

Chaco Culture National Historical Park, New Mexico IDA 2016 Annual Report

Chaco Culture National Historical Park has continued to maintain a successful night sky program with increased focus on stewardship of our dark night skies. In addition to regular scheduled public programs including regular night sky programs every Tuesday, Friday, and Saturday evening, monthly moon walks, and special guest lectures; we have conducted outreach to local communities bringing night sky appreciation to local elementary schools. The park also recruited an intern to develop an archaeoastronomy guide for visitors (see attached), created a Junior Ranger Night Explorer Patch (see attached), and funded the creation of a Dark Sky video for the interpretive staff traveling trunk.

This fiscal year our Artist in Residence, Stan Honda, an accomplished photographer, conducted several night sky presentations at Chaco Culture National Historical Park and Aztec Ruins National Monument presenting his art, high quality wide-angle night sky landscapes visible at Chaco. He discussed his background and presented some of the amazing photos that he's taken during his residency. Stan's fantastic work has helped to better promote the night skies present at Chaco.

The Chaco Night Sky Program attendance has increased nearly 40 percent since last year; suggesting that the program is growing significantly. Chaco provided 41 dark sky programs to 3364 visitors this year.

We continue to see increased interest in our dark sky programs. Chaco continues to strengthen our partnerships with the Albuquerque Astronomical Society and the Friends of Chaco as they support our dark sky programs.



Witch Head Nebula, or IC2118, is a reflection nebula in the constellation Orion. Image taken at CCNHP.

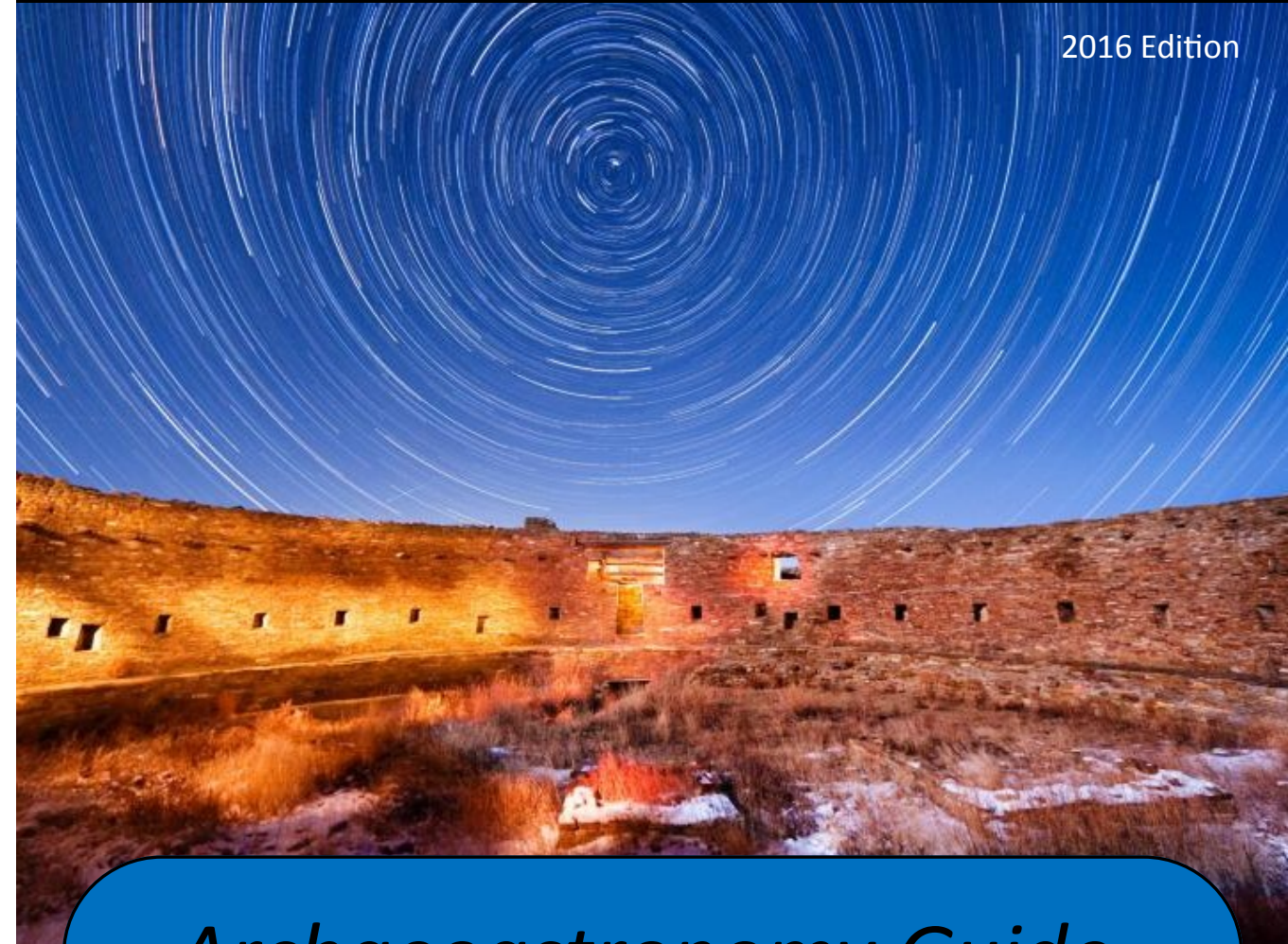


Chaco Culture

National Park Service
U.S. Department of the Interior
Chaco Culture N.H.P.



2016 Edition



Archaeoastronomy Guide

Please return this guide to the Visitor Center for the enjoyment of future visitors.

