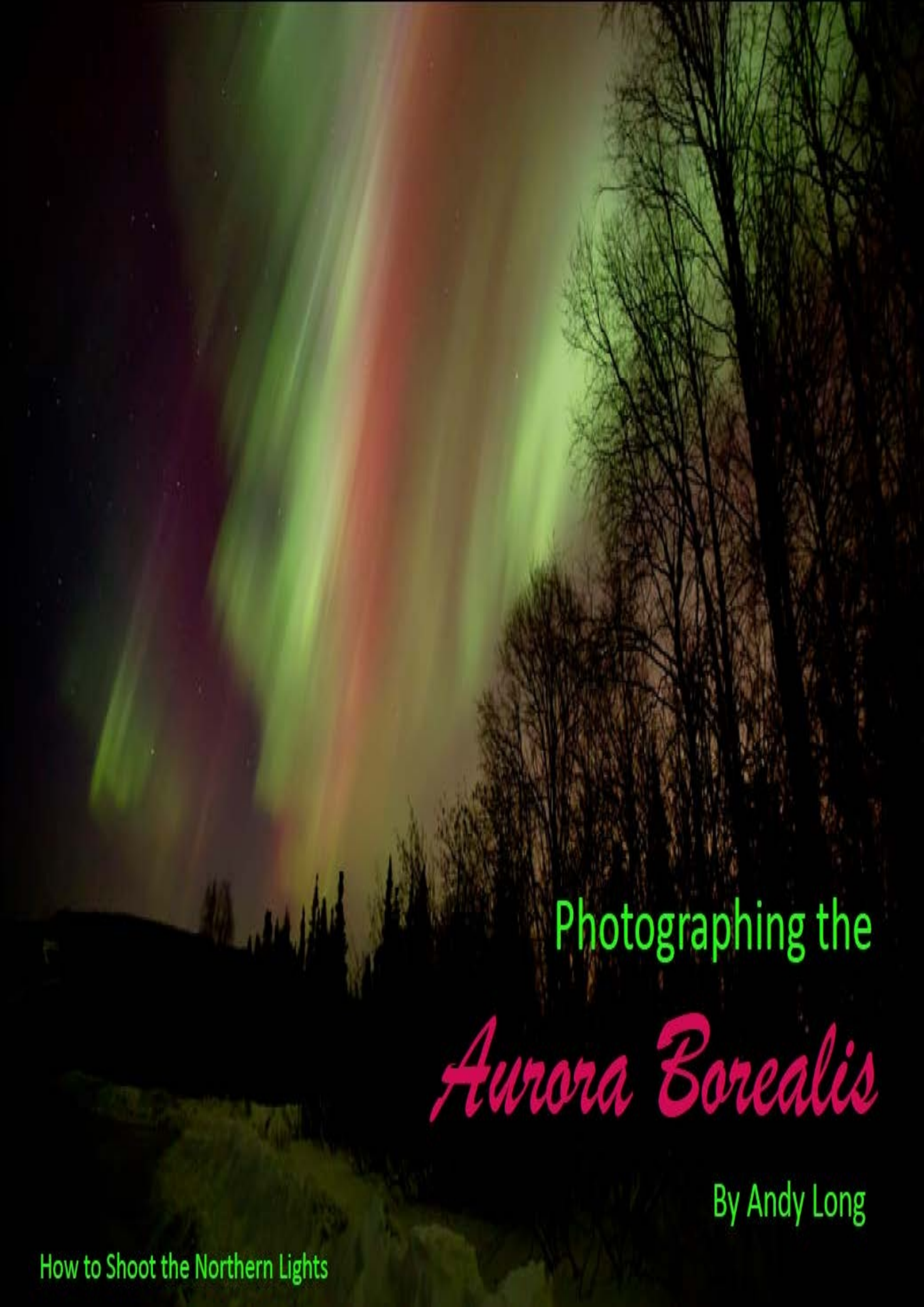

Photographing the
Aurora Borealis
By Andy Long
How to Shoot the Northern Lights

Photographing the

Aurora Borealis

By Andy Long
How to Shoot the Northern Lights

Written and Published By: Andy Long; www.firstlighttours.com Version 1
All photos by the author unless otherwise indicated.

Credits:

NOAA; http://helios.swpc.noaa.gov/ovation/
University of Alaska Fairbanks Geophysical Institute; http://www. gi.alaska.edu/AuroraForecast
http://www.astronomy.ohio-state.edu/~pogge/Ast161/Unit2/phases. html

Wikipedia; http://en.wikipedia.org/wiki/Wikipedia
http://www. blogcatelog.com

http://www. spaceweather.com
http://www. sportsmedicine.about.com
http://www.nightskystation.com
http://www.the-digital-picture.com
http://www.freegraphicdownload.com

Thank you - I'd like to thank Steve Rew, Bob Dean, and Betty Holling for their work with editing the book. You found things I missed and helped clean it up making it a better read for everyone.

Contents

About the Author

Growing up in Florida, Andy Long started his career in sports photography and writing, but a job opportunity in Jackson, Wyoming, opened his eyes to the world of wildlife and nature photography. After several more years of sports work back in Florida, he made the move to Colorado to fully concentrate on wildlife and nature and has not looked back.

After a few years of delving into the world of nature photography he has now been leading photo workshops around the world since 1994 and is a featured writer for several print and online photography publications.

He has been published in more than 40 different publications and books

as well as in National Geographic and Animal Planet television shows. Print publications include Alaska Magazine, Birder's World, Outdoor Life, View (Germany), Colorado Outdoors, Audubon field guides, Texas Parks & Wildlife, Nature Photographer, Outdoor Photographer and Montana Outdoors. He is a winner in the Audubon Share the View contest (aurora images) and the national RoseWater Network Photographer of the Year.

Like many outdoor photographers, Andy drew a lot of inspiration from the work of the master - Ansel Adams. One quote of Adams' has held true for quite a long time: "Sometimes I arrive just when God's ready to have someone click the shutter." With some of the opportunities pro vided by the northern lights, this quote comes to life.

First Light Photography, LLC
www.firstlighttours.com
www.andylongimages.com

About this Book

Numerous years back while leading an Alaska brown bears workshop, Andy saw some

books of aurora borealis images. He was hooked and a winter trip to Alaska to photograph the incredible beauty presented on the pages of those books was soon to follow.

This book is divided into four parts

Part 1: Understanding the Aurora This section provides an understanding of what the aurora borealis is and how and why we're able to see it. The discussion will tell how the various colors come about and describe some of the shapes it takes as it dances across the sky.

Ever since his initial scouting trip he has been leading workshops yearly to the far north to let others see, experience and photograph this amazing phenomenon.

While his true love is wildlife, Andy will tell you his favorite thing to see and photograph is the northern lights. His passion of teaching others about the aurora can now reach more people through this book.

Come take a journey to see some beautiful shots of the aurora and learn how you can take shots like this when (not if) offered the chance to visit an area where the sky comes alive with color. When you want to experience this, visit Andy's website and sign up for a northern lights workshop and let him take you to the best spots possible and personally teach you.

Images in this Book

As a Canon shooter, most images were shot with a Canon 5D Mark III or a 1Ds Mark II with multiple lenses. All instruction is relevant for any DSLR as a variety of brands and lenses have been used by workshop participants to take memorable photographs.

Part 2: Getting You and Your Camera Ready
- As you prepare to go out to photograph the northern lights, you need to get both your body and camera ready. The last thing you need is to walk outside and see a great display going on and not have anything ready to take a photo. This will prepare you both in terms of clothing and what equipment is needed and how to get it prepared for a night of shooting the aurora.

Part 3: Shooting the Aurora This is the heart of the book where you learn the why and how of capturing the shots shown throughout these pages. There's more to it than you might think with f/stops, shutter speeds, ISO, lighting techniques, timers, cable releases and more.

Part 4: Image Processing Some special techniques will be covered in this section including how to put together a time lapse film and a stacked star trail with some northern lights in it. There will also be tips on what to do in postprocessing to clean up your favorite aurora shots to make some beautiful prints and what to do to get them ready for posting on the web.

Links on the Contents page take you directly to the indicated pages and those on the bottom of most pages jump to that section.

“Understanding the Aurora Borealis

“No pencil can draw it, no colors can paint it, and no words can describe it in all its magnificence.”

Julius von Payer, Austrian explorer

Legends of the Aurora Borealis

7

‘Aurora’ was the Roman Goddess of Dawn, ‘Boreas’ is Greek for ‘wind’ making the Aurora Borealis the Dawn Wind, a wind that can be seen like none other on earth. The aurora has fascinated man for centuries.

Seeing the aurora is included in every “must see before you die” list. Just watching the aurora borealis is a sight to behold as you stand and become mesmerized by its movement and colors. No matter what part of the world the aurora is discussed, every country it appears in has its own folklore and myths about what it is. Very few got it right until the late 1800s.

In China and northern Europe some described the aurora as dragons or serpents in the sky. Countries where gods were part of the culture

- Iceland, Greenland and Scandinavia - it was seen as a burning bridge which their gods used to travel from heaven to Earth and back.

One legend from the Inuit describes the aurora this way: “The sky is a huge dome of hard material arched over the flat Earth. On the outside there is light. In the dome, there are a large number of small holes, and through these holes you can see the light from the outside when it is dark. And through these holes the spirits of the dead can pass into the heavenly regions. The way to heaven leads over a narrow bridge that spans an enormous abyss. The spirits that were already in heaven light torches to guide the feet of the new arrivals.”
One Canadian legend likens the aurora to the spirits of the dead dancing in an ethereal light to entertain themselves after the sun sets while wearing multi-colored clothing.

Some believe that whistling and making other sounds at the aurora will either cause it to become more active, use it as a way to speak to their ancestors or even that the aurora will come down and take their heads off, thus making them observe it in silence and awe.

Those not seeing supernatural beings saw the aurora as a predictor of the weather. Snow and bitter cold were thought to follow bright auroral displays in Scandinavia, while the Eskimos saw just the opposite with the spirits bringing favorable weather.

Some Inuit described the lights as the dancing souls of favorite animals. Some believed they were “fire foxes” that lit up the sky with sparks that flew from their glistening coats. To the Swedes they were merry dancers, “girls running around the fireplace dragging their pants.”

1893 Fridtjof Nansen woodcut of the aurora

Oh, it was wild and weird and wan, and ever in camp o’ nights We would watch and watch the silver dance of the mystic Northern Lights.
And soft they danced from the Polar sky and swept in primrose haze; And swift they pranced with their silver feet, and pierced with a blinding blaze.
They danced a cotillion in the sky; they were rose and silver shod; It was not good for the eyes of man — ‘Twas a sight for the eyes of God. — Robert Service, from “The Ballad of the Northern Lights,” published in 1908

History of the Aurora Borealis

8

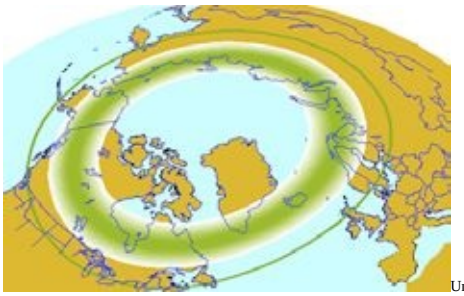
For thousands of years no one knew what the aurora borealis was or where it came from. Descriptions can be found dating to the 4th century B.C. when Aristotle made the first scientific account of it, describing glowing clouds and a light that resembled flames of burning gas.

The first real description is found in the Norwegian chronicle The King's Mirror from 1230. One explanation was that the oceans were surrounded by fire and that auroras were their light reflected in the sky. Another was that reflected sunlight from below the horizon illuminated the sky and a third explanation was they were fires from Greenland.

French astronomer Pierre Gassendi is credited with being the first to name them the aurora borealis, or Northern Lights, but they've been observed by ancient Chinese and Greeks for thousands of years. Eskimo and Scandanavian peoples have traditions of the northern lights at least as far back as 700 A.D.
In the 17th century, Anders Celsius said the lights were caused by moonlight reflected by ice and water in the air. Other scientists believed the refraction of moonlight and the reflection of colored rays by ice crystals in the atmosphere caused the aurora. Also in the 17th century Galileo Galilei called this phenomenon Aurora Borealis. He thought the aurora was caused by sunlight reflected from the atmosphere.
Around the turn of the 20th century, Norwegian physicist Kristian Birkeland placed a spherical magnet inside a vacuum chamber and shot an electron beam at it. He found the beam was guided by the magnetic field to hit the sphere near the poles. He reasoned the sun must shoot beams toward Earth, where the magnetic field guides them in near the poles. His view was close to reality, except the corpuscles originate in our magnetosphere, not from the sun.

