

MONTHLY OBSERVER'S CHALLENGE

Las Vegas Astronomical Society

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&

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SEPTEMBER 2015

NGC-7000 (Caldwell 20) – Emission Nebula - The North America Nebula

Introduction

The purpose of the Observer's Challenge is to encourage the pursuit of visual observing. It's open to everyone that's interested, and if you're able to contribute notes, and/or drawings, we'll be happy to include them in our monthly summary. We also accept digital imaging. Visual astronomy depends on what's seen through the eyepiece. Not only does it satisfy an innate curiosity, but it allows the visual observer to discover the beauty and the wonderment of the night sky. Before photography, all observations depended on what the astronomer saw in the eyepiece, and how they recorded their observations. This was done through notes and drawings, and that's the tradition we're stressing in the Observers Challenge. We're not excluding those with an interest in astrophotography, either. Your images and notes are just as welcome. The hope is that you'll read through these reports and become inspired to take more time at the eyepiece, study each object, and look for those subtle details that you might never have noticed before.

NGC-7000 (Caldwell 20) – Emission Nebula - The North America Nebula

NGC-7000, or Caldwell 20 is also known as the North America Nebula due to its unique shape. It is an emission nebula in Cygnus. It is quite large and covers an area four times the diameter of the full moon. There is a unique formation called the Cygnus Wall which is where most of the star formation is taking place.

It lies approximately 1600 light-years away and has an apparent mag. of around 4, but that is highly deceptive due to the nebula being spread over such a large area. However, despite it being so difficult to see in large telescopes due to its size, it can be quite easy in binoculars and on dark, transparent nights, can even be spotted with the naked eye as a haze just to the east of Deneb.

NGC-7000 was discovered by William Herschel on October 24, 1786.

Observations/Drawings/Photos

Greg McKay: Observer from Nevada



This shot was taken in the early morning hours of September 12, 2015 at the LVAS Cathedral Gorge event, 12:47AM -12:57AM to be exact.

It was taken through my 500mm f3.65 Schmidt-Newtonian. I used an unmodified Canon 5D Mark II, ISO1600, 10 minute exposure, no filters, on an Ioptron ZEQ25GT mount auto-guided by an Orion Starshoot Autoguider using Phd2 guiding software. Final output edited in Adobe Lightroom.

I was very excited to see the results as they appeared on my laptop. I had never before photographed or attempted to spot this object visually. I had no idea what a huge area of sky this object covered. Even in the extremely wide field of view of this scope, it stretched out across the entire frame. I'm looking forward to imaging it again with different equipment.



Jaakko Saloranta: Observer from Finland



This fine and bright nebulosity, NGC-7000, appears strikingly similar to its moniker and is a fine object with or without an instrument. Many observers routinely claim to have seen it with the naked eye as a "brightening in the Milky Way east of Deneb". However, there is a brighter star cloud just north of the mag. 4 star 60 Cygni that has the same shape as North America Nebula! This appears striking in the photograph (see below) by the Finnish deep sky observer Iiro Sairanen.

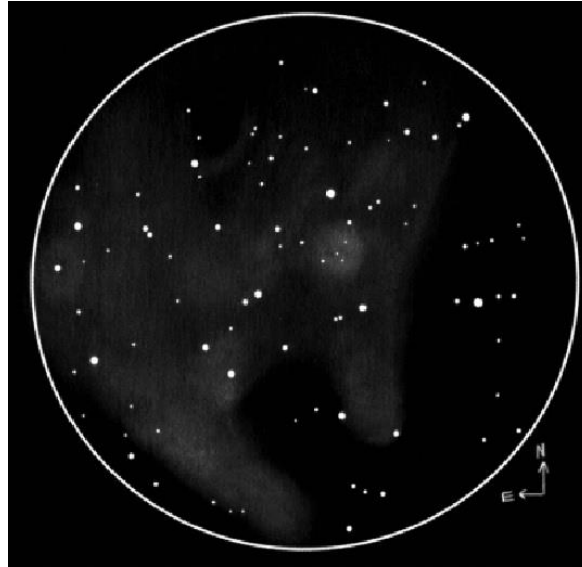
It's also brighter visually than NGC-7000 and the observer needs to be certain it's really NGC-7000 that he or she is seeing. Many have simply seen the brighter star cloud but completely missed the true North America Nebula. The best way to separate the two is to use an O-III or UHC filter. With a filter, the star cloud disappears and a new nebula emerges south of it – this is the true North America nebula!