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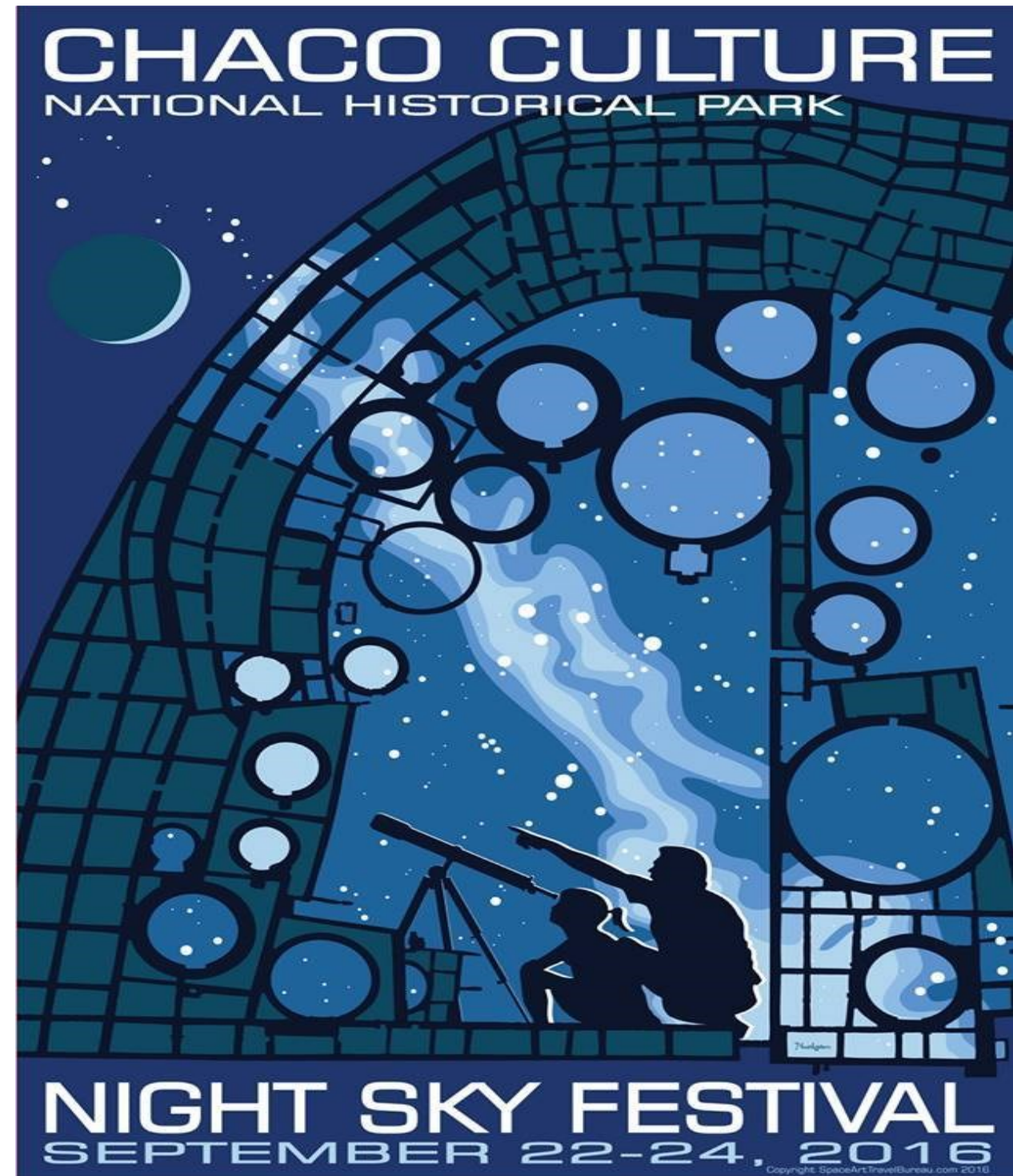
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Introduction

The ceremonial life of many of the people in Chaco Culture National Historical Park (NHP) here on earth may be timed to the events seen in the heavens above. The observational powers of people who lived intimately and harmoniously with all aspects of their natural environment are considered to be acute and multifaceted. Many sites in Chaco Canyon have been selected by such researchers as places that offer examples of ancient knowledge of astronomy. Some researchers go as far as asserting that the architecture found in the great buildings of Chaco is especially aligned to solar and lunar events.



Get involved & References

Ongoing Research

The Solstice Project, Santa Fe, New Mexico @ www.solsticeproject.org

Get involved locally

International Dark Sky Association @ www.darksky.org

Global Astronomy Month, April

International Observe the Moon Night, October @ www.lpi.usra.edu

Find a local International Dark Sky Association chapter @ www.darksky.org

Eclipse Gatherings @ www.eclipseaas.org

Find local amateur astronomy groups

Suggested Readings/References

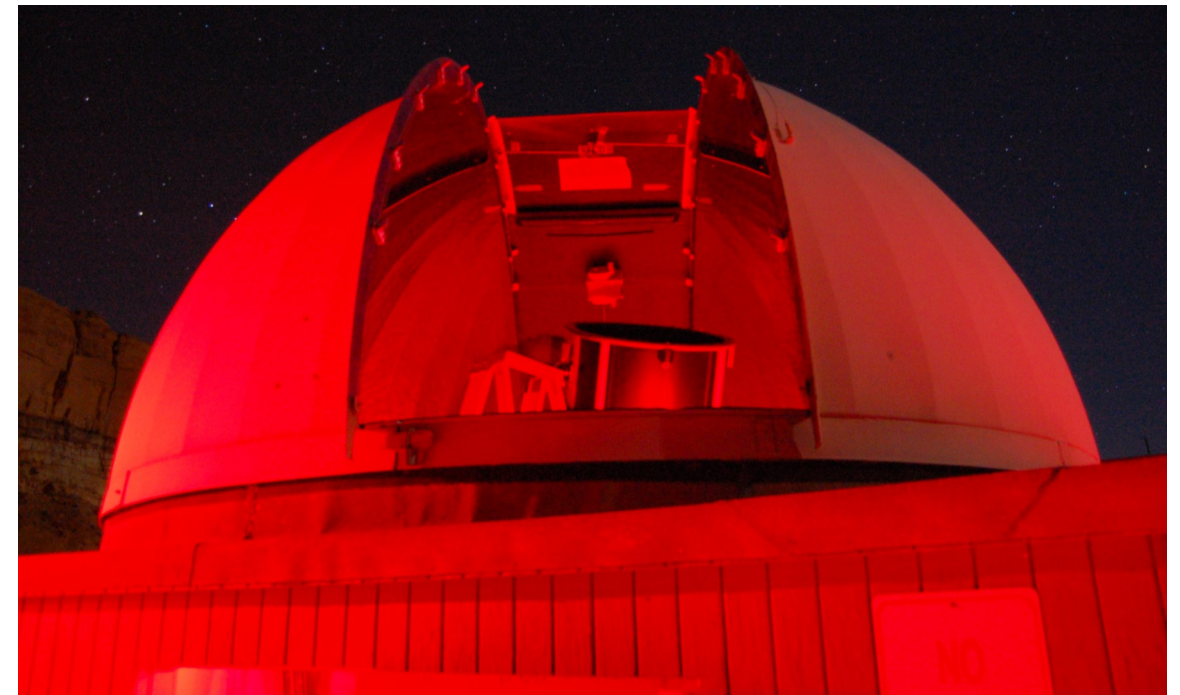
- ◆ Living the Sky: The Cosmos of the American Indian by Ray A. Williamson, 1984.
- ◆ Prehistoric Astronomy of the Southwest by J. McKim Malville & Claudia Putnam, 1989.
- ◆ Stars Above, Earth Below by Tyler Nordgren, 2010.
- ◆ Chaco Astronomy: An Ancient American Cosmology by Anna Sofaer, 2008.
- ◆ Moon Tracks by Ron Sutcliffe, 2006.
- ◆ Archaeological Surveys of Chaco Canyon, New Mexico. Publications in Archaeology 18A. Chaco Canyon Studies. NPS USDO. Washington, D.C. 1981. Hayes, Alden D., David M. Brugge and W. James Judge.
- ◆ Chaco-esque by Richard and Shirley Cushing Flint, 1989.
- ◆ Ecological Consequences of Artificial Night Lighting by Catherine Rich, 2006.