In the 1800s Christopher Hansteen established observing stations and arranged with sea captains to record the Earth's magnetic field, becoming the first to point out the aurora occurs as a continuous ring around the geomagnetic pole. Sophus Tromholt organized a network of northern lights observation stations and pointed out they seemed to form a ring around the North Pole. He made the first illustration of what was later known as the auroral oval and what was later known as the auroral oval and year sunspot cycle.

In more recent times Swedish scientist Suno Arnelius offered his thoughts in 1708 suggesting solar rays were reflected off ice particles in the atmosphere. A strong aurora on March 6, 1716, was observed in parts of Europe and gave birth to more science. Sir Edmund Halley, of Halley's Comet fame, published the first detailed description of the aurora. He suggested that "auroral rays are due to the particles, which are affected by the magnetic field; the rays parallel to Earth's magnetic field."


University of Alaska Fairbanks Geophysical Institute

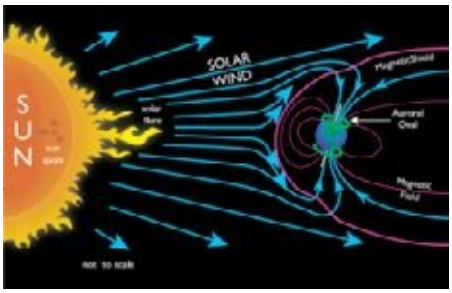
In the 1930s, Sydney Chapman and Vincent Ferraro proposed that clouds of electrically charged particles ejected from the sun fly across space and envelop the Earth. Further research shows as they reach the Earth's atmosphere, they go around it. Most of the flare keeps going beyond earth but some swirls back in and enters the atmosphere, mainly from east to west at the area of the magnetic poles.

Following the launch of Soviet and U.S. satellites, centuries of theories, observations and speculations were put to the test. Scientists discovered the space around Earth was filled with high-energy particles, trapped by the magnetic field. The probes proved the existence of the solar wind and a series of satellites mapped out the shape of the magnetosphere. Satellites in the tail of the magnetosphere found it unstable, and low altitude polar satellites measured the electrons producing the aurora.

Rockets are still being sent into the aurora today gathering even more information.

What is the Aurora?

There is actually a lot known about the aurora. They are created by solar flares / coronal mass ejections (CMEs) emitted from the sun which shoot out through space. As they reach the Earth's atmosphere, they go around it much like water in a river going around a rock. Most of the flare keeps going beyond Earth but some swirls back in and enters the atmosphere from east to west at the area of the magnetic poles.



The temperature above the surface of the sun is millions of degrees Celsius. At this temperature, collisions between gas molecules are frequent and quite explosive. Electrons and protons are thrown from the sun's atmosphere by the rotation of the sun and escape through holes in its magnetic field.

These CMEs release large quantities of matter and electromagnetic radiation into space. This material forms a plasma and reaches Earth in one to five days with the speed of the solar wind playing a part in the number of days. It takes several hours for the CME to detach itself from the sun, but when it does it can speed 9

space at up to seven million miles per hour. There are times when a CME takes just 40 hours to reach Earth. By comparison, sunlight takes just eight minutes to reach Earth.

Most aurora occur in a band known as the auroral zone, which is at 3° to 6° latitude from the geographic poles, or 10° to 20° from the geomagnetic poles. This corresponds roughly with the Arctic and Antarctic Circles. The aurora enters through this area because the Earth's magnetic field is weaker near the poles.

The aurora is classified as diffuse or discrete. The diffuse aurora is a featureless glow that may not even be visible to the naked eye. The discrete aurora has sharply defined features that vary in brightness from just barely visible to bright enough to read a newspaper by. In northern latitudes, the effect is known as the aurora borealis (or the northern lights). Auroras seen near the magnetic pole may be high overhead, but from farther away, they illuminate the northern horizon as a greenish glow or sometimes a faint red, as if the sun were rising from an unusual direction.

Its southern counterpart, the aurora australis (or the southern lights), has features that are almost identical to the aurora borealis and changes simultaneously with changes in the northern auroral zone. It is visible from high southern latitudes in Antarctica, South America, New Zealand, and Australia. The aurora also occurs on other planets. Similar to the Earth's aurora, they are visible close to these planet's magnetic poles.

Solar Cycles

There are two main cycles used to determine when strong solar activity takes place. The first is a 27-day cycle. Just as the Earth rotates on its axis, the sun does as well with one area of the sun having more activity than others and it faces Earth every 27 days.

Even when this area is not facing Earth, the sun boils off enough particles from other areas to create continuous and predictable aurora over the Earth's polar regions. The solar wind

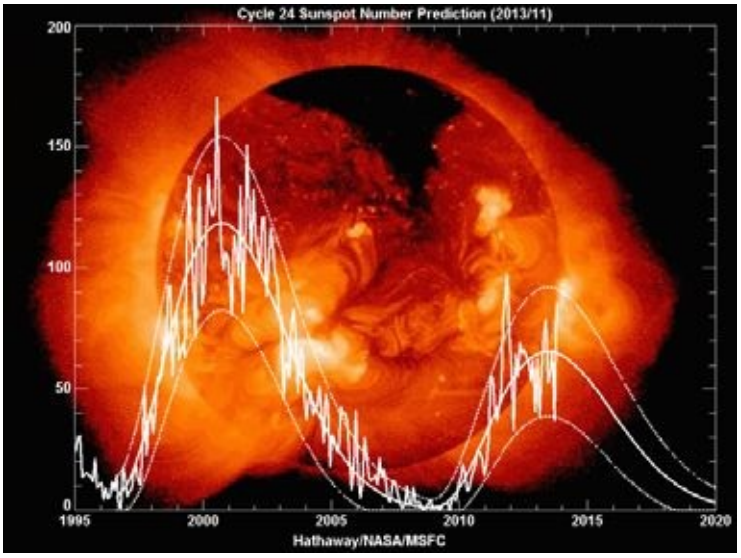
also generates near-constant but lesser displays. Recently there has been another part of the sun that has become much more active with flares than it had previously.

The second is an 11-year cycle. It takes about this time for the sun to go through its cycle of 10

an increase and decrease in the number of sunspots. As it reaches the close of a cycle new sunspots appear, while a new cycle produces more in higher latitudes. As cycles overlap, spots from a previous cycle develop even after those from the new cycle appear. This causes solar scientists to have a difficult time determining when one cycle ends and another begins.

Not every 11 year peak is the same. Some cycles have had nine years between them and some up to 14. The average is 11.1 years. Durations of the peak also vary from one to three years. At the high point of the cycle, the sun produces as many as five CMEs a day and at the low point it averages one a day. There was a period, though, between 1645 and 1715 when sunspots were exceedingly rare. This period of solar inactivity corresponds to a climatic period called the “Little Ice Age” when rivers that are normally ice-free froze and snow fields remained year-round at lower altitudes.

We are currently in what is referred to as Sun Cycle 24. While not as strong as Cycle 23, good solar activity, and thus good activity should occur through 2016 or 2017.



SEASONAL VARIATIONS - In spring and fall the Earth is farthest north or south of the sun’s equator the closer to the poles you get. This is when the Earth is more likely to get the solar winds that come off the areas of high sunspot activity making the time near the equinoxes best for aurora activity. After doing research about the best time of year and best places to photograph the aurora in Alaska, I chose a time around the spring equinox in the Brooks Range to go and photograph the northern lights. This image taken on March 26, 2005 is my first photo of the aurora.

SOUND AND THE AURORA - Legends say the aurora emits sound. No recording has verified any sound coming from it. While there hasn't been extensive research, those who study the aurora do not believe there is any sound associated with it. I myself have never heard anything.

BEST TIME - There's a time referred to as solar midnight when some of the best viewing occurs. To determine, find out what time sunrise and sunset are for your location. Solar noon is the time in the middle and solar midnight is 12 hours later. When the aurora is active there is usually a strong display within 30 minutes on either side of solar midnight. A good range of time for general activity is between 10 p.m. and 3 a.m. Don't wait until midnight to start looking for the aurora. From experience, I've seen it as early as 9 p.m. when solar midnight was 1:30 a.m.

WHAT TO LOOK FOR - The auroral breakup is the most spectacular part of a display. Breakups involve a brightening of forms and a rapid change from plain to rayed and then to swirling across the sky. Multiple breakups can occur on a night of moderate to high activity while a low forecast is likely to have only one. If multiple bands appear, watch that area as a breakup is likely. If these appear early in the evening the breakup probably will be spectacular and continued watching may bring about several more breakups. When a big breakup occurs, once it dies down there can be a lack of activity for 30 minutes to an hour. Breakups can last close to an hour to as short as five to 10 minutes.

PROXIMITY TO THE EARTH - Some people who observe the aurora think it comes down and touches the Earth. This can not be further from the truth. The closest the aurora comes to the ground is about 35 miles and is generally about 60 miles above the Earth. This is the reason it has to be clear or just partly cloudy to be able to see any activity.

FORECASTING THE AURORA - With lots of research having been recorded for years, predictions provided by several sources are pretty good in giving accurate forecasts about what the aurora activity will be like for the upcoming days. These are updated if a very large CME is emitted by the sun that is fast moving and powerful. There are websites and phone applications which provide aurora forecasts and some are listed on the

Reference page at the end of the book.

Multiple bands going across the sky indicate a good bit of movement usually follows.

A strong auroral breakup can produce a wide variety of colors, shapes, and forms.

Auroral Colors

Several factors come into play in creating the colors visible to the eye and more importantly to the camera. There are times when images have colors appear which were not seen by the eye due to the length of the exposure and the sensitivity of the ISO. When a strong aurora is predicted, the likelihood of reds and magentas appearing in the photo increase.

One factor is based on which gas — oxygen or nitrogen — is mixing with the electrons in the atmosphere. Color also depends on how fast the electrons are moving and how much

energy they have when they collide. High energy electrons cause oxygen to emit green light while low energy electrons cause a red light. Nitrogen typically gives off a violet or pink color. Vertical blues can be seen when electrons collide with ionized nitrogen.

Another factor in color formation is altitude. The higher altitudes (> 105 miles) generate red, the middle (70 to 105) green and the lower edge (50 to 70) pink or violet. When the sun is “stormy,” red can occur at altitudes between 55 to 60 miles can be quite brilliant. Other colors can be found at the combinations of the different levels.

These color variances are due to the nature of the atmosphere at the altitudes and how oxygen emits light. Oxygen takes about a second to emit energy as green light and up to two minutes to emit red light at lower elevations. The atmosphere at high altitudes contains a greater percentage of atomic oxygen and is thin, giving the atoms ample time to emit red. The pinkish color comes from a combination from oxygen red and blue from nitrogen.

Green is the most common color when observing the northern lights.

Very intense aurora gets a purple edge. The purple is from lighter gases high in the ionosphere, like hydrogen and helium

Purples can also be found at the mix of different altitudes between the layers of curtains. Quite often these show up more in the camera than to the eye and a little increase in exposure, saturation and vibrance (explained later in the Image Processing section) will bring these out.

Reds are among the rarest of the aurora colors and when visible are a treat for everyone. Looking at the curtain you can see they are at the higher altitudes.

Pinks appear at the lower edges of the bands and are at the lowest altitudes, typically between 55 and 60 miles above the Earth.

Auroral Shapes

The different shapes of the aurora are a mystery scientists are still trying to figure out. The shape depends on where in the magnetosphere the electrons originate, what causes them to gain their energy and why they dive into the atmosphere. Even so, a variety of common shapes have been identified and given names.

Homogeneous arc / band – At its least active, the aurora forms diffuse arcs with no structure hanging across the sky from east to west.

Band with structure – An active pattern of rapid variations. One or more bands extend east to west and rays following the Earth's magnetic field can dance across or between the bands.

Curtain – This is a magnificent auroral pattern where the bands and rays fill most of the sky. Waves undulate back and forth, and light intensity varies rapidly. Seen more when the aurora is lower on the horizon allowing for more of a side view of the activity. Quite a thing to see.

Rayed arc – When the aurora becomes more active vertical rays form. These are actually fine pleats in the auroral curtain.