I did try to view it with the naked eye on October 8, 2015, but in vain. Despite the decent SQM-L reading of 20.05, the object remained invisible. The try was probably doomed from the start as some aurora glow was visible in the northern sky. Aurora Borealis has a huge (negative) impact on the darkness of background sky. I've seen it several times with the naked eye, but cannot positively claim I've done so without a filter.

Telescopically, NGC-7000 is at its finest with small, wide-field instruments. The sketch displayed here was done on multiple nights and with multiple magnifications. It represents a view at 30X ($2^{\circ} 16'$) with a 4.7-inch refractor. I also used an O-III filter.

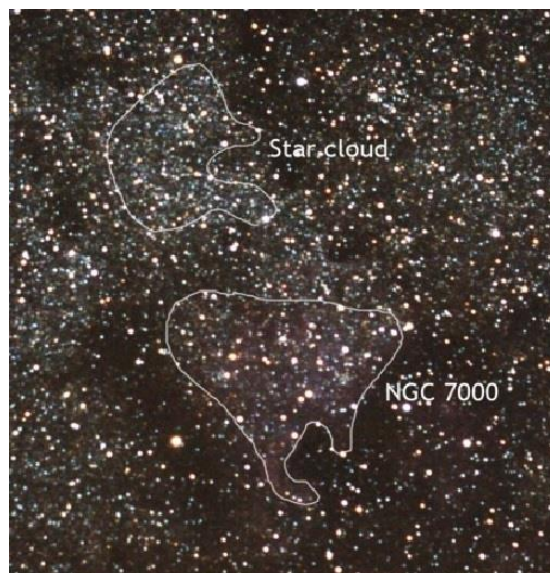
"The amount of detail visible is puzzling. "Mexico" and the northern coast of "Gulf of Mexico" appear the brightest. Best contrast gain with the O-III filter. Several open clusters were visible within it: NGC-6996, NGC-6997, Collinder-428, Teutsch-22 and FSR-0273 (Froebrich, Scholz, Raftery). The last two are best seen with larger apertures. Altitude of object 73° . Weather: 46°F , humidity $\sim 90\%$, 1006 hPa, no wind, moist."

The most obvious dark nebula in the region is Barnard 352. With a careful gaze and very wide field of view (or binoculars!), it can be followed all the way up north to a large dark nebula I call "The Dark Sunflower". It's more commonly known as the "Funnel Cloud Nebula" and consists of several separate LDN objects.



NGC-7000 imaged by Iiro Sairanen. Canon EOS 305D 50 mm, 18 min (stacked), f/4.5, ISO1600 + manual tracking with TAL-1 telescope.

The star cloud is strikingly familiar to NGC-7000 (as noted above), especially with the naked eye. For many years I thought I'd seen NGC 7000 without any instrument but my friend Iiro showed me wrong.