Poster Designed by Tyler Nordgren (p.25)

Sky as Constant

While many of these ideas remain controversial, what cannot be questioned is the extreme degree of darkness that today characterizes Chaco Canyon's night sky. The extremely high quality of the dark sky visibility of the park has attracted groups of people from the four corners and beyond.

At least one constant we know is true is that looking at the sky is continuing an ancient tradition. Although much of the Chacoan environment has changed over time, the sky has changed the least. We are looking into the sky for the same reasons as those before us. Perhaps we are trying to find our place in the universe.



Chaco Observatory, est. 1998

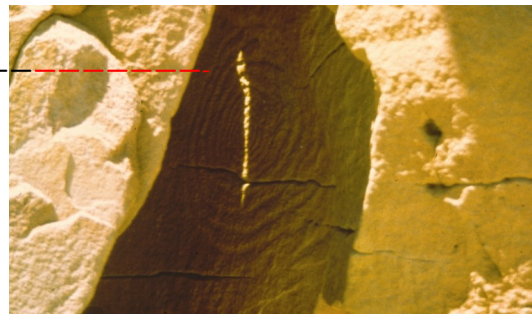
What This Book is About

This booklet is intended for the visitor who would like an onsite guide for seeing the sites for themselves. It offers pictorial and written descriptions clearly as possible so the visitor gets their chance to survey the sites in their fullest physical context.

As with many areas of research there have been a variety of people and institutions offering their methods and conclusions. Often disagreements abound. It is not the purpose of this booklet to favor one researcher over any of the others. Rather, we are concerned with the visitor's experience and want their time in the canyon to be as informative as possible. They will remember the sites where they gain the greatest understanding of the site's significance.

We have also been very selective in our choices of sites, concentrating on places the visitor can actually go. An example is the famous "Sundagger" on Fajada Butte, one of Chaco's natural icons. It has been and off limits area for park staff and visitors for many years. Much has been published (books, films, magazines, etc.) and there is ample information at Chaco's bookstore.

Sundagger



All people everywhere have made their best attempts to understand our truest relationship with the larger world. While we continue to seek the greater understanding, it is also invigorating to look back at our predecessors, stand in their place and come face to face with the same view of the world they would have seen limited only by our capacity to let it in.

Modern sky watching in Chaco Canyon



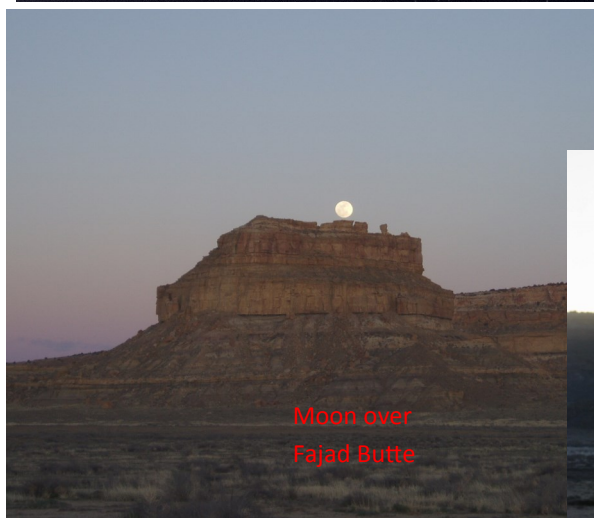
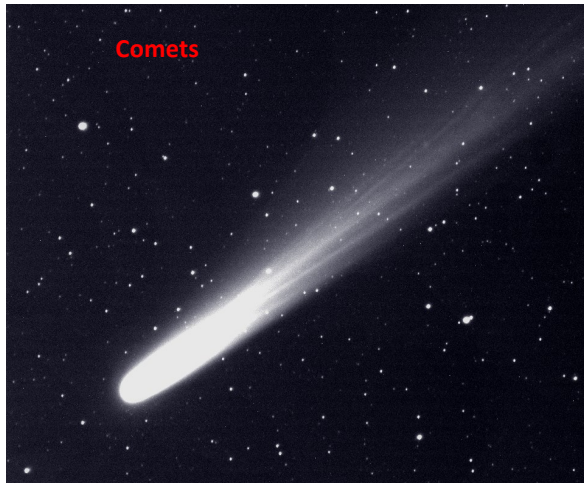
In Chaco Canyon, we continue the tradition of watching the sky by hosting night sky programs throughout the week, moonlight moon walks in Pueblo Bonito, exploring the sun through our solarscope and hosting an annual astronomy festival. As an International Dark Sky Association (IDSA) Park, we establish a "sanctuary of darkness" and a dialogue for ways to enjoy and protect natural darkness.

In order to protect our night skies and preserve their stories, the IDSA suggests awakening your nocturnal senses and conquer fears of darkness by stargazing from your own backyard, talk with your neighbors about your appreciation for the night sky, and consider using light only when you need it. All living things benefit from natural darkness; consider replacing your outdoor fixtures with energy-efficient and shield-responsible shades.



Constellations, Comets, and Night Sky Patterns

We know the Ancient Chacoans watched the Night Sky and probably noted these common Night Sky Phenomenon



What is Archaeoastronomy?

Archaeoastronomy is the study of ancient people's astronomy. Its interdisciplinary approach allows it to investigate written records, folklore, observations of celestial events, alignments in architecture and traditions of calendar keeping. All, hopefully, have the goal of understanding the deeper cultural context of the peoples involved.

Architectural orientations can be measured and compared to what was going on in the sky. If patterns are found among the constructions of the culture, we gain insight into some of their strategies for survival in a most harsh land.

Chaco has nearly five decades of research by different groups, institutions and individuals using a variety of methodologies. It is clear that the people of Chaco encouraged a thorough understanding of the celestial realms, both day and night. Many of the studies have centered on observing the sun as it rises and falls in changing arcs tracing out the rhythmic pattern of the seasons.

Why is it important?

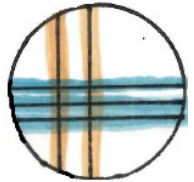
- This is what calendars used to be. To understand the patterns of change is essential to live a life that is in balance with the natural world. Watching the sun, stars and moon were the direct ways that people learned how to tell time. We believe that the predictive quality of the markers is what made them most useful. Some days are marked on the day itself, but if you are going to prepare for ceremony, agriculture, etc, you must be able to predict the times.

