigator wishing to pursue research in the high-mountain environment. Professor Pace was designated the first Director of the Station. The existing Special Use Permits issued by the U.S. Forest Service to the Navy were re-issued to the Commandant of the Twelfth Naval District. This arrangement, although practical and expedient at the time, was ultimately to prove difficult for the White Mountain Research Station.

⁴In May of 1954, the U.S. Board of Geographic Names formally approved the proposal of Professor Pace to name the 3,975-m (13,040-ft) peak south of White Mountain Peak "Mount Barcroft," in memory of the pioneer high-altitude physiologist, Sir Joseph Barcroft, Cambridge University, England.

A development of vital importance to the research objectives of the Station occurred on November 16, 1951—the signing of a Cooperative Agreement between the U.S. Forest Service and the U.S. Navy, setting aside 20 sections of the Inyo National Forest on the highest part of the White Mountains for high-altitude research purposes. The entire 20-square mile research area lay above 3,658 m (12,000 ft), and included the site of the Barcroft facilities. The major feature of the Cooperative Agreement was that vehicular traffic into the research area was to be restricted to the minimal official travel necessary to support the research activities. It was recognized in 1950, and it is equally true in 1994, that unregulated vehicular traffic into the area would quickly and irreversibly destroy the delicate biologic balance of this natural resource—a transitional biological zone between the Sierra Nevada and the bulk of the Basin and Range province.

In 1952, Robert Gordon Sproul, then President of the University of California, appointed the first President's Advisory Committee for the White Mountain Research Station. This committee has historically included many of the most distinguished scientists in all disciplines of natural, medical, and social science from all campuses of the University of California, and from private and public institutions of higher learning in California and elsewhere.

Also in 1952, the National Science Foundation and the Rockefeller Foundation joined the Office of Naval Research in providing funds for maintenance support of the Station. In 1955, the Regents of the University of California began to provide financial support to balance the gradual withdrawal of support by the Rockefeller Foundation; by 1958, the Regents had completely supplanted the Rockefeller Foundation in contributing to the maintenance of the Station.

During the summer of 1953, Professor E. Schulman, Laboratory of Tree-ring Research, University of Arizona began his study of the longevity of the local Bristlecone Pines (*Pinus longaeva* D. K. Bailey). After his untimely death five years later, his work was carried on by Professor W. G. McGinnies, H. C. Fritts, and C. W. Ferguson. Their research determined that there were living individuals of the Bristlecone Pine that were over 4,600 years old, and by using both living and fallen trees they were able to establish a continuous tree-ring chronology for the past 7,500 years. In recognition of this work, and the discovery of what to many biologists is the oldest living organism, the stand of trees studied a few miles south of Crooked Creek by Dr. Schulman and his colleagues has been designated the Edmund Schulman Memorial Grove.

In 1957, a National Science Foundation grant of \$132,000 was awarded to the Station for the construction of an electric power line 26.4 km (16.4 mi) long to supply the White Mountain Peak (4,342 m [14,250 ft]), Barcroft (3,800 m [12,470 ft]), and Crooked Creek (3,094 m [10,150 ft]) facilities with electrical power. It became obvious in the winter of that year that the overhead power line to the White Mountain Peak site was impractical, owing to severe icing of poles and lines; approximately 20 years later it also became obvious that an overhead line above approximately 3,048 m (10,000 ft) was impractical from Crooked Creek to the Barcroft facilities. The line and poles in that 13-km (8-mi) stretch were downed in a severe ice storm in the winter of 1979.

In 1958, the White Mountain Research Station's first facilities in the Owens Valley were located in a leased building in Big Pine. This building served as both the headquarters for the Station and as a storage warehouse.

A new nine-acre site for the Owens Valley facilities and headquarters 5.6 km (3.5 mi) east of Bishop was leased from the City of Los Angeles in 1962. In 1965 three small frame buildings (one an ice house) were acquired from the U.S. Vanadium Corporation and moved to the site east of Bishop, and in 1966 a pre-fabricated steel classroom was added to the Owens Valley facilities.