Rob Lambert: Observer from Nevada

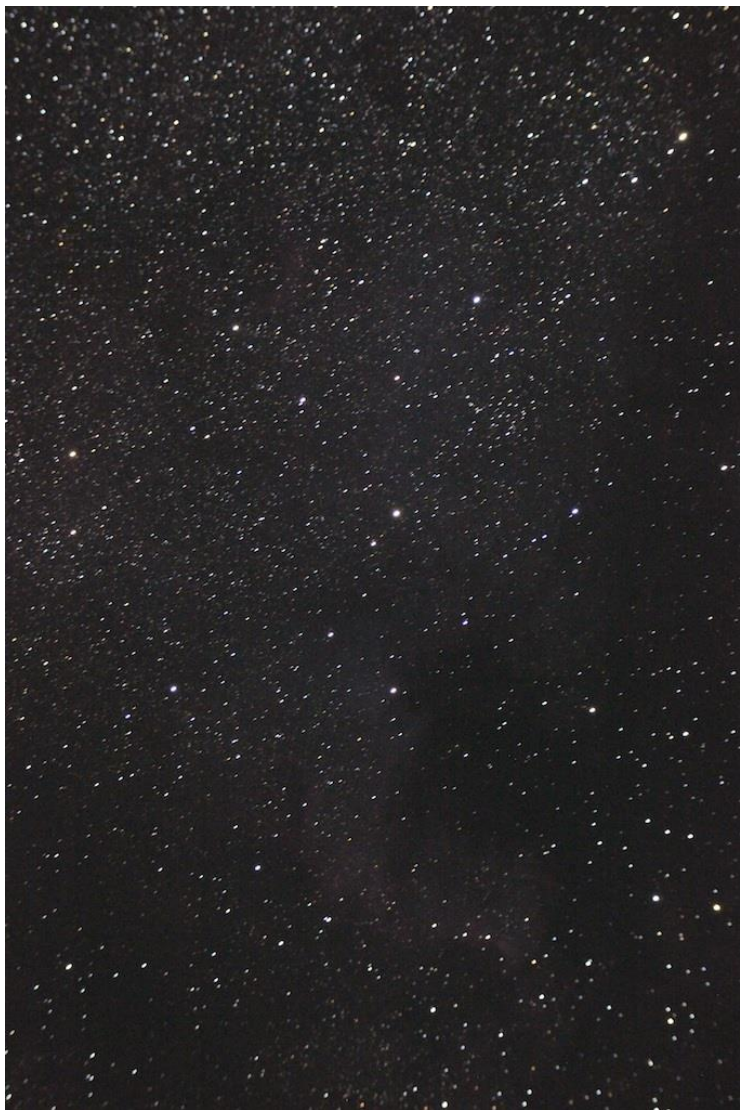


The purpose of my astro-images are somewhat different from most people that do astrophotography. My images will never be seen in *Astronomy* or *Sky & Telescope* magazines. Rather than going for the pretty magazine photos, I prefer to capture images that are as close to what one might see at the eyepiece. Only on rare occasions will the view of deep sky objects at the eyepiece ever be the same as that captured by a camera. Our eyes can't capture and hold the color of deep sky objects in low light situations, when viewing through the eyepiece of a telescope.

I've provided two photos of NGC-7000, the North America Nebula. The first is a 20-second exposure at ISO3200, captured with an unmodified Canon T3i DSLR at prime focus in my 80mm APO. It's a single frame image that has not been tweaked in any manner. It's exactly what the camera captured at the moment the photo was taken. I limited the exposure to 20 seconds to eliminate star trails, because I didn't use a guide scope to improve tracking, on my equatorial mount. This was my first attempt at capturing images with a DSLR instead of my Mallincam video cameras. The field of view with the Mallincam was just too small to capture the nebula without having to stitch multiple images together.

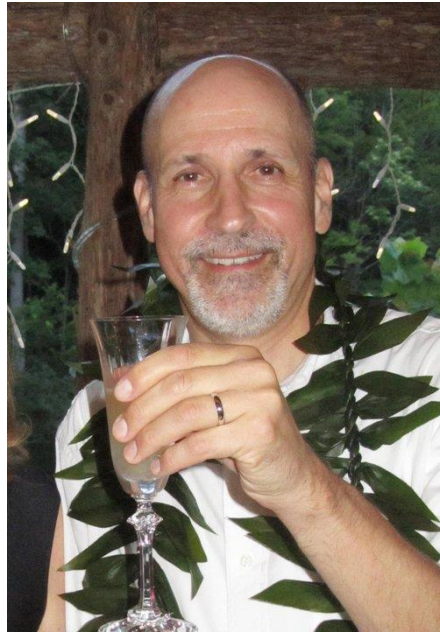
The second image is the same base photo as the first, but it has been enhanced only in exposure and contrast to make the nebula stand out a bit more. No other adjustments were made to the image. The nebulosity's pink color is more evident in this exposure.