We also recognize in these ancient peoples a kinship. We too exist successfully in our environment only if we pay attention to what the larger world is telling us. While we have technologies the ancients did not have, we must also pay attention to the world as it dances out the seasonal patterns, and always be alert to changes in those patterns. In Chaco we look for those places where a thousand years ago watchers stood looking out to the horizon, or into a darkened room watching a slice of light on the wall, taking note of the time of year and how it all changes.

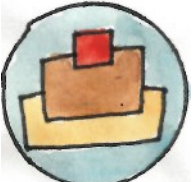
How To Use This Guide

- Please, travel only to sites described in this book as noted. Staying on trail maintains these sites for cultural respect, geologic integrity and future generations.
- This is a not a textbook but a guide for your own interpretation.
- Evidence for these interactions has been based on decades of research and collaboration although their intention can not be proven.
- If you would like to read more in depth about these types of sites within and beyond Chaco Culture NHP, please see our suggested readings.

KEY



Architectural Alignment: This symbol represents an alignment to cardinal directions, or an astral body, within a building or site.



Interacting Architecture: This symbol indicates an interaction between structures within the Chacoan system.



Interactions with Rock Art: This symbol suggests a pictograph(ic) or petroglyph(ic) relationship with an astronomically significant site.



Possible Astronomic Event: This symbol represents a potential witnessing of an astronomic event during the Chacoan era.



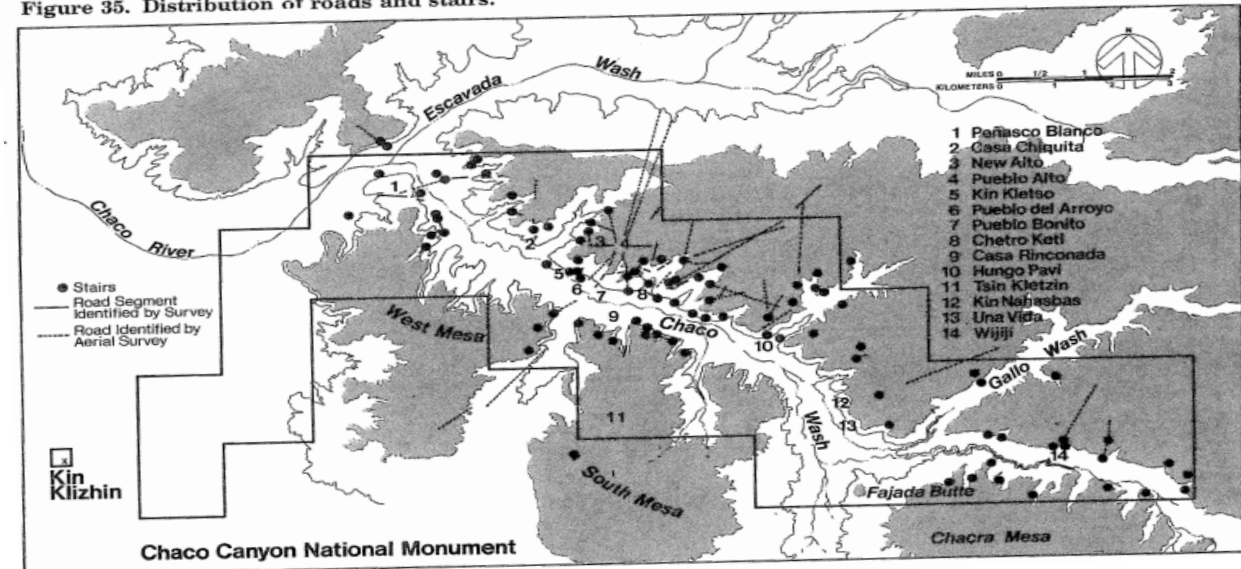
Horizon Marker: This symbol suggests a natural marker on the horizon that has a relationship with sun, moon, or sky watching.

There are many different ways people have described the linear features that the Chacoans built across the landscape; some people call them roads. Some suggest they were symbolic rather than utilitarian that served as reminders to the larger population of their connection to Chaco. Some researchers think that they were processional paths for incoming pilgrims. Some think they were trading routes or pathways for foot races. This “road system” has segments up to 40 miles long and 30 feet wide in many places. The road connects many features throughout the greater Chaco system through lines of sight that could have been used for signaling.

Whatever the significance of these roads, they were elaborate. Like so many features in the Chaco system, these “roads” were overbuilt for any purely utilitarian purpose. With incredible consistency and extensive soil removal (trenched digging and berms are characteristic of these thoroughfares rather than compacted soil) suggest these sites were of great importance. However, what for?

One segment of this system, the North Road, is so precise in its northern orientation, suggesting the Chacoan’s interest in the cardinal directions.

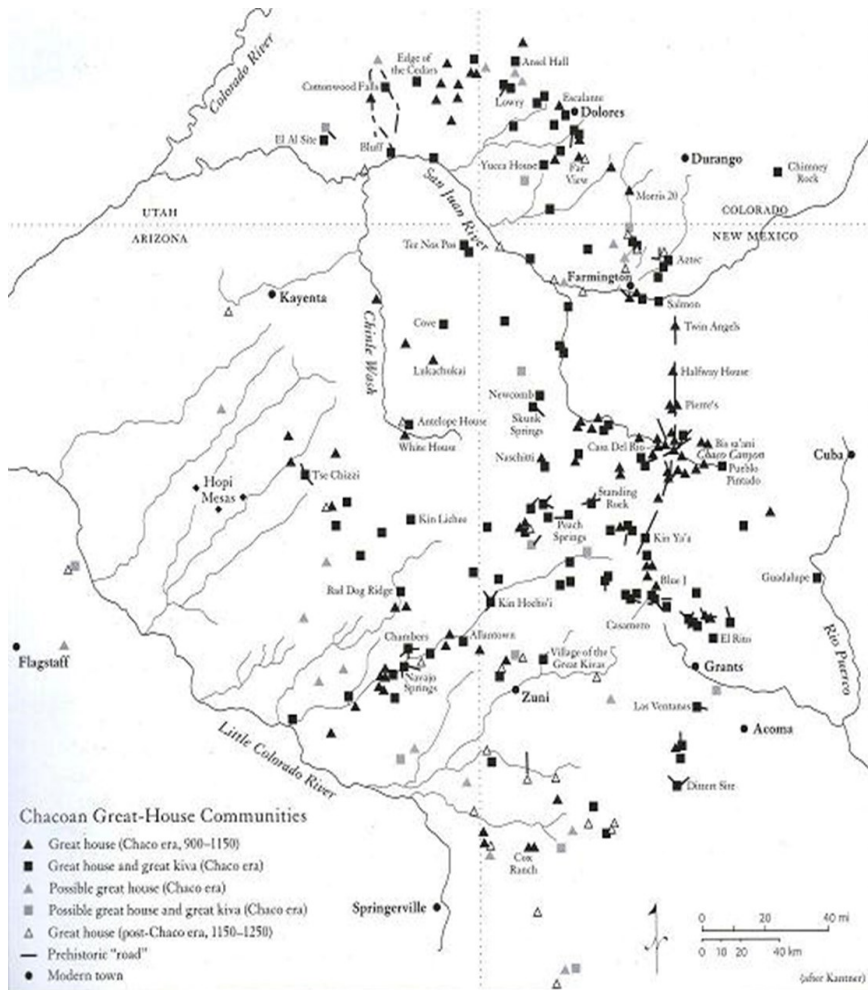
Figure 35. Distribution of roads and stairs.