In 1970, a pre-fabricated steel building was added to the Owens Valley facilities as a dormitory for 30 individuals; this unit was completely remodeled by 1984. One of the wood frame buildings was expanded into an office, kitchen, and large dining room building in 1983, and enlarged in 1987 to seat 70 individuals. The second frame building that had been used as a laboratory was remodeled into a dormitory in 1981. The former ice house, which had been used as an animal holding space during its early usage at the Bishop facilities, was remodeled into a modern scientific laboratory in 1985. Both the classroom and the steel dormitory were later remodeled in 1985. The Bishop facilities serve as headquarters for the activities of the White Mountain Research Station and for those at Crooked Creek.

In 1961, three more buildings were erected at the Crooked Creek site: a dormitory, a research poultry house, and a vehicle maintenance shop (Quonset) were added to the small frame building that had provided living quarters during the earliest history of the Crooked Creek facilities. The poultry house has been dismantled, the Quonset building will be removed upon completion of the new Crooked Creek facilities, and the wood-frame dormitory and adjoining frame building are being converted into a modern laboratory.

Water used at the Crooked Creek facilities came from a nearby spring north of the facilities until 1990. In 1990 a water well, testing 75 gal/min, was drilled south of the facilities; this water now supplies the facilities at Crooked Creek.

During 1971, the 1951 Cooperative Agreement between the U.S. Forest Service and the U.S. Navy was replaced by a Classification Order under Secretary of Agriculture Regulation U-3, establishing the White Mountain Scientific Area. The new scientific area included both the Summit Laboratory and the Barcroft facilities.

In 1973, the Office of Naval Research determined that it no longer had a high-altitude research mission and offered to transfer all property and pertinent Use Permits to the University of California. An environmental planning study was funded (\$10,000) from the Office of the UC President, a Justification Statement was prepared, and the Statement was submitted to the U.S. Forest Service on March 26, 1975. Three years later, on May 4, 1978, with the concurrence of the U.S. Forest Service, the U.S. Navy transferred all property and pertinent use permits to the Regents of the University of California.⁵ During the three-

⁵On May 4, 1978, the Department of Navy, Western Division Naval Facilities Engineering Command, P. O. Box 727, San Bruno, California (Navy Reference: 241:HNH:js, ONR White Mtn/D) transferred "buildings, structures, utilities, and other facilities" to the University of California. On the list of the attached facilities to this memorandum from the Department of Navy is the "Administration Building (58 x 24 x 10) at Crooked Creek," and, "19 miles of unimproved road from Crooked Creek to the Summit Lab on White Mountain."

five-year period (1975-78 or 1973-78) astronomers, in addition to working in the infrared, tested the optical seeing and sky brightness above the White Mountains. Optical testing was part of the University's study related to attracting the planned 10-meter telescope.

In 1976, a 16-ft diameter by 20-ft high observatory was erected at an elevation of 3,871 m (12,700 ft), near the Barcroft facilities. A 62-in spin-cast mirror telescope was installed in the observatory (remaining there from 1976 to 1979). Also in 1976, the lease with the City of Los Angeles for the Owens Valley facilities was renegotiated and included 32 acres.

The UC/Cal Tech (Keck) 10-meter telescope Site Selection Committee in 1979, reviewing the data collected by the 62-inch mirror telescope near Barcroft, along with data from several other possible sites, concluded that the Mauna Kea, Hawaii site was superior to White Mountain as a site for the 10-meter telescope. Mauna Kea's altitude was comparable to that of Mt. Barcroft, but the overhead water vapor was twice that at White Mountain. However, the lower latitude site in Hawaii offered more sky coverage, more uniform weather, lower winds, and lower day/night temperature changes; these factors determined the selection.