Rays – This pattern is typical of high solar activity periods. Rays lined up along the

Earth’s magnetic field move quite rapidly.

Rising vapor column – The auroral curtain sometimes appears to touch a mountain top. 19

This illusion occurs because the aurora is low on the horizon where perspective gives the feel it’s touching the ground.

Corona – The aurora may appear as rays shooting out in all directions from a single point in the sky. This dramatic form occurs when you’re directly beneath the swirls and folds of a curtain during periods of high solar activity.

Pulsating aurora – If you are standing outside and think you see something moving but there is no color, this is a pulsating aurora. They are very weak and difficult to recognize, but your eyes and mind are not deceiving you.

It’s said you can’t see the aurora during the day but this is only somewhat true. While colors are not visible, a pulsing sensation can occur. I observed this one time and it was situated in the middle of the auroral band proximity and I saw what appeared to be a heartbeat / pulsation in the sky. I had a sense it would be a good night of activity because I saw it so early and in fact it was one of the best nights of aurora photography encountered with a group.

While not always the case sometimes, the aurora first appears as a homogeneous band across the sky. Once it splits into two bands, it’s time to get outside for some photography. For the first-time observer it can be good to get out at the first sign to get some photos. Usually there will not be any action or movement for a little while when it’s taking this shape. It can surprise and start dancing shortly after the appearance of the first band, although this is not typical.


Simple homogeneous band arcing across the sky. The blue sky shows this was early in the evening. **Understanding the Aurora Getting Ready - Body Getting Ready - Camera** Shooting the Aurora Image Processing

As bands get structure and get wider there is a better than likely chance more splitting and movement will follow. These shots were taken a minute apart with the image on the left looking to the east and the image on the right taken to the west showing the structured bands filling the sky from one side to the other.

When a curtain starts rippling across the sky the pleats moving from one side to the other can be observed. The lower the band on the horizon, the more prominent the height of the curtain. A faster shutter speed can pick up more definition in the pleats than a longer exposure where they will blend together.

With a rayed arc, the pleats in the curtain are more apparent. The greater movement and mass indicates a very active auroral display. If situated directly below this display it would have appeared as a corona dropping down (see next page).

A corona will appear directly overhead. When a corona does develop, be ready to take more shots as quite often it will then have the bottom drop out and color will fill the sky. The photo on the About the Author page is the subsequent shot from this corona when it dropped.

Predicting the Aurora[24]

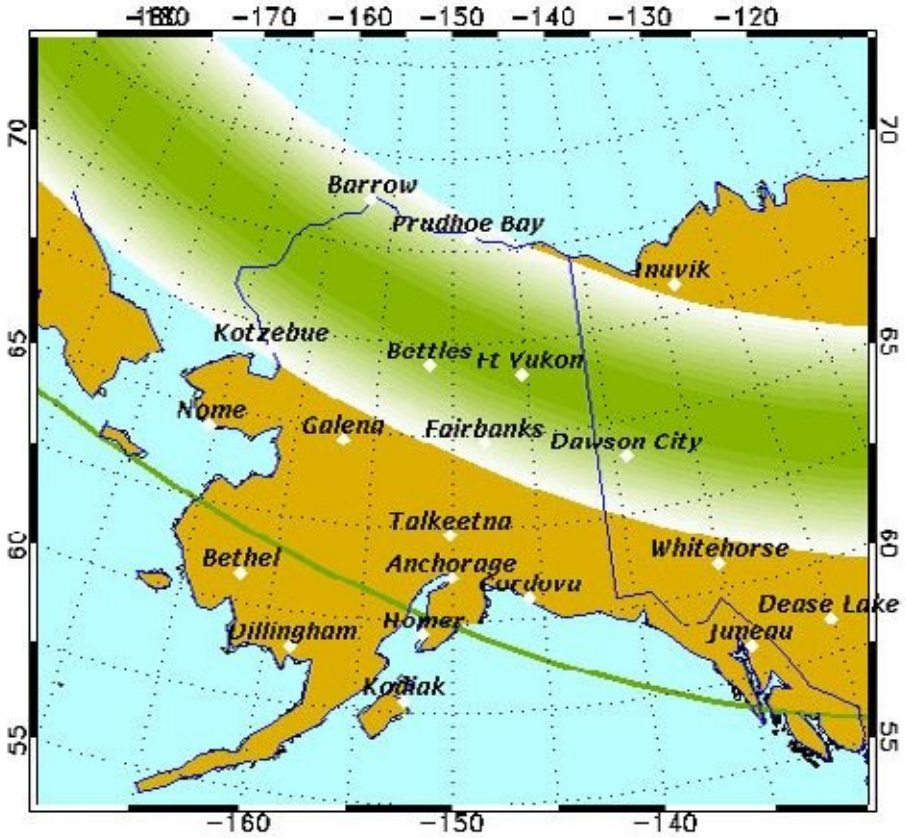
With the aurora fascinating so many people, both observers and scientists want to know what is going on with it at any given moment around the Earth. Currently there are two primary outlets which provide real-time aurora forecasts, The National Oceanic and Atmo spheric Association (NOAA) and the University of Alaska Geophysical Institute.

The data provided by the University of Alaska Geophysical Institute can be found at http:// www.gi.alaska.edu/AuroraForecast. They also have a SmartPhone app available for both iPhone and Android.

On their website there are maps available of

different locations around the world as well as an activity level scale from 1 to 10 showing how intense the aurora is going to be that day. It provides a forecast of both the band width for where the aurora can be seen and the level for up to a week.

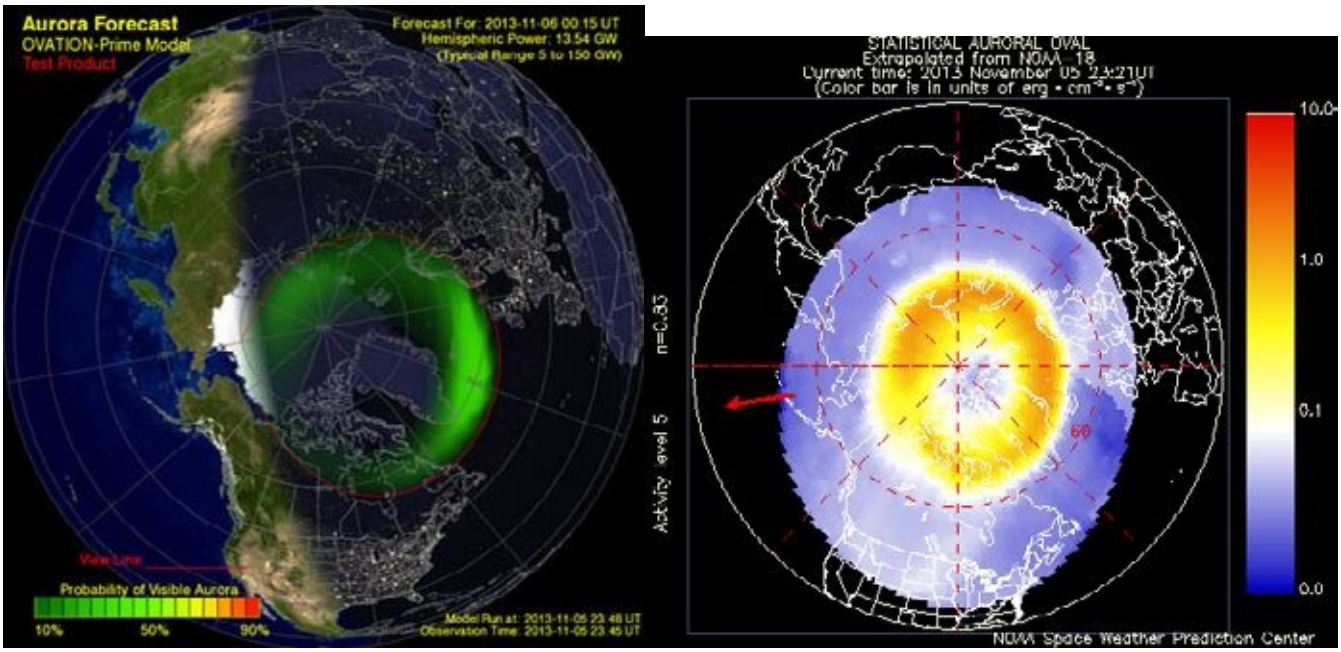
The band in this graphic shows where the au rora is expected to be seen. The darkest green areas are for the highest probability and the white along the edges have a slight chance.



The NOAA website, presently at http://www.swpc.noaa.gov/pmap/, displays a map of the northern and southern hemispheres showing where the aurora is currently active and how strong it is (left graphic). The information comes from the Polar-orbiting Operational Environmental Satellite (POES) showing the auroral oval. NOAA is in the process of developing a new website with more information from new data. This site is currently located at http://helios.swpc.noaa.gov/ovation/ (right graphic) and they believe this to be a better and more accurate predictor.

The Space Weather Prediction Center and the Space Weather Prediction Testbed have introduced this new Auroral Forecast product based on the OVATION Prime model which provides a 30-40 minute forecast on the location and probability of auroral displays. This model is driven by real-time solar wind and interplanetary magnetic field information from the Advanced Composition Explorer (ACE) satellite. In addition to providing estimates of where the aurora might be visible, it also provides output in terms of energy per unit area. For the online displays, the data is converted into a relative intensity map. This has been further translated into a probability of observation. The images show both

where the aurora is most likely to be observed as well as how bright it might be. The model also calculates a globally integrated total energy deposition in gigaWatts with Hemispheric Power ranges from 5 to 150. For values below 20, there may be little or no aurora observable. For values between 20 and 50, you may need to be near the aurora to see it and for values above 50 the aurora should be quite observable with lots of activity and motion across the sky. Once the range goes over 100, this is considered to be a very significant geomagnetic storm and the aurora may be seen for hundreds of miles.



More Aurora FAQ

What are the best months to see the aurora?
Statistically, March and April in the spring and September and October during the fall contain the most geomagnetically disturbed days coinciding with more aurora activity. While other months have lower numbers of active sun days, you will probably see the lights in October, November, December, January, and February if you're in the right location.

The solar activity numbers show the historic average of geomagnetically disturbed days for 1912-2007. This includes low years of the cycle so in active years the number increases quite a bit. Below these are the sky conditions in Fairbanks, Alaska, which is one of the best spots in the United States for viewing the aurora. By looking at the combination of highest activity and more clear nights, it shows that March is the best month to plan a visit to northern Alaska for viewing and photographing the aurora, which is when the First Light workshops are held.

Solar Activity Jan Feb Mar Apr Sep Oct Nov Dec Avg. 3.1 4.5 6.0 5.7 5.6 5.8 3.9 2.9

Sky Jan Feb Mar Apr Sep Oct Nov Dec Clear 9 8 10 7 4 4 7 7
Partly Cloudy 6 6 7 8 6 5 5 6
Cloudy 16 14 14 16 20 22 18 18

Can I see the aurora during the summer when it's not as cold? Simply put - No. Because the aurora is viewed primarily around the auroral band, summer months do not

offer the dark sky needed to observe northern lights activity.

Where all can I see the northern lights?
The best place to see the aurora is in far north areas like Alaska, Canada, Greenland, Iceland, Norway, Sweden, Finland and Siberia. They are seen in the southern hemisphere usually only in Antarctica (southern lights). 26

How far south can they be seen in the United States?
For a fairly strong display it's not uncommon for the aurora to be seen in Boston, Minneapolis and Seattle. According to SpaceWeather.com, the aurora was seen in more than half of the U.S., with people in places as far south as Alabama, Georgia and Arkansas seeing it as recently as 2011. In 1989 the aurora's extreme reach showed its power as it appeared as far south as Key West, Florida, and the Yucatán Peninsula.

How long do the lights last during the night?
Anywhere from 10 minutes to all night, depending on the magnitude of the incoming solar wind. Coronal holes consistently produce auroras but big solar flares and CMEs are responsible for global aurora displays.

What is the rating scale seen on the predictions?
Every three hours, magnetic observatories around the world measure the largest magnetic change their instruments recorded during this time. The result is averaged with other observatories to produce an index that tells how disturbed the Earth's magnetic field is. This Kp Index is based on a 1 to 9 scale. If the Kp is 4 or higher it's going to be produce a strong auroral display because we are in the middle of a geomagnetic storm. Depending on location a 3 also can be quite strong and it's not uncommon to see the aurora when the prediction is for a 1 or 2.