Adjacent Ancestral Puebloan & Chacoan sites

Although it is not certain that the many Chaco-esque great structures were ever incorporated into a large collaborative system, there are many distinct, shared, region-wide architectural traditions. Twelve of these 200 Chacoan structures lie in Chaco Culture NHP and exhibit the heart of these traditions. These sites may represent a direct and almost spiritual link between our

Selected List of Outlier Chacoan Sites



- Chimney Rock, Colorado
- Aztec Ruins, New Mexico
- Salmon Ruins, New Mexico
- Homolovi, Arizona

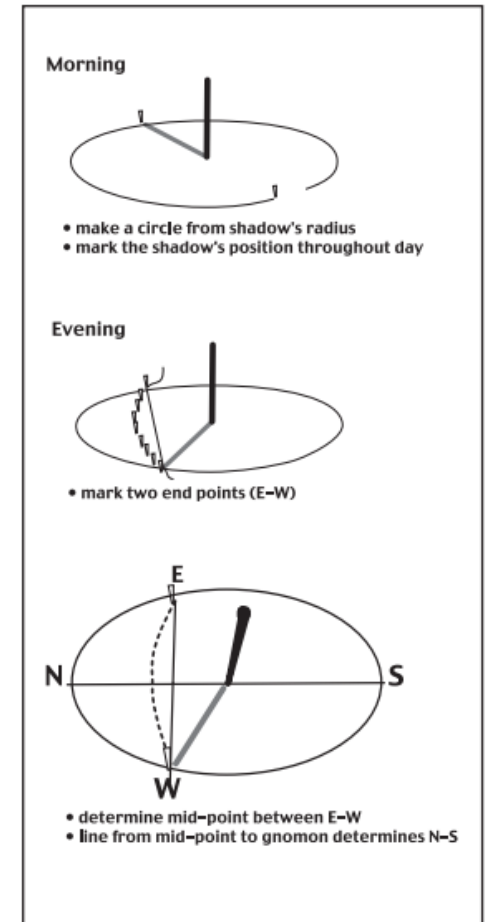
MOMENT FOR SCIENCE : orienting the world with gnomons

Finding North by the sun!

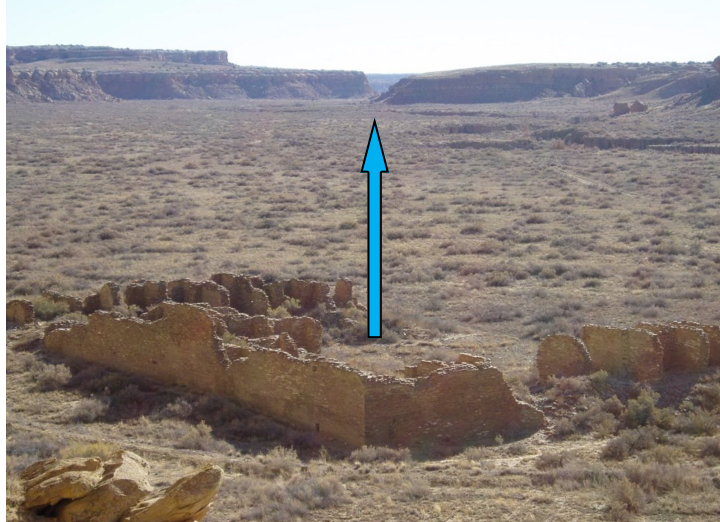
Setting up a stick perpendicular to the ground and marking shadow lengths on either side of noon can determine geographic north with excellent accuracy. North can then be discerned by bisecting the line between the endpoints of the shadows of equal length and then connecting this point with the base of the stick.

After determining North, one can continue to use simple tools to determine other cardinal directions! The ancestral astronomers in Chaco Canyon probably used shadow and light to determine directions without using objects we can use today like a compass.

Chacoan skywatchers witnessed the sun and moon rise and set along the horizons of Chaco canyon. Their incredible ability to subsist in a high desert climate for centuries, as well as build elaborate and cardinally-aligned structures, suggests an elaborate understanding of apparent solar and lunar movements across our sky.



Anna P Sofaar and the Solstice Project, Inc. C 2007

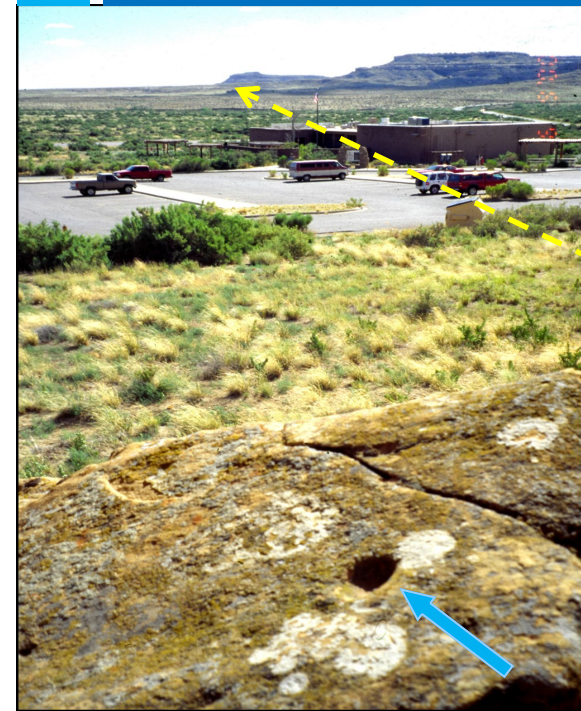


From inside the southwest corner of Wijiji, the diagonal of the building lines up with a notch on the southeast horizon.



Two weeks before summer solstice, the sun rises in the left of the notch acting as a predictive marker.

During the summer solstice, the sun rises in the right side of the notch, as predicted two weeks earlier, thereby confirming the winter solstice.



On the west side of Piedra del Sol is a view to the southwest mesa, where the sun sets two weeks before the winter solstice.