Between 1975 and 1978, the Crooked Creek facilities were used by the UCLA Department of Earth and Space Sciences for its summer field class. In 1979, the UCLA geology class moved to the Barcroft facilities. In the summer of 1980, the class returned to the Crooked Creek facilities. This seemingly unimportant period in the history of the Crooked Creek facilities was a central element to events that began in 1979.

In 1979, the Crooked Creek facilities were "informally transferred" to the U.S. Forest Service by Acting Director William J. Welch. The U.S. Forest Service refurbished the facilities in that year and had proposed to make the facilities available to scientists (*i.e.*, utilization of two small one-person hutlets near the main building) on an as-needed basis. There was no provision for housing UC classes at the Crooked Creek facilities in the Forest Service's plan. The final transfer of the Crooked Creek facilities by Acting Director Welch was apparently slowed by the UC Berkeley Campus Matériel Management Department. The Station had traded its road grader for future road maintenance by the Forest Service, and in 1979 it was the plan to trade the value of the Crooked Creek facilities for future road maintenance by the U.S. Forest Service. The Station had planned on maintaining its Barcroft facilities on a year-round basis and on housing two of its WMRS staff at those facilities throughout the year. Owing to the cost of road maintenance and labor, it was reasoned that the Station could no longer operate the Crooked Creek facilities and maintain its Barcroft facilities. However, no formal transfer took place from the Regents of the University of California to the U.S. Forest Service.

During 1980, C. A. Hall became the Director of the White Mountain Research Station. A new 20-year land lease for the Bishop facilities was negotiated with the Los Angeles Department of Water and Power that year, and efforts were initiated to clarify the ownership of the Crooked Creek facilities. Under the new director, the Barcroft facilities were only open during the late spring and into the early fall, (*i.e.*, when there were researchers to occupy the facilities.) The Barcroft facilities were to be reserved for research,

and classes of students occupying the same facilities were considered to be incompatible with research activities. On the other hand, the Crooked Creek site was perfect for classes and ideally located for studies of natural history and science. However, the modest accommodations were insufficient for large numbers of students.

During 1980, there were lengthy written correspondence and negotiations between the UC Office of The General Counsel, the UC President's Office, the President's Advisory Committee, the Forest Supervisor of Inyo National Forest, the District Ranger of the White Mountain Ranger Station, and the Director of White Mountain Research Station regarding ownership of Crooked Creek. An oral understanding was reached between the University and the Forest Service by March of 1981, and by May of 1981, finalized "Short-term and Long-term Agreements" for the use of the Crooked Creek facilities were transmitted to the Forest Service by the Office of the Senior Vice President of the University of California. However, by August of 1981, the Forest Service had not responded to the proposals and there followed a change in the senior administrative personnel in the Forest Service for the region. A new acting Forest Supervisor made a significant change in what were to have been the finalized agreements between the Forest Service and the University regarding ownership of the Crooked Creek facilities. He returned the Agreements to the UC General Counsel with a claim that the U.S. Forest Service owned the Crooked Creek facilities even though there had been no transfer of title by the Regents of the University of California. However, by 1982, the issue of ownership of the Crooked Creek facilities had been resolved—the resolution was that the Regents of the University of California owned the facilities. Following this difficult period for the University and the Forest Service, a new spirit of friendly and thoughtful cooperation between the White Mountain Research Station and the U.S. Forest Service was achieved, and the friendship continues today.

At a dedication ceremony in 1983, attended by more than 200 individuals, the main building at the Barcroft facilities was named the Pace Laboratory, in recognition of the more than 30 years of contributions by Professor Nello Pace to high-altitude research and for his extraordinary wisdom and foresight in first developing the White Mountain Research Station.