Are there any harmful effects from the aurora?
There have been reports of blackouts, communication failures and damage to satellites during extremely major solar storms but these have happened only a few times since the early 1970s.

Can I photograph the northern lights with my point and shoot? The answer to this is probably not. Point and shoot cameras are getting much better and there are a few out there with the capability to get all of the settings needed but the quality will be lacking. A camera that allows settings for high ISO (800 or higher), exposures of 10 to 30 seconds, allows for putting the camera on a tripod and manually focusing the lens are needed to photograph the aurora.

Can I see the aurora when it's cloudy? It can only be partly cloudy to see the aurora. There has to be some breaks in the clouds as the aurora is about 60 miles above the Earth at its lowest while clouds are situated between 6,500 feet and 45,000 feet. A solid cloud bank will obscure the aurora no matter how strong it is.

Can the aurora be seen when the moon is bright? Yes. My favorite time to photograph the aurora is when the moon puts light on the foreground. When there's snow, it brings light and detail to the scene providing a much stronger combination of foreground and aurora. More on this subject later in the book.

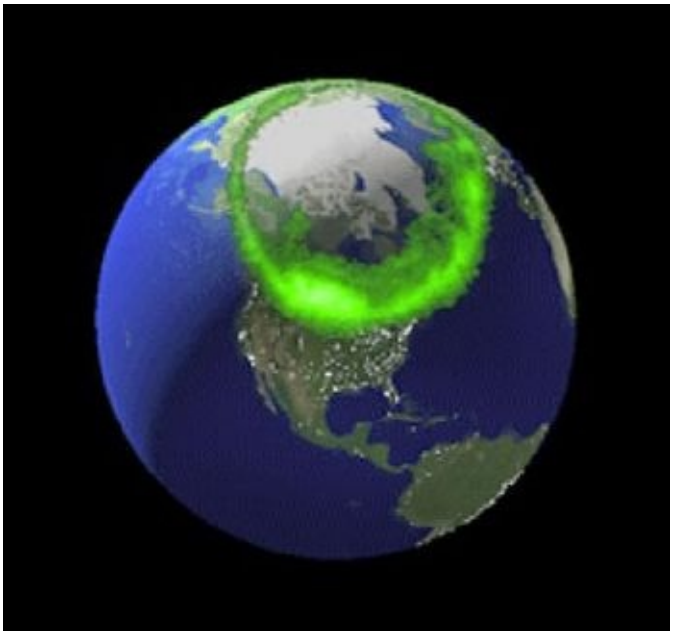
Where to See the Aurora[29]

Wherever the auroral band appears around the Northern Hemisphere, the aurora can be photographed. While there are chances to see and shoot it further south than the band, the intensity level has to be higher to reach these locales. Most of the areas where the band is located are not very accessible, but there are some spots where there is reasonable access.

There are eight countries where the auroral band can be regularly counted on being ob served during the times of year when nights get dark during the winter months - Norway, Finland, Sweden, Iceland, Greenland, Canada, Russia, United States.

In Russia, the band is primarily along the north
ern coast line and extremely difficult to reach.
If you do want to make the long trek, Murman
sk, Siberia and the Kola Peninsula are the spots.

In Norway, Tromsø is the preferred destina
tion due to its location above the Arctic Circle
within the oval. Other Norwegian locations
include Alta, Svalbard, and Finnmark.



Artist conception of the northern auroral oval expanding southward over the U.S. during high solar activity. Credit: NASA likely to see the lights in the skies over the town of Nellim, close to Lake Inari, Finland's third largest lake. Other good spots here include Luosto, Utsjoki, Ivalo and Kakslauttanen.

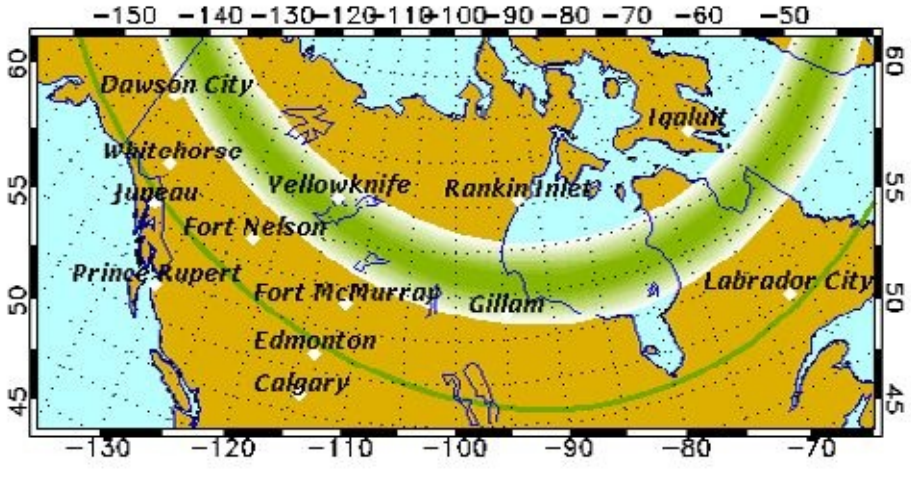
The area near Abisko, Sweden, is scientifically
proven to be a great viewing spot. The 43 mile
long Torneträsk Lake creates a patch of sky
which remains clear no matter what the sur
rounding weather patterns are. Other Swedish
spots to go are Kiruna and Swedish Lapland.
Greenland is a rare destination for the average traveler, however some accessible areas in the south and east of Greenland provide good viewing opportunities. Best Viewing Locations: Kulusuk and Ammassalik

The most popular overseas destination for Americans by far is Iceland. With easy access to Reykjavik and the entire country being within the auroral band, there are great opportunities everyFor Finland, Sodanklya is the home of the
Northern Lights Research Center. You're also
where. The most popular spots are outside of Reykjavik, Akureyri and particularly Jökulsárlón (the Glacial Lagoon). Great landscape shooting during the days makes up for any cloudy nights.

North American Viewing[30]
Canada

For ease of access, North America can't be beat for finding lots of places to go and photo graph the aurora borealis. By area, Canada has more locations to get to than the rest of the Northern Hemisphere put together as the band reaches across from the Atlantic Coast to the border of Alaska.

Northern Canada's tundra backcountry is a prime viewing spot. Head to the town of Yel lowknife, Northwest Territories or Whitehorse, Yukon Territory to see the swirling lights. Yel lowknife has become a hotbed of activity for aurora viewing as it has promoted itself as a top aurora viewing destination the last several years. While there is great viewing here, make sure you get well out of town due to the light pollution as the area is flat and the light drifts a long way.



photograph the northern lights.

The Canadian aurora band map at right shows the range for a prediction on a quiet rated night of just a one on the scale.

Alaska: The Last Frontier

In the United States, the only state with the band going across it is Alaska. While the aurora can often be seen in Maine, Minnesota and North Dakota and other northern states, the intensity level has to be high so the chances to see it are low for planning a trip to specifically Not even all of Alaska is beneath the auroral oval so where you go in the state matters. Both Anchorage and Juneau are well south of the oval and even Fairbanks at its high latitude is just south of the true auroral oval.

Because of where the oval is situated over Alaska, Fairbanks is a great starting point for any northern lights trip. The further north you go from here the better the chances of viewing and photographing the aurora. Refer back to Page 24 for a view of the auroral band over the state of Alaska.

Throughout much of North America, mountain ranges are situated on a north to south axis. The ranges in northern Alaska go east to west. Because of how the weather patterns flow, these ranges help block certain conditions and create clearer nights at different times of the year. They can also trap weather in and cause extended periods of cloudiness. More often than not, though, during winter there are cold, clear nights.

Based on the latitude of the auroral oval, as the Earth rotates the Brooks Range in northern Alaska is right in the middle of the band during peak activity time based on solar midnight.

Getting You and Your Camera Ready

It’s Cold Out There

Boots

The first and most important thing to know about preparing to go on a trip to photograph the aurora is that it’s going to be cold. Probably very cold. Because the best locations for viewing and the time of year the aurora is visible, cold temperatures are to be expected.

Getting the right gear for the cold is the first thing to consider in terms of purchasing items for standing outside at night for up to several hours in sub-zero temperatures. Depending on the time of year a trip is planned and how far north you venture, options can vary on how warm of gear is needed.

If a late September trip is planned, temperatures will not be as cold as on a trip in February or March. There also won’t be as much snow on the ground which can make standing around for several hours warmer than on ground with snow on it in late winter.

BOOTS - Starting from the ground up, a good pair of insulated or pac boots are an adequate option for being outside on a sub-zero night. If you question that this may be the only time the shoes will be needed and you opt for some not designed for cold

temperatures, you'll be uncomfortable and the trip will not be as enjoyable. Spend the extra money for shoes and other items to keep you warm so as not to be miserable standing around for several hours on the snow-covered ground.
32

Several companies make very good lines of insulated and pack boots. A pack boot can be defined as a boot with a removable lining. Although the concept has been around for a long time, the contemporary style has a rubber sole and leather uppers with a felt liner.

The main idea for these different boots is that the further the sole of your foot is from the ground the warmer it will be. So, the thicker the soles the better off you will be.

There are multiple terms used for rating a boot's quality in the cold, primarily grains, but the best thing to check is how low a temperature the shoes are designed to handle. Always get a pair rated for lower than what the temperature should be on the trip. A shoe with a rating of -25 F or lower should be sufficient.

A good starter boot that is more than sufficient for most moderate conditions is the Sorel Caribou. Sorel makes a variety of winter boots but the Caribou is their biggest seller with others designed for more extreme conditions. Another maker of winter boots is LaCrosse. They have both pack and insulated boots. Their

winter boots page, lacrossefootwear.com/ performance/winter/boots/, has boots sorted by different categories based on your needs - Mild, Moderate, and Extreme.

If you know you'll be going to photograph the northern lights several times, a great option is bunny boots. Bunny boots is the widely used nick
name for the Extreme Cold Vapor Barrier Boots used by the U.S.
armed forces.

These liner-less bulbous boots retain warmth by sandwiching wool and felt insulation between layers of rubber and are worn with one pair of heavy wool socks. These boots are rated for -65 F. Bunny boots are very popular in Alaska for those who have to spend any

amount of time outside during the winter.

Lower Layers

When you think of lower layers for clothing in cold temperatures, toe and hand warmers are not typically the first thing to come to mind. But, they are a very important piece of equipment in putting layers together.

These little things that go in your shoes and gloves can be a life saver. There are a variety of brands on the market, but the ones found to be the most reliable in the field by workshop participants are those made by Grabber. Other brands include Hot Hands, Heat Factory, and Little Hotties. Besides making them for the toes and hands there are also ones that are called body warmers that can be placed between layers of clothing on your body.

The most important thing to keep in mind when using these is to never place them directly against your skin as they can cause damage to both the nerves and tissue to whatever area they are placed. No matter how good it might feel, never use hand warmers as toe warmers as the chemical make-up is much stronger than toe warmers and damage can occur as the skin is more sensitive on the toes and there is less 33

circulation there as the feet are the furthest away from the heart.

To use toe warmers, unpeel the protective coating, revealing an adhesive side and place these on your socks. The instructions say to put them on the bottom of your toes but I have tried them both on the bottom and top and have found both work about the same. One tip to keep in mind is to take them out of the pack to expose them to air about 15 minutes before putting them on. Many people say they don’t seem to work at all but they do to a certain degree and when it’s -20 F every little bit helps.

As for the hand warmers, there are several ways to make use of them. One is to keep a pair in the pockets of your coat to wrap your fingers around from time to time. The other, and recommended, way it to put them between layers of gloves. When shooting the autight so the buttons on the camera can be used easily. Those that are thicker or have grip material make it tougher to work the various buttons and functions on the camera.

When it comes to the outer gloves, that is a personal preference. Look for the warmest that can be found but are not too tight. This is to allow air to circulate inside them so that cold air does not get trapped between the layers and make your body colder than it needs to be. This tip needs to be kept in mind for all layers of clothing, even boots. Your outer layer needs to be snug but not tight to allow for air to move around and not be trapped as this only leads to feeling colder than necessary. Also try not to have too many layers on as this will trap the air as well. Some people like mittens or gloves that a part that folds back to let the fingers be exposed.

rora it’s best to have two pairs of gloves, a liner

MITTENS OR GLOVES -

and a heavier pair. The reason for this is twoThere are pros and cons

fold. One, it’s hard to to both of these. Mittens work the camera with are great as they allow the large gloves and the hands to be curled up taking them off for a easily around the hand few minutes to make warmers inside of them changes to buttons or
to change a battery is
easier with a liner. The
and also for the fact the fingers will be closer to each other to share

second is that more than likely it will be pretty warmth. cold outside and the two layer system works
best.
The best kind of liners are those that are skin
The drawback with mittens is the lack of dexterity in using the camera, which means having to taken them off to change any settings. As you will have to change shutter speeds throughout the night, practicing with mittens on to do this is helpful. If not many changes are needed once the shooting starts, mittens can be used for operating a cable release, remote or depressing the shutter button if using the two-second timer.