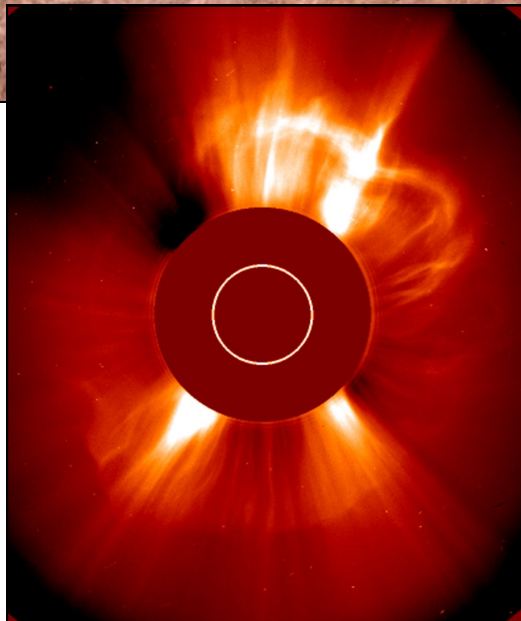


Pecked basins (as marked above) and grinding areas (see right) are often found in tandem. Both of these features are found at this site, perhaps indicating where a sun watcher would grind material such as corn, or precious stones. These would then be deposited as an offering in the pecked basins as part of his sun watching activity.

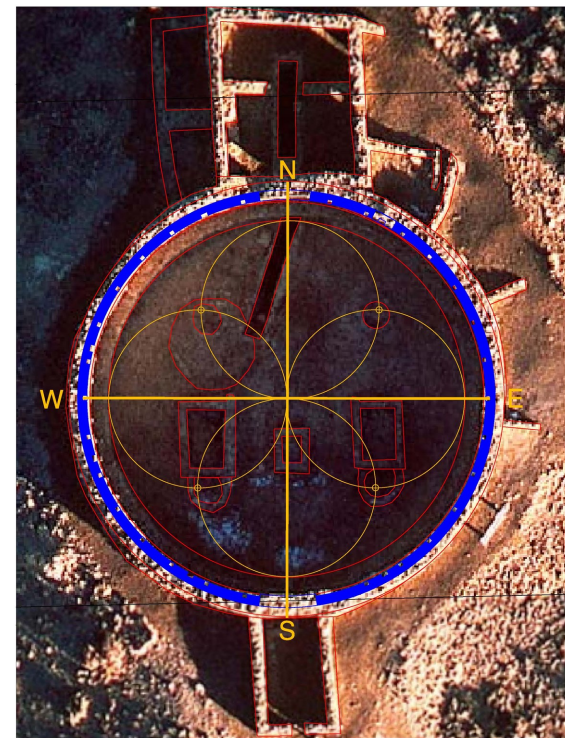




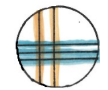
On the south side of the boulder there is a petroglyph that may be a rendition of a total solar eclipse, which we know the Chacoans witnessed in 1097 CE.



To the left, is a picture from a solar observatory in space, showing the corona of the sun, highly resembling the petroglyph seen above.



Summer solstice sunrise enters the kiva through a North side of the building east of the door, 25 minutes after sunrise occurs, the sun enters one of 34 niches that ring the inside wall of the kiva.



The largest of the great kivas that we know of in the Chaco system has cardinal direction alignments within its architecture.

Precise alignments to N-S lie between the two stairways in the building, Four distinct features—2 niches and 2 walls on floor—define the W-E line through the center of the building.

Casa Rinconada

1075-1250 CE



This N-S line of the stairways lines up directly with New Alto on the mesa top across canyon.



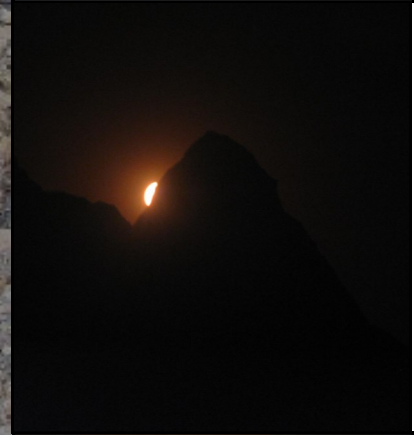
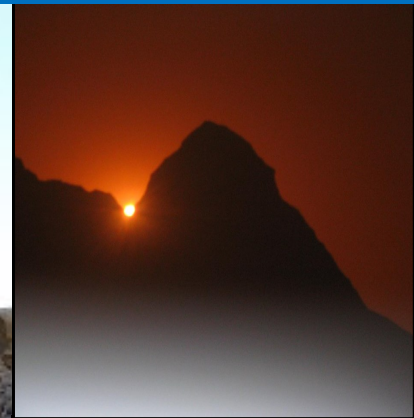
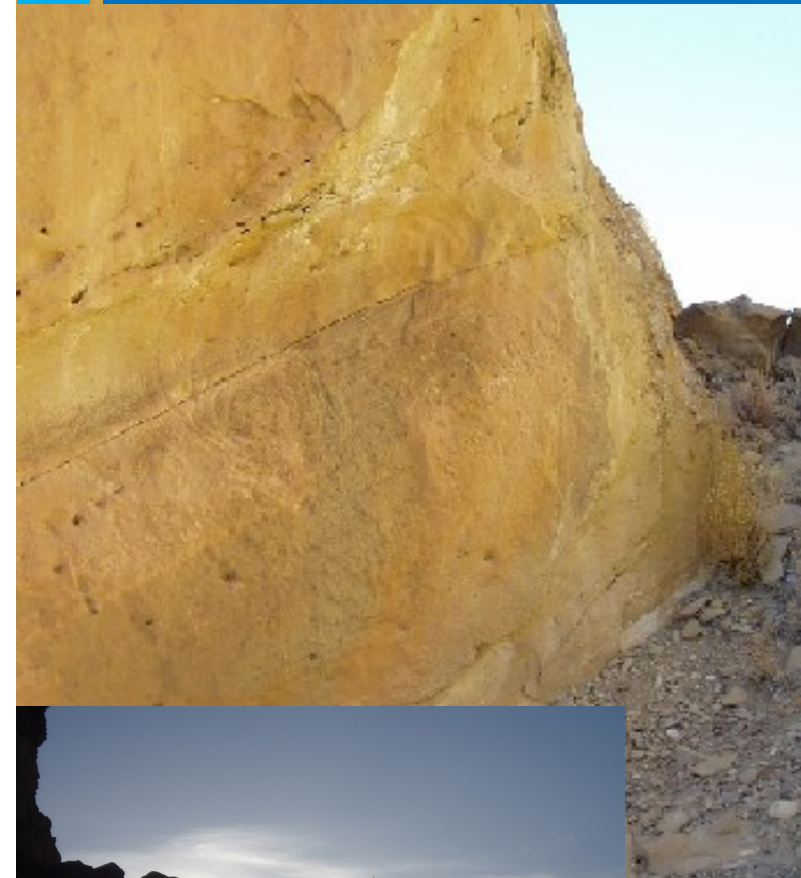
The north side of the structure has a room that has two doors directly W-E that are also in line with the equinox sunrise.