To quickly identify the North America Nebula, concentrate on the darker regions near the bottom of the photo. You'll be looking at the areas that would be identified as the coastal waters around Mexico. As you move up in the photos, you'll see the nebulosity that makes up what would be the United States. The large grayish-pink area is the nebula. The lower portion of the nebulosity is the most concentrated and is where the more intense red color is found. If I calculated the field of view correctly, the FOV in the photos is approximately 3° tall by 2° wide. Even with my small refractor, I was only able to get half of "Canada" in the FOV. That should give you some idea of how large this nebula is. Its general size is thought to be about 100 light years. The density of the star field along with the presence of the nebula is evidence that the North America Nebula sits astride the Milky Way.





James Dire: Observer from Hawaii



NGC-7000 is a large emission nebula located in the constellation Cygnus. Because of its continental shape, it is also known as the North America Nebula. The nebula measures roughly $2 \times 3^\circ$ in size and is visible naked eye from dark sites with excellent transparency and no moonlight.

My first image of the nebula was taken with a Canon 30D camera with a 100mm f/2 lens. The exposure was 30 minutes as the camera rode piggyback on an equatorially driven telescope. North is up and east to the left. The bright star on the right side of the image is Deneb, a.k.a. Alpha Cygni. The center of the nebula is 3° away from Deneb. The bright red star to the immediate left (east) of the nebula is Xi Cygni, mag. 3.7.

While the naked eye can see NGC-7000, the eye cannot detect the faint colors picked up by the camera during long exposures. As is apparent in the image, the nebula contains a higher concentration of stars than the surrounding region. When visually capturing it naked eye or with binoculars, we're seeing a combination of the light from thousands of unresolved stars as well as the emissions from the nebula. It's too large to see with telescopes under medium to high magnifications as the light is spread out too much. The nebula is best viewed with binoculars or rich field telescopes at very low power! A nebula filter will help bring out the North America shape.

The exact distance to NGC-7000 is unknown, but estimates range from 1,900 to 2,200 light years. These estimates imply the nebula is more than 100 light years in size. It's not known what star or stars are exciting the nebular gasses to glow.

I took my second with a 71mm f/4.9 apochromatic refractor using a SBIG STF-8300C CCD Camera. The exposure was 270 minutes taken over three nights when the nebula was high overhead. Normally, long exposures through a hydrogen-alpha filter are required to produce the bright red nebular emissions. However, I was able to extract the nebular emissions using the data from my single-shot color CCD camera and lots of digital dark room techniques.





Glenn Chaple: Observer from Massachusetts



The last time I recorded an observation of NGC-7000 was back on August 20, 1977 with a pair of 7X50 binoculars. The NELM was 6.0.

It was definitely visible when oriented to match the namesake “North America Nebula.” I made a sketch and checked it for accuracy using a photo on P-29 in the July 1977 *Astronomy Magazine*. Unfortunately, I don’t have that sketch available.

I did a more current observation on October 12, 2015. The NELM was 5.0-5.3. With a pair of 10X50 binoculars, I used an “Astrocard” to locate NGC-7000, which made finding it fairly easy. The first and most recognizable area was California and Mexico which was pretty bright.

When I switched to 15 X 70 binoculars, it was much easier and brighter. I couldn’t see open cluster NGC-6997, which was located in the Ohio region. It was great going back to this object, as it has been many years since observing it the last time.