If you know you’re going to be going to extreme weather places quite a bit, another option with mittens is to get
some beaver mittens. Personally, this is

what I have and use at the present time. They cost quite a bit more than store bought mittens and gloves, but the extra cost is well worth it.

As it does for the beaver itself, the fur traps body heat underneath and acts like a blanket for warmth. With the beaver being an aquatic animal, the mittens are extremely waterproof.

Gloves offer greater dexter
ity but are not as warm as

mittens. Be sure to select liners first, and then get insulated gloves or mittens that fit over them. Gloves

typically have several layers to them including thinsulate or other warming material and an outer layer that is waterproof. Gloves provide cooling surfaces around each finger, so there is a much greater area for heat loss than with mittens.
Depending on how thick the fingers are, multiple camera functions can be used with a little bit of practice. Cable releases and shutter buttons are easily used with bulky outer gloves as well as the dial for changing the shutter speed. Pushing the small buttons for image review and other functions may take a little bit of practice and patience to use them without having to take them off throughout the night.

THERMALS - One of the biggest advancements in recent years in clothing for extreme conditions has come in a key area - long underwear. Long underwear was traditionally made from natural fibers such as cotton and wool. Advancements in technology have allowed for production from synthetic materials that offer excellent body temperature regulation.

Now commonly referred to as thermal underwear, they work by trapping heat through a built-in insulation system. When your body releases heat, the underwear confines the heat, keeping it close to your body and keeping you warm. They also have the added ability to remove moisture, referred to as wicking. The most common and popular material for thermals today is polypropylene.

Thermal underwear for me is the most important clothing item. With regards to which thermal underwear to use, the following needs to be taken into account:
* Able to insulate / regulate body temperature * Be lightweight
* Use high quality material
* Fit snugly and comfortably
* Be fast wicking

Thermals that are advertised to work great for the active, such as skiers, are not always the best for standing around photographing the northern lights. You should never use cotton as a base layer because it will soak up moisture and instead of keeping you warm it will chill you down. The same holds true for outer layers.

Some of the better brands to look for are Under Armour, Duofold, and North Face. Don’t

skimp on the cost of this item as it is the most important layer you will have on.

SOCKS - In addition to finding a really good pair of boots, socks are also a key element in having warm feet. Some people like to opt for a two-layer

system of socks with the first being a liner that is good at wicking away any moisture caused by your feet sweating.

The second layer needs to be a good wool sock that is designated for expedition wear or extreme cold conditions. Besides regular wool socks, Merino wool is extremely good for this.

As mentioned in the boot section, if a pair of bunny boots are being worn, only one pair of socks are recommended, the warm wool pair.

Good base layers make for a warmer and more enjoyable outing.

Outer Layers

HEAD - “When your feet are cold, cover your head.” - Old Inuit saying

Just about everyone has heard that most body heat escapes through the head. This myth derives from a 1950s military experiment where subjects were exposed to extreme temperatures while wearing arctic survival suits - from the neck down. Naturally, the majority of the heat loss was from the uncovered head. If this experiment had been performed with people wearing swim trunks, they would have lost no more than 10% body heat through their heads.

But, hats play an important role in winter dressing. The key to effectively keeping warm is protecting all of the body evenly. Instead of piling on layers and keeping the head bare, aim for even coverage from head to toe.
35

The outer hat should cover your ears which can become very cold if there is wind. This can be a beanie hat that you can pull down over your ears, or it can be one with ear-flaps or even the hood of your outer coat if it’s insulated. viable option. Cotton holds moisture and loses its insulating properties in cold weather so this is a poor option for just about all clothing. A wool mix or synthetic shirt, woolen sweater, or fleece are some of the best choices.

My preference is for a multimaterial hat that does not have gaps that let the cold air through. Fleece-lined is very popular as well as wool, especially Marino wool. This is my inner layer with the outer layer being the hood of my coat.

PANTS - The type of pants or bibs worn is as much a personal preference as shoes are. Options can run the gamut from wool pants to insulated ski bibs to fleece lined corduroy pants. I have been wearing wool pants with a pair of good thermals for years and have been fine.

Like other items, if you use insulated pants / bibs, make sure they're rated for -25 F. Many items are designed for skiing or snowshoeing where you're constantly moving, and standing around is a lot different, so clothing needs to be purchased with that in mind.

SHIRTS - Layers are best for the upper body starting with the inner layer. Heavy or wool sweaters work well but watch out for cable knit sweaters as they allow too much air through them. Wool shirts are good if the scratchiness doesn't bother you. Heavy flannel shirts are a A good two-layer system works great at night photographing the northern lights. This two layer system may be different if glasses are worn or not. The first layer could be a Balaclava face mask that covers the cheeks and neck. It you don't wear glasses, one that covers the mouth and nose can be considered. If glasses are worn, no matter what the packag

ing says about it not fogging your glasses is false. I have yet to see one that people wear that does not fog up glasses as the condensation from your breath will get up onto the glasses and freeze.
COAT - The heavier the better. Parkas, downfilled and GoreTex jackets work best for standing outside at night. Several people have tried the newer omni-heat jackets and they don't live up to the billing so they aren't worth the high cost. Fleece does not work well for the outer layer as it's not bulky enough to trap the heat of your body inside the jacket. The thicker the insulation the better off you'll be. Don't try to save money with this item as the best ones are not cheap.

When starting off each of my northern lights photo workshops we stop at the best outdoor clothing store in Fairbanks - Big Ray's. There has yet to be a session go by that someone hasn't bought some clothing to help them out for the duration of the trip. Some have even waited to go here to get their entire outfit. Big Ray's online sales are available at http://www. bigrays.com.

Whatever you get and wherever you get it, make sure you talk to a salesperson and let

them know you're going to an area where the temperatures could be -20 F and you'll be standing around for long periods. That way they can point out items that will work best.

Food and Drink

Food might not seem like an important part of the puzzle when planning to be out in the extreme cold. While not as important as the clothing that is worn, certain aspects of what you eat will help play a role in keeping warm. 36

produces a decreased desire to drink, so one of the biggest needs during winter is proper hydration. On my workshops, we always like to have a thermos of hot water nearby for making hot chocolate as well as water bottles.

In cold weather your body temperature normally drops. Your metabolism increases to warm the air you breathe and you burn slightly more calories to stay warm. Breathing in cold, dry air forces your body to warm that air and with each breath, you lose a bit of water.

Because of this, additional fluids are needed to replace the water that gets lost. The cold also When it comes to eating during cold weather, warm foods are ideal. Cold foods and fluids chill the body, and in winter hot foods and drink are better.

Ideal foods are complex carbohydrates to help provide the extra calories to be burned to help your body stay warm. Soups, chili, bread, pasta, baked potatoes, peanut butter, lean meat, and low-fat cheese are good choices.
It's also important to eat continually to replace carbohydrate stores that are being used for warming. If you don't replace this energy you will likely feel more chilled. We try to plan ahead and bring energy bars, trail mix, sandwiches and other things that people like while on the road. Eating not only provides fuel but also increases heat production in the body.

A word of caution in cold temperatures: decrease caffeine intake as caffeine dries you out and minimize alcohol consumption as alcohol dilates the blood vessels and increases heat loss.

Wrapping It Up

As you can see, there's a lot of preparation that goes into getting ready for a northern lights adventure. Don't let any of this get in the way of the trip of a lifetime. Yes, it will cost a bit to get all of the clothing needed to take a trip at the best time of year - March - but the sights and memories made are more than worth it.

If possible, try to find some friends who have some of these items which can be borrowed. From my research there are no places to rent clothes or boots in either Fairbanks or Anchorage if planning a trip to Alaska. I'm not sure what might be available in other parts of the world.

Another thing to consider is looking online for used items. Some people who take a trip like this and only wear things just for this adventure might put them on sale on various websites. It's still a good idea to talk to a salesperson about your exact needs but realize that the items mentioned here will pretty much do for a trip to the far north when

temperatures are well below 0 degrees.
As mentioned earlier, if a trip is planned in late September the temperatures will not be nearly as cold and clothing can be modified. With Fairbanks, Alaska, being a popular spot for starting an aurora trip, below are the average lows and highs for viewing months to know what to expect. Remember that predictable viewing ends in early April and doesn't start until mid-September so temperatures for these months are skewed a bit. While temperatures are nicer in September, remember there are fewer clear nights. This is true for places other than just Alaska.

Jan Feb Mar Apr Sep Oct Nov Dec Average High 3 11 25 44 54 32 12 7 Average Low -11 -7 2 21 34 16 -2 -8 Record Low -60 -52 -41 -24 5 -27 -45 -66

Don't ruin a trip by not being warm enough, make sure you have the right clothing.

Camera Accessories

When it comes to getting all of your camera gear ready for a night out in the cold, getting everything ready is critical to getting good images. While preparing the body for the cold plays a key role in standing around outside in potentially sub-zero temperatures, getting all of the camera gear prepared is just as important.

In this next section, the types of equipment needed and preparing it to go outside and 37

you pay for. Some very inexpensive tripods are clumsy, wobbly and often hard to manipulate. Generally, the leg locks are not as secure and easy to use and the load limits are not very high. Also, if a wind does pick up they usually are not as stable as a larger tripod. Most of these come with a tripod head built onto them and these may or may not have a quick release plate for camera removal. In cold temperatures this can be very important.

precautions for going out and in will be cov
ered. This will range from the necessary items

When it comes to trito the accessories that will make life easier for pods, there are two photographing the northern lights. choices - carbon fiber and aluminum. The

Tripods

Not many people put a lot of thought into their tripods, but actually this is one of the most important pieces of equipment available for photographers. And for shooting the aurora it is an absolute must. I don't know of a single photographer who can keep a camera and lens combo steady for up to 30 seconds when the temperature is about -15 F.

difference between the two is cost and weight. Carbon fibers cost almost twice as much as aluminum but weigh quite a bit less. For cold weather work such as with the northern lights, the leg sections do not feel as cold as aluminum when you handle them. If used for other types of photography with larger lenses, carbon fibers have a greater weight to stability ratio.

To offset the sting of touching a tripod in cold Thus, a good sturdy tripod is an essential piece
of equipment. Many people wanting to travel
light will get a small, lightweight tripod but all
they are doing is cheating themselves out of
getting the best images possible.
temperatures, pipe insulation can be added to the top leg section to counter how cold the tripod gets, no matter if it's carbon fiber or aluminum. There are several companies that make pads and covers for the top section or you can choose to make your own with some

There are quite a few very inexpensive tripods
out there but as the saying goes - you get what
inexpensive pipe insulation from the local hardware store and some tape.
Using the thicker padding of pipe insulation is

also helpful as it adds some cushioning when you carry the tripod over your shoulder.

When buying a tripod, it's good to get one that when a head and camera are attached the camera is at eye level. If you get one that's shorter than you are, you'll be having to stoop over all the time to compose your image.

TRIPOD TIPS

At the end of the night it's good to keep the tripod legs extended. Anything metal that can freeze or get condensation on it. Keeping the legs extended as it adapts to the temperature change can help avoid any problems the following day such as a joint freezing up and not allowing it to open or close.

If your tripod is equipped with a center post, avoid raising it as you lose a bit of stability and have made your expensive tripod into an even more expensive monopod with a sturdy base.

Tripod Heads

A sturdy tripod with a good tripod head that is easy to operate in the dark (with gloves on) will make composing your images a lot easier.

Just as choosing the right tripod is important, picking the proper tripod head is just as important. The main options for a head are a panand-tilt or a ball head.

There are also some pistol grip tripod heads on the market but from what I've seen in the field they don't always have the tension to keep the camera and lens in place when pointed up into the sky at a pretty sharp angle.