In addition to the alignment with the two doors the sunrise appears on the equinox at a distinctive point on the horizon.



Piedra Del Sol



On the East side of a boulder, there is a spiral about a foot across in diameter. Looking out from the center of the spiral, the sun rolls up the side of a triangular boulder to the east, two weeks before the summer solstice there is a triangular boulder to the east.

Supernova Pictograph & Halley's Comet



In the west end of the canyon near the end of the Penasco Blanco trail, is a pictograph which suggests the witnessing of a star that exploded as a Supernova in the constellation Taurus, next to a waning crescent moon on July 5, 1054.

This is an event we know the Chacoans would have seen as this was during the height of the Chacoan culture. The star became so bright when it exploded that it could be seen during the day for over three weeks. (We have recordings from Asia and the Middle East also verifying this event.)

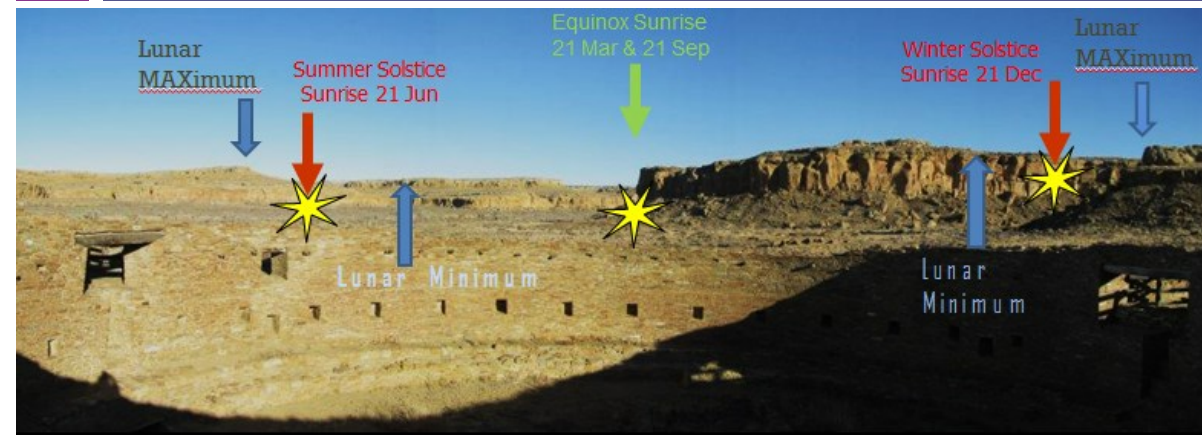
The hand may be a directional component, pointing to the horizon where the supernova rose an hour and forty-five minutes before sunrise.

The concentric circles beneath the upper paintings might be the sun before it rose or, possibly a comet when taking into account the pigment to the right. We know in 1066 CE, these people would have also seen a spectacular return of Halley's Comet. Within this twelve year period (1054 to 1066), some of the Chacoans would have seen both of these incredible events. These interpretations are purely circumstantial as these paintings cannot be dated.



Red pigment is probably crafted of hematite (iron oxide ore), found here in the canyon.

MOMENT FOR SCIENCE : Sun and Moon Cycles



From the naked eye observations of ancient people's view point, watching the sun and moon would have been of high importance. They would have quickly grasped the yearly cycle of the sun's rising and setting positions. To illustrate: while the sun always rises on the eastern horizon, it does so between a position to the north and another to the south. These extremes are the SOLSTICES, which means 'sunstandstill.' Here the sun will rise without change for 4-5 days, and set in its opposite position. Watching the sun from a particular place on earth gives the observer fixed reference points from which to memorize this annual cycle in order to bring the people of the community into a harmony with the seasonal cycles. The construction of buildings can also provide fixed places from which to observe.

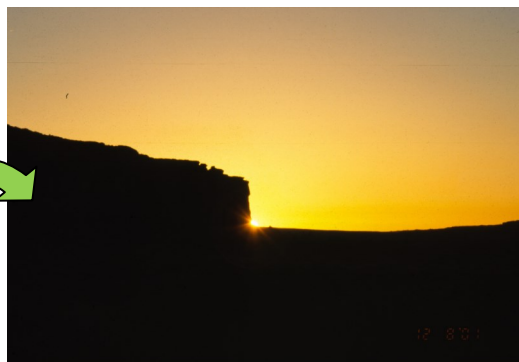
The moon is more complicated than the sun. Besides its monthly swing around the earth with its changing phases, it also has 'standstill' positions to the north and south. Every month in its orbit around the earth, an observer on earth could view the moon rising and setting between a northern position and two weeks later between a southern one. The distance between the north and south positions changes almost every month and a faithful observer will see the distance increase every month. There will come a time when the moon will rise and set at its most northern, and two weeks later, at its most southern. For the next 2-3 years, the moon will rise between these points. This is the lunar maximum, sometimes called "Major Lunar Standstill." Following these years the moon's north and south points will decrease until, once again, the moon 'standstill' which is called lunar minimum, or sometimes called "Minor Lunar Standstill." This cycle takes 18.6 years.

Kin Kletso

1100-1150 CE



To the East of Kin Kletso there is a natural notch on the horizon.



From the SE corner of Kin Kletso, two weeks before the winter solstice sun rises in the notch.



From the NE corner the sun rises again in the same notch on the winter solstice.



Kin Kletso is a very late great house, built in two phases. Unlike many of the great houses, it has no plaza and it does not particularly face south. It contains seventy-five rooms, including five round structures. However, it has a very distinct relationship to the eastern horizon and the winter solstice.

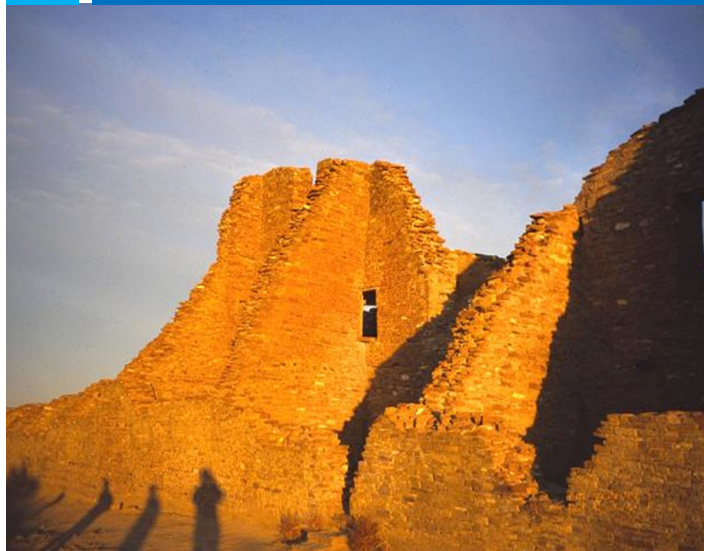
Pueblo Bonito

820-1200 CE



To the west of Pueblo Bonito are natural horizon markers that can be used to mark many different times of year. Above you see where the sun rises on the summer solstice. Below, you see where the sun rises on October 29, and is the first day that the sun goes into the doorway. From this SE corner of Bonito, we see the two basic techniques for marking the sun— from summer solstice to October 29: natural horizon markers; from October 29 to winter solstice: the light on the wall inside the room.