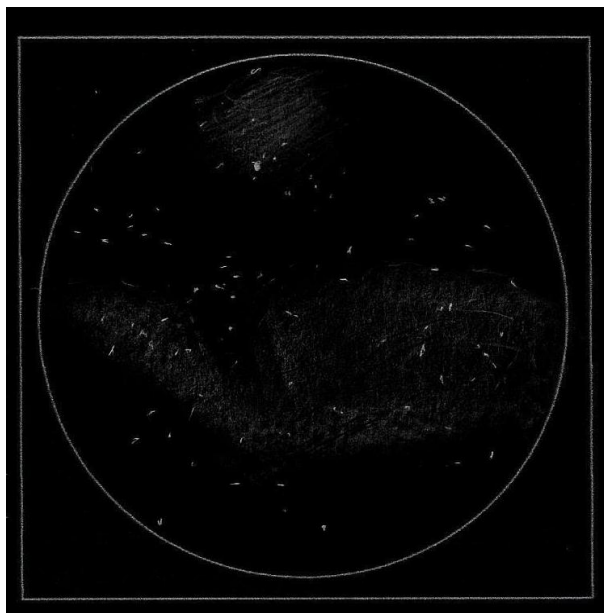
Francisco Silva: Observer from Nevada



I observed NGC-7000 on September 8, 2015 from Mid Hills Camping, Essex, California at 1,711 feet. The temp was 80°, humidity was 9% with no moon. The transparency was medium as well as seeing.

With an 8-inch Dobsonian, 15mm and 30mm EPs and a UHC filter, I observed the following:

I used the star Deneb to reach the area and began my search. Because it was so high in the sky, it was a little uncomfortable to find it. If not for the UHC filter, I wouldn't have seen it. I think I saw the Pelican Nebula as well (IC-5070) and the open cluster NGC-6997. I could see a very dark area where there were almost no stars.



Gus Johnson: Observer from Maryland



The North America Nebula, NGC-7000 is best observed with binoculars. It's a very large nebula with the shape resembling the North American continent.

In August, 1986, with 2.4-inch refractor @ 24X, I saw the nebula with direct vision. The darkest area was the Gulf of Mexico.

In August, 1984, with 8-inch reflector @ 58X, the nebula was very easy to see. I saw the Pelican Nebula just to the west, appearing very faint and diffuse.

Jay Thompson: Observer from Nevada



I observed NGC-7000 with a 17-inch Newtonian reflector on December 23, 2014 at Meadview, AZ. I could see it at 125X without a nebula filter. I needed to sweep the telescope to see all of the nebulosity.

I observed it again with the 17-inch at Cathedral Gorge on September 10, 2015. At 95X and no nebula filter, I could plainly see the brightest part (Mexico).

Next, a deep sky filter helped bring out the nebulosity. The part that's Mexico was more evident and the Gulf of Mexico showed up well. I could trace more of the upper part of the continent also. Due to the size of the nebula, using the 17-inch at 95X was just too much magnification.

The North America Nebula was a naked-eye object that night. In 10X50 binoculars, I could see some dark lanes including the Gulf of Mexico.

The best view I ever had of the North America nebula was on September 11, 2015 from Cathedral Gorge. I used a 3-inch f/4 Newtonian at 15X with a UHC filter. The Gulf of Mexico and western coast were very evident. On the other side of the Gulf of Mexico, I could see the faint glow of the Pelican Nebula. I could plainly see the shape of the North America Nebula and it was bounded with black space. The low magnification allowed the whole nebula to be viewed at once.

Roger Ivester: Observer from North Carolina



On September 17, 2015, I observed NGC-7000, the North America Nebula in Cygnus. The sky conditions were fair seeing with an NELM of 5.0. Using a 10-inch f/4.5 reflector at 36X (FOV 1.8°) with an O-III filter, I observed the following:

A dark sky is preferred for this very large emission nebula, however, I've observed the North America to a satisfactory level on many occasions from my moderately light polluted backyard using my 10-inch reflector. An O-III filter is essential when observing this object.

I found it necessary to place a commercial black cloth to shield ambient light from entering my eye, due to several unshielded streetlights in relative close proximity. After covering my head, the difference was amazing, as the outline of the nebula became much sharper and brighter.

The dark region known as "the Gulf of Mexico" is the most noticeable feature. At 36X and with a FOV of 1.8°, much of the North America shape was visible. Open star cluster, NGC-6997, a sprinkling of faint stars was located in the "Ohio" region. If using an O-III or UHC filter while observing the North America Nebula, be sure to remove when observing this cluster.