If opting for a pan-and-tilt type tripod head the one thing to keep in mind is that you will

have two different adjustments to make for most shots and potentially three. This makes setting up a composition a bit tougher and takes more time than with a decent ball head. 38

wears on. But like many other things, it's all about personal preference and what you as the photographer prefer and how much you are willing to spend. The movements available from a pan/tilt head provide a very high level of control. They are also the most affordable solution in most cases.

For most photographers, a ball head is the best option for use on their tripod, no matter what subject is being shot. Once the camera is on a ball head, there is pretty much just one knob to turn and move the camera into position, making for easy recomposing. A ball head can move in a 360-degree circle, thus providing the easiest and best adjusting.

No matter which tripod head is used, make sure the quick release plate is secure on the camera. Also ensure the knobs for positioning the direction a shot is being taken are tight.

While moving the camera around while shooting, loosen the knobs to do this rather than

just turning the camera on the head as this will cause the plate to become loose on the camera body. I have seen numerous situations where turning the camera enough will cause the plate to get very loose and the camera almost fell off.

Good brands to look for include Really Right Stuff, Gitzo / Manfrotto, Giottos, and Kirk. With heavy gloves on and temperatures potentially quite cold, all of this extra maneuvering can cause a bit of frustration as the night

Above is the Really Right Stuff TVC-33 Tripod and BH-55 LR Ballhead combo I use for shooting the aurora. Both the head and tripod are very sturdy. While this combo costs more than most people want to spend on this equipment, you should not skimp on either of these items as it's important to have a good base from which to shoot, especially if a wind picks up. This goes for all types of photography.

Even though this is a large (tall) tripod that will hold a big telephoto lens it is very lightweight, coming in at 6.15 pounds for both.

Remote Releases

To help with getting the sharpest image possible when doing northern lights photography, or with any long exposure shooting, a cable release or timer is an invaluable accessory to have in your camera bag.

When working with a cable release in very cold temperatures, one problem can be expected - a frozen cable release that will stop working and even possibly cause the small wires inside to completely freeze up and break.

There have been times a wired cable release has not frozen, but when it does there is a better than likely chance it's ruined forever. The first sign one is going is if when a button on the camera is pushed to either look at the LCD screen or another function and it doesn't operate. Unplugging the release and testing the button again will show whether the problem is with the release or the camera.

Most wireless releases require a line of sight with the infrared eye on the front of the camera so using one of these means reaching around the camera to trigger a shot. There

are some wireless remotes available where a transmitter is slid into the flash hot shoe and then plugged into the cable release jack and the remote can then be used from a variety of locations, including having your hands in your pockets or having the remote inside of your gloves. Because the connection cable is very short and does not move once attached there is less likelihood of it freezing.

The best option for taking shots at night to minimize movement of the camera is to use the 2 second timer if that option is available on your camera. If there's only a 10 second timer it is best to use a cable release and hope it doesn't freeze or by gently depressing the shutter button.

Batteries

Every camera will go through batteries while shooting in the cold faster than in normal conditions. Shooting long exposures puts a drain on the battery and more often than not it will have to be changed during a night of northern lights photography.

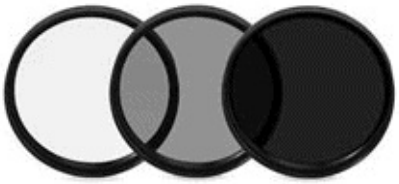
Some newer cameras have more durable battery life and they might make it through the night, but no matter which camera is used, have at least one extra battery readily available. When one does go and is replaced, it will regain a little charge once warmed in a pocket for a little while. Keeping a set of hand warmers in the pocket with a switched out battery will help revive it quicker.

When changing batteries, having liner gloves to make the change quicker is useful. If you have to go back inside you may lose out a great images. Always make sure all batteries are fully charged for a night of aurora photography.

Filters

Whatever you do, be sure to remove all filters from the lenses you'll be using to photograph the northern lights. Too often the filters will cause concentric rings and ruin more shots than not. This includes gel, plastic and glass filters and especially UV filters that some camera stores push to get people to buy and leave on at all times. If a polarizer

happens to be on a lens and you set the camera up for proper exposures, it will cause a missed shot due to the two-stop effect it has on the exposure.



Tape

Tape is an important accessory to add to the camera bag; and not just any tape. The best type to have is a white vinyl electrical tape. This will be used after you get your focus set,

as will be discussed later in the Shooting the Aurora section, and switching the lens to manual. Once in manual focus, the tape

will help keep the focus ring in place so focus doesn't change while shooting during the night. 40

Memory Cards

Over the time I've spent photographing the
northern lights and with lots of workshop participants, we have yet to come across a situation where anyone has had a problem with a memory card. As a reseller of Delkin products, I usually have some of their CF Cards available during workshops. NASA uses Delkin CF Cards in space and with as cold as it is there they would only choose cards that will hold up to their standards. SanDisk Extremes are also very reliable cards and have held up well even though their specifications show they are good to just -13 F.

Having extremely high capacity cards is not necessary for a night of aurora photography as not as many shots will be taken compared to a lot of other subjects. If your camera is above 20 megapixel, it's always good to have at least at 16 GB card so you're not changing cards too often. If you opt to try a series of time lapse shots or a very long star trails stack with the aurora, you would want to start with a fresh card that will hold a lot of RAW images. RAW versus jpeg will be discussed in more detail in the Shooting the Aurora section.

Flashlights

Because you’re working with your camera outside at night, you will need some form of light or head lamp to see the controls. Some people prefer to use a head lamp as it frees up both hands, but with the hats that are worn, a head lamp might not fit well. If you have a head lamp and it doesn’t fit over your cap, just hold it in your hand as if it were a flashlight.

I have two types of lights I use for a variety of functions while shooting the aurora. One is a small key-chain type light by Inova called the Microlight that comes with different colored lights including the two best for aurora shooting - blue and red. I also have a small MagLite to provide light for moving from place to place.

A colored and dim light

works best as it helps you retain your night vision much more than a bright white light and it also doesn’t interfere with others nearby taking a photo. If you do wear a head lamp, make sure it’s off before you look directly at someone as it will blind them for a minute or so. I try to avoid using a light at all because after a little while your eyes do adjust to the darkness. If and when one has to be used, keep the time minimal and away from the other photographers nearby.

Here are two incidents of lights being turned on in an area where others are shooting the aurora. The one on the left was a person turning a head lamp on and then turning around illuminating part of the snow in the foreground. Above, the person had a red light and turned it on while walking out into an area in front of people shooting from above.

Luckily in both of these situations the person did not turn towards another person and put the light right into their face but I have seen this happen on numerous occasions and the second person lost their night vision for a couple of minutes.

Whenever working around other people at night, be sure to ask if anyone has their shutter

open and wait until no one is taking a shot and try to minimize both the time the light is on as well as the direction towards other photographers.

Also check to see where others are so as not to get into someone’s shot.

Painting with Light

There are times when extra light is called for. A flashlight can be used to paint light on a foreground subject to bring detail out in it if the moon is not out. For shots such as the one on this and the next page, just a small amount of light is needed, especially if there’s snow on the ground. Too much light will over-expose the snow so just a quick on and off of the light source will provide enough light to accomplish the desired effect. Several attempts might need to be done with the painting to get the outcome just the way you want it, primarily because of the reflective nature of snow.

Your Camera at Night

Photographing at night can push your equipment to its limits. There may be no more demanding lens test than reproducing the colors and movement of the northern lights and stars you see and don’t see across the camera’s field of view. This is especially true when working with the aperture wide open to capture what light is available.

The sensor also has to work extra hard. When night photography gets serious, individual photons of light hitting the sensor are counted. Daytime photography, in comparison, is like measuring flood-beam levels of light. The ability of the sensor to capture and record low levels of light while minimizing noise diminishes the quality of night sky images able to be captured.

Thankfully, sensors in current DSLRs have reached amazing levels and operate at limits never thought possible. Compared to ten years ago, the sensor is miles ahead in technology. Imagine what it will be like in another five years. As a result, DSLRs now open up photographic possibilities unheard of before.

Instead of taking images of the aurora between 30 and 60 seconds, I’m now taking them at around two to five seconds.

Your Camera in the Cold

There is no doubt your camera will get cold. While I have seen nighttime temperatures dip into the -20s F, a camera typically will not ice over. What can happen is the LCD screen can fog up if it is breathed on and gets condensation on it, making reviews tougher to see. A microfiber cloth will help clear that up.

There are multiple ways to adjust a camera for going from the cold into the warmth of a building to keep it from icing up. My preference is to have an extra stocking cap to put over the camera and lens outside for a little while to drop its temperature before bringing it inside and then leave the cap on the rest of the night and take it off in the morning. Some use a large Ziploc bag to put the camera and lens in to bring inside while some will put them in the Ziploc bag and then into their camera bag. A third way is to leave a camera bag outside zipped up while shooting and put the camera, with the lens still on, in the bag to take inside.

HELPFUL HINT

Try to avoid going inside too often to warm your body up when it is really cold. Each time you go back inside the less time you're able to spend outside before getting uncomfortable with the temperature.

Stay out as long as possible, especially if the aurora is active as you don't want to miss a shot.

There are times a camera has to be taken inside for a little work with gloves off such as changing a battery or checking and changing some settings. The main thing when doing this is to make sure the lens cap is on before going in. If not and it's noticed right away, take it outside immediately and wait for the fogging to go away as it should in less than a minute. If it doesn't, using a cleaner such as Eclipse sensor cleaner which has methanol in it will clear the lens up almost immediately.

Only once have I seen a camera freeze up on someone while shooting. When they were taking a photo the shutter froze and after a little testing we just let it warm up overnight inside and when it was tested in the morning is was fine. This is the reason why it's best to have two camera bodies on a potential once in a lifetime trip as you never know when something might happen to one and you don't want to miss out on some great shots the remainder of the trip.

Regarding batteries and the cold, it's best to turn off the LCD Review function so that a review does not appear after every image taken as this uses up a lot of battery power. Reviews will need to be done from time to time, especially when first starting out, but keeping these to a minimum will prolong battery life.
There are times when it is safe to go inside to take a little break. After a large breakup and the sky goes quiet, it usually take a while before the activity picks up again. Now is a good time to go in and get a cup of hot chocolate to warm up but keep stepping outside to look for the aurora to start getting active again.

I had one person complain at the end of a workshop they didn't get many aurora shots and

another chimed in that they had taken well over 100 in the same night. Guess which one kept going back inside to warm up.

Yes, it might be uncomfortable but how often are you going to get a chance to see the greatest light show on Earth?

The more time spent outside in the cold, the slower some functions on a camera will become. At some point it might take a few seconds for an image review to come up. It's also important not to change lenses outdoors as you never want to get moisture or condensation inside the camera body. Sensors are very sensitive and you don't want to take a chance of anything happening to it. Don't take a cold lens off inside either as the back element will be exposed and fog up.

Camera Bodies

The are a wide array of Digital Single Lens Reflex (DSLR) camera bodies on the market that work just fine for photographing the aurora borealis. Over all of my years of leading northern lights workshops, by far the two most popular brands are Canon and Nikon. There have been others and every DSLR out there is capable of taking good images. As a Canon shooter, references and terminology will relate to that but know that everything mentioned will relate to other bodies as well.

Today, cameras come in two formats: full frame and cropped, based on the size of the sensor. More about the size of these can be found in the section regarding Noise and Noise Reduction. Each brand has a good selection of both full frame and crop bodies to choose from and every year the list grows. The advancements the manufacturers make the better aurora images you can take.

In determining which body to use for aurora shooting, realize both have advantages and disadvantages. As with most camera equipment purchases, get the best that you can afford or want to spend.

The following is a list of the advantages and disadvantages of a full frame body and a cropped sensor body for aurora photography.

ADVANTAGES

• A full frame sensor has lower noise at high ISOs because of the larger pixels.

• When a lens is put on a full frame body, that is the true mm length you will be shooting at.

• If money is a concern, a cropped body is more reasonably priced, but the price of some full frame bodies has been dropping recently.

• Generally, a full frame sensor provides a broader dynamic range and better low light performance offering a higher quality image.

• It’s possible to use full frame lenses & APC-S lenses on a crop sensor body… but you can’t use a crop sensor lens on a full frame DSLR.

• When using a full frame lens on a cropped sensor body there is less vignetting.

DISADVANTAGES

• The price point of most full frame bodies can be quite high.