In 1984, the Station received a grant from the National Science Foundation for \$150,000, and the Station contributed \$50,000, to bury the power line for a distance of 13 km (8 mi) from the Crooked Creek facilities to the Barcroft facilities—work was completed in 1985. The reduction in diesel fuel fumes from diesel-electric generators, the ability to provide non-variable power, and the availability of power on a 24-hour basis at the Barcroft facilities marked a major improvement in health, safety, and service for researchers. An incidental, but not insignificant benefit was that the removal of the telephone poles that had carried the overhead lines enhanced the stark beauty of the terrain between Crooked Creek and Barcroft. The burial of the power line was a remarkable achievement with the limited funds available. The work was carried out under the direction of Senior Superintendent David Trydahl.

In 1986, the Station began to plan for new or substantially remodeled facilities at Crooked Creek. The Crooked Creek site is at a "crossroads" along the crest of the White Mountains, near the Wyman Canyon road to the east, the Silver Canyon road to the west, and along the crest road from the Shulman Grove of Bristlecone Pines to White Mountain Peak. The elevation of the Crooked Creek site is such that it presents less physical stress on classes of students and research groups than that found at the Barcroft facilities where oxygen is less abundant. A good supply of water is available, and the biota is richer in the Crooked Creek area than at higher elevations. The Crooked Creek site lies within a classic geologic region, which includes Early Cambrian fossils; it is within a few hundred meters of an early native American archaeological site, and within a few kilometers of the highest recorded archaeological site in North America; and it is bordered by a grove of ancient Bristlecone Pines. New housing facilities at Crooked Creek, it was reasoned, could lend themselves to field biology and geology classes and seminars for universities, colleges, and educational institutions. The facilities could also be used in cooperation with the US. Forest Service. The Crooked Creek site can be reached by regular vehicles along paved and gravel roads generally from May through November, making it unique amongst high-altitude research stations elsewhere that are severely limited by fall, winter, and spring conditions.

In 1986, Marc Appleton and Associates, largely *gratis*, began to develop plans for proposed new facilities (~\$2,000,000) at Crooked Creek. With the support of the WMRS Advisory Committee, the Station set out to gain the necessary acceptances of those plans in terms of its Environmental Impact Report, acceptance from the U.S. Forest Service, county authorities, and the citizens of the region. The process of review was a long one, and the quest for funds to build the new facilities proved to be fruitless for several years.

However, in 1989, the fortunes of the Station changed dramatically. Through friends of Vicki Doyle-Jones, Program Representative for WMRS at UCLA, the Station was made aware of two cedar-log buildings (one called the Starlight Bar and Grill) (total ~6,000 sq ft) that were to be demolished in downtown Los Angeles, two blocks from the posh Bonaventure Hotel and adjoining the head offices of UNOCAL. The Station was able to negotiate the purchase of the buildings for \$10,000. The dismantling of the buildings by WMRS staff was fraught with danger from thieves, looters, and street people who wished to use the buildings as their home or stole from the staff. Truckers carrying hay to the Los Angeles area from Bishop hauled the dismantled log buildings from downtown Los Angeles to Bishop, on what normally would have been a return trip with unloaded trucks. In 1991 the Office of the President of the University of California allocated funds, over a two-year period, to be used for the purpose of building new facilities at Crooked Creek, with the log buildings from Los Angeles as the base of the new facilities. The support of Senior Vice President William Frazer and UCLA's Capital Programs office were instrumental in bringing construction of the main buildings (shop/utility building, dormitory/office building, and kitchen/dining room building) at Crooked Creek to conclusion. Without their encouragement, the initiation of the contact by Vicki Doyle Jones with the owners of the log buildings,

the dedication of purpose by Marc Appleton and his associates (who in a novel way re-cast the earlier plans for the new Crooked Creek facilities), the able direction of the dismantling of the log buildings and the management of the skilled construction of the new facilities by Senior Superintendent Trydahl, and the quality of workmanship and care exercised by those building the Crooked Creek facilities, the dream of providing a new research facility in the White Mountains would not have been realized.

The following chapters provide a review and new data on the natural history of the Crooked Creek area. This information can be supplemented by *Natural History of the White-Inyo Range*, edited by C. A. Hall, Jr., University of California Press, 1991.