IC-5070, "The Pelican Nebula" lies just to the west of NGC-7000. The Pelican was fairly easy to see, appearing as a large very faint diffuse region without any definite shape.

NGC 7000 - NORTH AMERICAN NEBULA

DATE: SEPTEMBER 17, 2015

TELESCOPE: 10-INCH REFLECTOR

36X - 1.8° FOV

NELM: 5.8

REGION KNOWN AS THE
GULF OF MEXICO, MOST
RECOGNIZABLE.

NGC 7000 IS VERY FAINT,
REQUIRING AN O-III

FILTER AND A HEAD

CLOTH TO BLOCK AMBIENT

LIGHT, DUE TO SEVERAL
UNSHIELDED STREETLIGHTS,

IN RELATIVE CLOSE PROXIMITY.

NGC 6996 - OPEN STAR CLUSTER, VERY

FAINT SPRINKLING OF STARS - OHIO REGION.

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JOHN FOSTER

Fred Rayworth: Observer from Nevada



Though I've observed NGC-7000 numerous times in the past, for the purposes of the challenge, and for the best I've ever seen it, as well as the nearby Pelican Nebula, I'm using my observations at Cathedral Gorge State Park at 4,800 feet on the evenings of September 10-12, 2015.

September 10, 2015: Mostly clear and calm with a few lingering, puffy clouds. The clear sky clock said they'll go away later and they pretty much did, though there was still much on the horizons up a good ways. The transparency wasn't superb but it wasn't too bad, and I got a few pleasant surprises, especially near the zenith. The winds stayed calm but when the temp dropped, it dropped! It still didn't get down to much below 50°.

The nebula was a lumpy haze with many dark areas and a particular dark "gulf" like the Gulf Of Mexico. There were multiple clusters buried within it, but I couldn't see them because of the O-III filter. Using the 76mm Dob with an 8mm EP (37X), I just saw the hint of something but it was basically not there until I put in an O-III filter. Then I caught a vague shape but couldn't really tell it as "North America." I COULD see it, but that was about it. Without the filter though, it wasn't much.

September 11, 2015: It was a bit clearer than the night before and the transparency was much better. No puffy clouds either. The mush was much lower to the horizon and the view was superb. However, seeing sucked and Saturn looked terrible. However, that wasn't my concern. The air stayed calm except an occasional zephyr. The temp never dropped as bad as the night before. An outstanding night.

Wow! I used 48X and the UHC. The nebula was super nice. The Gulf was very evident. Lots of details like ripples and whorls, especially around the edges near the gulf. Florida quite prominent with that bright star at the "Keys." Could follow the East Coast up as well as the Yucatan. The nebulosity extended way beyond regular EP and was much more detailed than the

OIII yesterday. Followed it all the way to Canada. I also had a much better view of the Pelican and the shape and wings. This time I used the stock 25mm EP (12X) with the 76mm scope. I also changed to an LPR filter and the nebula stood out more. I could actually see the “Gulf Of Mexico” as a vague dark area. With that wide of a field, I caught more of the entire nebula and part of the Pelican Nebula. Also, the night was more transparent and the filter was much better for it than the O-III.

September 12, 2015: Not near as good as Friday night but not all that bad. A lot more mush on the horizons and the transparency wasn't near as good. There were a few good holes but when I quit at midnight, it was starting to get bad in bands that those with sharp eyes could see. The breeze was still non-existent. The temp also never got that bad, or as bad as Thursday night. Conditions were the worst of the three nights, but still good enough.

Wow! 48X with the UHC showed NGC-7000 with great details once again. Tried the 76mm scope with KE25mm (12X) and LPR filter again. Could almost see all of it and indistinguishable dark areas but couldn't tell shape tonight.

NOTE: The drawing is a composite of multiple 48X eyepiece fields to take in all the nebula plus part of the Pelican. A single EP field just wouldn't do.