• Cropped sensor bodies do not allow for a wide enough field of view if not using an ultrawide wide angle lens (24mm or wider). If you only have a 20mm lens, on a full frame body it’s still 20mm but on a Nikon crop of 1.5 that lens is now just 30mm and for a Canon 1.6 crop it’s 32mm. That’s a lot of lost foreground and sky for the aurora.

• There are times that a full frame body and a wide angle lens cause vignetting in the corners.

The following pages are images taken through the years taken with different camera bodies with different lenses and sensor sizes.

Taken in March 2005 with a Canon 10D body and a 20-35mm f/3.5 lens at 20mm. ISO was set at 400 for this 10 second exposure. Not as much ISO and shutter speed combo were needed due to the brightness of the moon. Notice the lack of field of view due to the 20mm lens acting as if it were 32mm due to the 1.6X crop factor of the 10D. This was taken on my first trip to scout and photograph the aurora.

Taken with a Canon 1D Mark II body and a 16-35mm f/2.8 lens at 16mm. ISO was set at 500 for this 30 second exposure. With the 1D Mark II having just a 1.3X crop factor, the 16mm lens translates to a 21mm lens, giving a wider field of view and more visible sky. The larger sensor also produced less overall noise in the mid-tones and dark areas of the sky.

Taken in March 2010 with a Canon 1Ds Mark II body and a 16-35mm f/2.8 lens at 21mm. ISO was set at 640 for this 30 second exposure. With having a full frame sensor, ISO and shutter speeds were pushed to see what the camera could handle. With the higher quality sensor and longer shutter speeds, more colors of the aurora began to be picked up by this camera than previous versions used. Luck plays a part in aurora photography with getting a shooting star.

Shot with a Canon 5D Mark III body and a 16-35mm f/2.8 lens at 16mm. ISO was set at 2000 for this 2.5 second exposure. When you get a new camera body that is supposed to be able to handle high ISO extremely well, you should do some testing. Over the period of a month in Alaska, a variety of ISO were used ranging from 1000 up to 3200 with good results.

Point and Shoots

While it is not impossible to photograph the northern lights with a point and shoot / compact camera, realize the resulting image will not be very good. When compared to the images found on websites and on the pages of books taken with a DSLR, images taken with a compact camera will not have the same quality.

If your main intent is on seeing the aurora come to life in the night sky and getting a photo or two, then this type of camera might be of use to you but don’t expect much unless you have a very high-end compact camera.

As with DSLRs, camera manufacturers are adding more features to compact cameras and today there are many with the capacity to capture the northern lights. The biggest problem with using a point and shoot camera for the northern lights is with the size of the sensor. Typical compact cameras have a sensor size of 6.17mm X 4.55mm while more competent ones come in at a larger 7.6mm x 5.7mm.

With demand growing and the price of making larger sensors dropping, there has been a growing number of high-end compact cameras with larger sensors. The Fujifilm X20 has an 8.8 X 6.6mm sensor while the Sony RX100 has an even bigger sensor at 12.8 X 9.6

mm. The Canon G1 X boasts an 18.7 X 14mm sensor.

This last group is considered in the high-end range of compacts and there is now a line of ultra high-end compacts. Increasing sensor sizes even more, this group includes the Leica X2, Fuji X100S and Nikon COOLPIX A, which both feature a 23.7 X 15.6mm sensor. There's also the Sony RX1 with a full frame sensor.

NEEDED FEATURES FOR A COMPACT CAMERA

• Wide-angle lens of at least 24mm wide.

• High ISO capability, i.e. ISO 800.
• Ability to change aperture to f/2.8 or faster.
• Manual focus capability.

• Ability to change shutter speed manually to between 5 and 30 seconds.

• An eyepiece viewfinder.
• Ability to attach the camera to a tripod.
• Option to shoot RAW files.

51

Canon G1 X

Nikon Coolpix A

Sony RX1

Lenses
What Lens Should I Use?

With so many lenses available by a wider number of companies that make camera bodies, this is a question with more answers than merely asking which camera body should be purchased. Part of the answer goes back to getting the best for the amount of money you want to spend.

By the nature of northern lights photography, whichever lens you choose it is going to cost a bit. To be able to use a fast shutter speed at night the lens needs to be fast. This means the aperture should be around f/2.8. Nice shots can be made with an f/3.5 or f/4 lens but a longer shutter speed will need to be used. If paired with a newer camera that can handle high ISOs, some of the loss of speed can be compensated for by bumping up the ISO to get a faster shutter speed.

Another consideration is the quality of the glass. Most lens makers have two levels of

glass used in making lenses: consumer-grade glass and the high quality professional low dispersion glass. For Canon, their high-end glass is referred to as L lenses and for Nikon it is called ED. Other companies have different designations for this higher quality glass that will let in more light at a given f/stop than normal glass.

Whether you go with a very fast lens or regular or low dispersion glass, one requirement for an aurora lens is for it to be wide angle, primarily 52

24mm or wider. Most of the images I have taken have been at this range. You want as much field of view as possible in order to get a lot of sky and some foreground for aurora shots.

PRIME LENS OR ZOOM LENS?
Prime lenses (fixed focal length) are typically faster and offer better optics than similarly priced zoom lenses. While there are several attractive prime lenses for full frame cameras, there are very few that offer a suitably wide field of view for cropped sensor cameras.

Having experimented with a fixed focal length ultra-wide angle 14mm, my preference for an aurora lens is a zoom, allowing for changing focal lengths to fit the setting. For cropped bodies, the Canon 10-22mm lens is a great option, which offers a super wide field of view along with the Sigma 10-20mm. The Canon 16-35mm f2.8 and Nikkor 14-24mm are premium lenses designed for full-frame cameras but they can also be used on cropped sensor bodies. If you are able to get an f/1.4 or f/1.8 lens, that would be even better than those at f/2.8 because shutter speeds would decrease by half with the extra stop of light that is gained.

A good rule of thumb when choosing an ultrawide angle zoom (ultra-wide is anything 24mm or wider), is the zoom range should only be right around double the focal length. Getting a lens such as a 17-85mm will not provide the quality optics needed to take good aurora images. In the list of lenses on the next page you will notice that most zooms are double the widest focal length or just a little beyond this.

Lens Options

The following is a list of good short, fast lens options to consider purchasing or renting for shooting the northern lights:

Lenses Exclusive for Cropped Sensor Some wide angle lenses are built exclusively for certain APS sensor camera bodies such as the Nikon DX series and Canon Rebel lines.

Most of these lenses are not as fast as other options but have a better price point.

• Canon EF-S 10-22mm f/3.5-4.5 USM
• Nikkor AF 12-24mm f/4G IF-ED AF-S-DX
• Tokina 11-16mm f/2.8 AT-X 116 Pro
• Rokinon 16mm f/2.0 for APS-C
• Sigma 8-16mm f/4.5-5.6 DC HSM
• Sigma 10-20mm f/3.5 EX DC HSM

Good Lenses for Cropped Sensor Cameras Fixed Focal Length
• Canon 20mm f/2.8

• Nikkor 20mm f/2.8
• Sigma 20mm f/1.8
• Sigma 10mm f/2.8

Zoom
• Canon 10-22mm f/3.5-5.6

• Canon 15-85mm f/3.5-5.6
• Nikkor 16-85mm f/3.5-5.6
• Sigma 10-20mm f/3.5 53

• Tokina 11-16mm f/2.8

Good Lenses for Full Frame Cameras Fixed Focal Length
• Canon 14mm f/2.8L II USM

• Nikkor 14mm f/2.8 ED
• Rokinon 14mm f/2.8 IF ED

• Zeiss 15mm f/2.8 Distagon T* (has mounts for both Canon and Nikon; very expensive)

• Canon 20mm f/2.8 USM
• Canon 24mm f/1.4L II USM
• Canon 24mm f/2.8 IS USM
• Nikkor 24mm f/1.4
• Sigma 20 / 24mm f/1.8

• Various 28mm prime lenses (f1.8 and faster) to suit your camera
• Fisheye lens (if you want intentional distortion)

Why a Fast Lens?

Your wide angle lens should have an aperture of f/2.8 or faster. Using a large / fast aperture lens in conjunction with high ISO widens your shooting options. A lens of f/3.5 or f/4 is a full stop slower than f/2.8, causing your shutter speed to double to get as much light in.

There are two benefits of using a faster lens. One is that being able to reduce the shutter speed, allowing you to capture more detail in the aurora curtain and other shapes, particularly when it is dancing in different shapes across the sky. Faster shutter speeds help in bringing out this definition.

Two, a fast shutter speed allows you to shoot more frames during a display and the ability to move around to catch the action in different spots as it dances across the sky from one side to another.

Zoom
• Canon 16-35mm f/2.8 (**my lens of choice**)

• Nikkor 14-24mm f/2.8
• Nikkor 17-35mm f/2.8D ED AF
• Tokina 16-28mm f/2.8
• Various 24mm zoom lenses (f/3.5 and faster)

Mid-Range Zooms
• Canon 24-70mm f/2.8L II
• Nikkor 24-70mm f/2.8G ED

Renting a Lens

If you do not do a lot of other photography requiring wide angle lenses, you can rent a lens. The savings would be well worth considering before buying a lens that might not get a lot of work beyond this trip. For First Light northern lights workshops, we stop at a camera store in Fairbanks that has a good selection of rental lenses and camera bodies. There are several reliable online rental companies listed on the Reference page which can also be used.

A fast lens (f/2.8) combined with a high ISO (3200) allowed for a fast shutter speed of 2 seconds providing a lot of definition in this fast moving and constantly changing auroral

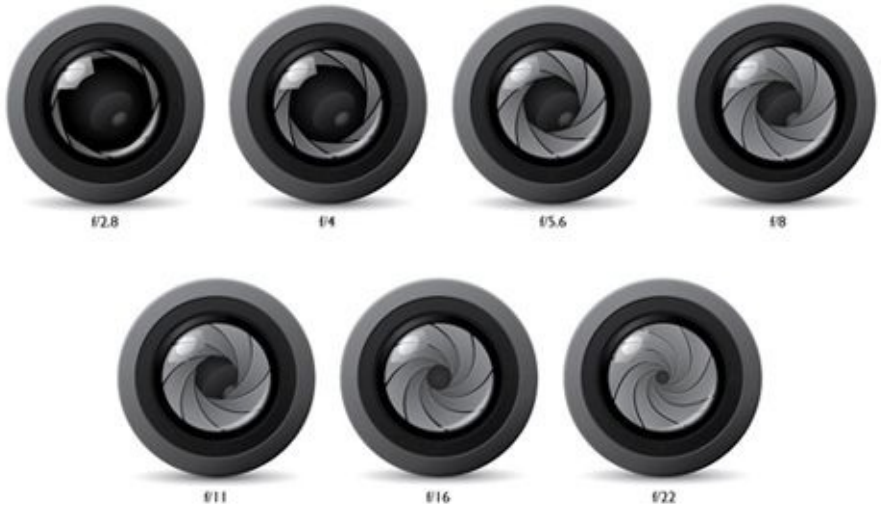
display. The curtain on the lower left would have been washed out, and replaced by a solid band with an exposure of six or more seconds.

Lens Aperture

At night, we are limited by the amount of available light we have to work with. Luckily, when photographing the northern lights they provide their own light. Even so, it is very common to work with the aperture of the lens wide open. This means setting the aperture to the smallest number setting available.

Some people have a hard time understanding how apertures (f/stops) relate to depth of field and shutter speed. As shown in the diagram on the right, f/stops refer to the size of the opening of the aperture diaphragm.

Today's DSLRs can be set up to adjust f/stops by either one-third or one-half stops. Most people leave it at the default of what the camera is when they get it and this is typically in one-third stops.
55



The lowest number for this diagram is f/2.8, the widest aperture as the diaphragm is wide open. This allows the most light to reach the cameras sensor for however long the shutter is left open. Each full stop down from this, the opening is half as large and to get the same amount of light to reach the sensor, the shutter speed must be doubled.
But, doesn't a wide open aperture also mean a shallow depth of field, someone might be thinking? Yes, it does, but also remember the aurora is 50 or more miles up in the sky. While your foreground subject is going to be a lot closer than that, possibly 15 to 20 feet away or maybe 30 yards or more in some cases, focusing at infinity will be more than enough for most wide angle lenses.
distance, their focusing mechanisms are set up for that.

With f/2.8 being what most people have when shooting the aurora, quite often the camera is set to that and left there for the night. It can be dropped down a bit when there's a full moon, but the better choice is to leave it wide open and adjust the shutter speed.