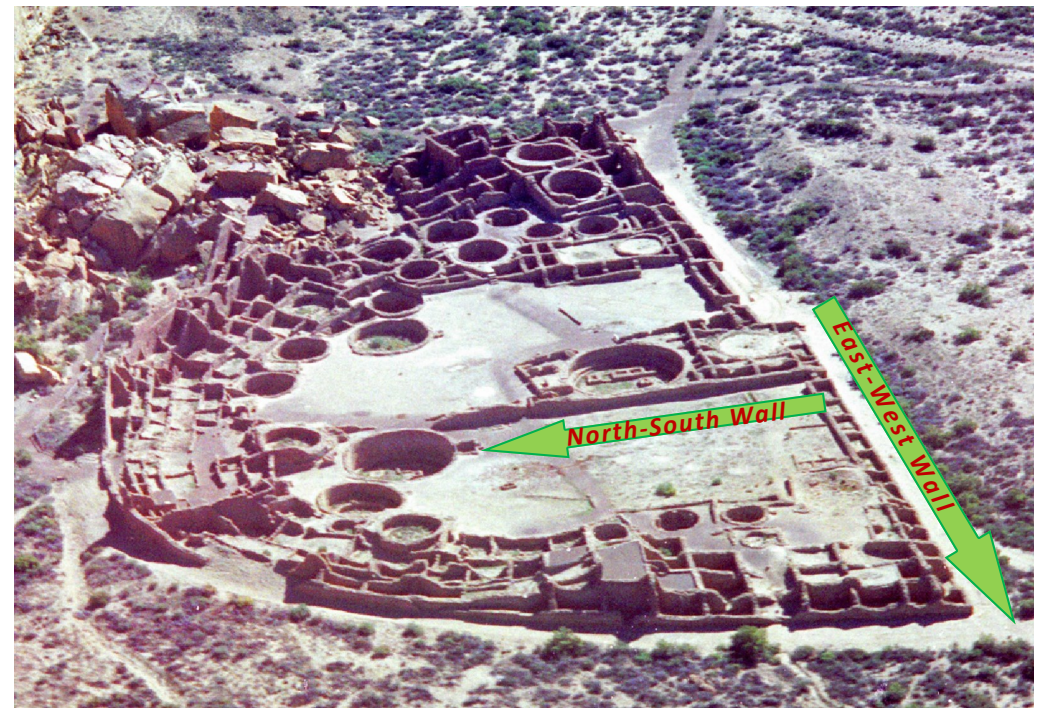




This corner door receives the sun beginning on October 29 (upper right). On the winter solstice, the sun has moved across the wall into the corner (middle right). The corner masonry structure seen in both photos was probably added to the room, filling in the original corner, suggesting the room was refitted to provide good prediction and confirmation o f the winter solstice.



Standing at this structural extension of this SE corner of Pueblo Bonito, provides a view to natural horizon features that can be used as calendrical markers.



Pueblo Bonito exhibits many of the attributes that make the Chacoan great houses special. The south facing aspect of the building takes advantage of the sun through the different seasons (it is a passive solar construction). The strict adherence to the cardinal directions (N-S-E-W) is shown in the illustration above. Being one of the first great houses in the Chacoan system, Pueblo Bonito has long construction dates (over 300 years) which may suggest evolving ideas and a changing social structure.





National Park Service
U.S. Department of the Interior

Chaco Culture NHP
1808 CR 7950
Nageezi, NM 87037
505-786-7014
nps.gov/chcu

News Release

For Immediate Release: September 8, 2016

Contact: Hilary Grabowska, Lead Interpretive Ranger, hilary_grabowska@nps.gov
505-786-7014 ext 261

Learn about Astronomy and the Effects of Light Pollution at Chaco Culture National Historical Park

For the first time, Chaco Culture National Historical Park will be hosting an Astronomy Festival on September 22-25th. Join us as we learn about the Solar System, celestial alignments, night sky photography, and light pollution.

As a part of the National Park Service Centennial, this Astronomy Festival will explore new topics and invite new visitors to explore and learn about the park and the dark sky. Chaco Culture NHP is a designated International Dark Sky Park and is one of the best locations to stargaze.

The Astronomy Festival will kick off with the Autumnal Equinox on September 22nd. The first 100 visitors at the gate before 6am will be able to witness the sunrise alignment through the doorways at Casa Rinconada. Throughout the rest of the day, solar telescopes will be set up and visitors can learn how to safely view the Sun.

Friday, September 23rd, continue to learn about safe Sun viewing practices, attend a tour of a Great House and learn about the celestial alignments, experience Native American flute music at 6pm and attend a Night Sky program with telescope observations.

Saturday, September 24th is National Public Lands Day and all entrance fees are waived. Learn about safe Sun viewing practices, listen to author Ron Sutcliffe talk about his book *Moon Tracks* and afterwards, he will sign copies, enjoy Astronaut food like freeze dried ice cream and Tang, experience Native American flute music at 4pm and attend a discussion about astronomy with keynote speaker Li-Wei Hung, a night sky research scientist with the National Park Service's Natural Sounds and Night Skies Division at 7pm.

Sunday, September 25th, learn about safe Sun viewing practices, attend a 2pm talk on night sky photography with professional photographer Stan Honda and attend a night sky photography workshop with Stan Honda that evening at 7pm.

Throughout the Astronomy Festival, the documentary *City Dark* will be shown, Jr. Rangers of all ages are welcome to earn a special Night Sky patch and take the opportunity to chat with park Astronomers about astronomy and its connection to Chaco Culture NHP.

Help us to achieve our centennial goal of connecting with and creating the next generation of park visitors, supporters, and advocates by joining us in our first Astronomy Festival and hopefully we can make this a tradition.

These events are made possible by assistance from Western National Parks Association and the Friends of Chaco.

www.nps.gov

About the National Park Service: More than 20,000 National Park Service employees care for America's 409 national parks and work with communities across the nation to help preserve local history and create close-to-home recreational opportunities. Learn more at www.nps.gov.



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Junior Ranger Night Explorer

2016

National Park Service
CENTENNIAL

Chaco Culture National Historical Park