This creates part one of why a fast aperture lens is needed when shooting the aurora and why the camera is set to its widest aperture.

A faster aperture = faster shutter speed = more definition in the aurora.
If you take a look at the focusing distances on most wide angle lenses, they have very small distances before it reaches infinity, in most cases 15 feet or less. Because wide angle lenses are designed to shoot subjects at a further For most people using a zoom lens with a maximum aperture of f/3.5, you will generally have little option but to use it wide open and accept whatever image quality it provides. Again, bump the ISO up to regain that lost f/stop.

ISO

With the advent of the new camera bodes and their ability to handle very high ISOs with less noise, I recommend using quite high ISO settings, around 1600-3200, for aurora photography. Over the next few pages, I discuss the reasons why, and other details about ISO and the types of noise that affect long exposure images in low light conditions.

ISO is the third part of the equation when it comes to putting everything together to obtain the proper exposure in conjunction with a particular aperture setting and corresponding shutter speed. As mentioned in the discussion on lenses, the aperture will be set to wide open, whether that be f/2.8, f/3.5 or f/1.4.

With that being a given, the next setting to help determine which shutter speed will be used to take shots of the aurora at night is the ISO. In it’s most basic sense, ISO controls the sensor’s sensitivity to light. The higher the ISO used, the more sensitive to light the sensor becomes. High ISO settings allow the shutter speed to be reduced, which results in more defined aurora shapes but they also increase noise.

At some point when putting the three together, noise is a necessary by-product that has to be dealt with. If a lower ISO is used, then a longer shutter speed will result, which causes noise. If a high ISO is used to get a faster shutter speed, noise will come about because of the high ISO. It is an unavoidable problem that is discussed in more detail later in the book.

The absolute lowest ISO recommended for shooting the aurora is 400, but that’s usually too low as it results in very long shutter speeds, sometimes up to 60 seconds depending on the f/stop and the lighting conditions. These long shutter speeds result in very little definition in the aurora as the bands combine together over the long duration. ISO 400 can be used when there is a moon out putting light on both the foreground and in the sky.

Here are two examples of images taken at ISO 400. The shot below was for 60 seconds because of the lack of a moon so there would be definition in the snow. Because of the long exposure the bands overlapped each other leaving little definition. The photo on the left was for 10 seconds due to the brightness of the moon. There is more definition in the aurora but an even higher ISO would have provided more because a faster shutter speed could have been used.

Camera and Lens Play a Role

How high an ISO can be chosen is partially based on the equipment being used, both from a camera or lens perspective.

Regarding the lens, if it only has a widest aperture of either f/3.5 or f/4, then bumping the ISO up to at least 400 and preferably 800 or 1000 is recommended in order to get fast enough shutter speeds. If the camera is just a few years old and has been recommended for being able to handle high ISOs, then starting at 1200 and going up to 1600 is possible. Because lenses of f/3.5 and f/4 are not typically of the low dispersion variety, the quality of the image would suffer if a higher ISO was used.

As for the camera body helping determine ISO, if it is several years old or has the smaller sensor sizes, very high ISO usage is not encouraged. Ranges from 400 to 1600 can be used and quality images provided, especially if low dispersion glass is mounted on the camera.

It’s always best to do a little bit of testing to see what your camera can handle. Even before going on a northern lights adventure, go out at night and do some testing with the body and lens combo you plan to use. Try multiple ISO settings such as 800, 1200, 1600, 2000, 2500, 3200 and possibly as high as 6400 to see what the results are. Try to do this test on a dark night and use a variety of shutter speeds between 2 and 20 seconds. Look at the results on your computer enlarged to 100% to see what’s acceptable.

Auto ISO

One feature on some bodies today is Auto ISO. By activating this, the camera will automatically choose the ISO based on the amount of ambient light.

While you can set what the maximum ISO range can be, there are pluses and minuses to using this setting. If there is a certain shutter speed range you want to work with, and the ISO changes automatically, the corresponding shutter speed could be out of that range.

What’s My Best ISO?

For shooting the aurora, select a high ISO setting that gives you a well-exposed image on the LCD. This can be as high as ISO 3200 with quality zoom lenses and ISO 1600 to 2000 for a fast prime lens. Although you can shoot at a lower ISO setting and post-process it for similar results, it’s important to see your image clearly on the LCD as you shoot, so you can assess the composition and get excited about what you’re shooting. On the low end, try not to go less than 800 ISO if possible.

If you don’t set a maximum range, it could go to a level too high for the camera to handle the corresponding shutter speed. Dynamic range could be lost and the added noise at the higher ISO can make the image unusable. This is especially true if working with a cropped sensor body.

If you like using this feature and can set a maximum range, set it to 800 for a cropped sensor and to 2500 or possibly 3200 for a full frame.

Some cameras will show very high ISO settings as H1 or H2, rather than an ISO figure. Refer to the manual if it’s not clear what speed these relate to. In some cases these settings are enabled through Custom Settings. Generally, there is little benefit to using these very high settings, especially when shooting RAW. Typically, I tend to want control over the various settings on my camera so I ignore this feature. If this is something you use a lot and are comfortable with, then go ahead and use it. If shooting in bright moonlight and a fully exposed image can be made at a lower ISO setting, this is an option. If the aurora is bright, you can adjust shutter speed down. Another consideration is how fast the aurora is moving and how short a shutter speed you want to use.

ISO selection is also based on how much post processing work you want to do and what the final product of the shoot is going to be. A very large print will require less visible noise than a smaller 8” X 10” print. Projection on a large HD television or through a projector also require a cleaner image. If for your own enjoyment, then amplified noise is not a big concern.

As illustrated in the next four pages, any ISO can be used and a good photo of the aurora can be made. As you see, the higher the ISO the more shape definition because a faster shutter speed is able to be used. The main thing this shows is whatever your equipment can handle, it will produce a good shot.

Noise and Noise Reduction

62

WHAT IS NOISE
These are the unwanted dots that appear on the image. They might not be seen on the LCD, but when viewed at 100% on a computer they are quite evident. These dots are referred to as noise and were known as grain in film days.

WHAT CAUSES NOISE
High ISO: Think of ISO as the volume knob on a radio. The more volume the louder the sound, but it also becomes distorted compared to the clean sound at lower levels. In a photograph, the higher the ISO, the more distortion (noise).

Long exposure time: This introduces static, which can be a cause of digital noise. When photographing the northern lights, these two are the main culprits because both are required in order to capture a photo.

Sensor size: The smaller the sensor the greater the noise at comparable megapixel size and cameras with larger sensors produce lower noise at higher ISOs. Most photographers shooting the aurora have a cropped camera body. Common crops are 1.3, 1.5 and 1.6. A full frame camera has a 24mm X 36mm sensor, while a 1.3 crop is 19.1 X 28.7, a 1.5 crop is 15.8 X 23.6 and a 1.6 crop is 15 X 22.5mm. Notice the reduction in sensor size for each of these. smaller. While you may want a camera with more megapixels for increased

resolution, it is a trade-off and a camera with larger pixels (less megapixels) will perform better in low light. This is the main reason that full frame cameras generally perform better in low light, because they have larger pixels than a cropped sensor. at night, dark areas of the sky will show more noise than a winter scene of snow, even at the same ISO. Like many in-camera functions, this works primarily on jpeg files as opposed to RAW files. If shooting with both turned on, it will have some effect on the jpeg but post-production work does a better job of eliminating this type of noise.

IN-CAMERA NOISE REDUCTION

Most photographers know the adage ‘use the lowest ISO you possibly can for the best quality image.’ That isn’t easy when shooting the aurora as discussed previously under ISO.

While over-exposing will help compensate and bring noise levels down, that isn’t a good option for shooting the northern lights as it can blow out the highlights in bright parts of the bands. Likewise, you’re more likely to see noise in high ISO files from any scene if images are under-exposed. To help offset the noise inherent to photographing the aurora, most newer camera bodies have two types of noise reduction options - High ISO Noise Reduction and Long Exposure Noise Reduction. The following is a description of both as well as the pluses and minuses of using these for aurora photography.

Pixel density: This works hand in hand with sensor size. Assume we have a variety of 14 megapixel camera. To fit those pixels onto a smaller sensor the actual pixel size has to be

HIGH ISO NOISE REDUCTION
Noise tends to be apparent in the plain, solid areas of a subject, especially in the mid-tone and dark areas. Because the aurora is shot

LONG EXPOSURE NOISE REDUCTION
When activated, the camera takes a second identical exposure for any shot longer than one second with the shutter closed. This lets the camera know which pixels are hot and exactly how much light leakage there is. The camera then subtracts the dark frame image from the original shot saving the result. Engineers call this Dark Frame Subtraction. The noise in the dark frame exposure is examined and subtracted from the original image.

The downside is this causes the shoot / write time to double because two exposures are being made. If the aurora is extremely active, that means half as many shots can be taken than with having this feature turned off.

Some believe noise is a result of a heated sensor and the cold temperatures of aurora shooting negates the noise so this setting can be ignored. This is more camera-specific so tests on your own gear is advised before choosing to activate this feature or not. My preference is to take more shots and do some clean-up of ones I want to use in post production.

Other Camera Settings

RAW VS. JPEG

A RAW file captures a much greater depth of information than in a JPEG file. For this reason alone, it is worth shooting in RAW whenever possible. RAW is also a lossless format in that when a JPEG file is saved on the memory card the data is compressed and some pixels are taken away. When work is done later in another program, each save takes away more data and eventually the file has too many compressions and the quality loss will show, even on a computer.

Because RAW retains all data, more work can be done in post processing on the RAW file without any loss of data, providing a very good file to print or post on the computer. Some people will shoot in RAW and JPEG where it saves a copy of each on the memory card. This takes up more space for fewer shots on a card, but the JPEG file is there for use, which requires less post processing work.

If Long Exposure Noise Reduction is set and the camera subtracts a dark frame, the effect is the same whether the camera saves a RAW or a JPEG file. However, the noise smoothing applied by the High ISO Noise Reduction setting only applies to the JPEG image. In this case, you are better off shooting in RAW and controlling the amount of noise during post processing. Multiple applications offer impressive noise reduction algorithms, so it is safe to leave the ‘High ISO Noise Reduction’ setting on the camera turned off and forget about it.

WHITE BALANCE

The most accurate white balance is generally achieved with a Daylight or Auto setting, although you may develop a personal preference for other settings in order to make the image warmer (Cloudy) or cooler (Custom 5000K). Generally, it is best to shoot in RAW mode so adjustments to color balance and tint can be made during post-processing.

IMAGE STABILIZATION

Turn off lens image stabilization. The newest, most expensive lenses are designed to allow for this being turned on while the camera is on a tripod, but in most cases when stabilization is used on a tripod for extended times, the motor will burn out and the repair cost is high.

SELF-TIMER

If triggering the shutter by hand, it is best to use the self-timer so camera shake has ceased before the shutter opens. A two-second delay works best if the camera body has this

feature. If the camera only has a 10-second timer it is best to use a cable release or wireless remote.

LCD BRIGHTNESS

LCD review screens on cameras today are quite bright. So you do not get a false reading when you're capturing a strong aurora, it is best to set the brightness to lower than default. Different cameras have different levels of adjustment. When finding this setting in the Menu, make sure you get it partially left of center so it is less than normal. Some cameras even have an auto-brightness feature which measures the ambient light and adjusts the display automatically. While great for bright daylight settings, this can be very misleading when shooting at night. The aurora may look great on the LCD but on a computer, it is almost always underexposed. Turn this feature off and set it manually.

LCD REVIEW

Turn Review off so it does not come on after every image taken. To review a shot to ensure composition and exposure is correct, use the review button to look at the photo for a couple of seconds and then deactivate. There are two reasons for this. One, having this come on after every shot burns up the battery quicker, and two, the light it gives off causing a loss of night vision for you and for others around you.

DRIVE MODE

Even though continuous drive is usually considered for shooting multiple frames a second for wildlife, this is a good mode for aurora photography. The main purpose for this is when doing continuous shots for stacking star trails or creating a time lapse where the remote is locked in and shot after shot its taken. If the action of the aurora is quite intense and moving very fast, numerous shots can be taken if the camera position does not have to be changed and the shutter speed is around two seconds.

EXPOSURE MODE

My two primary choices are Manual Mode or Aperture Priority for northern lights shooting. Manual Mode allows for complete control over both the aperture (f/stop) and shutter speed. The first setting which will stay the same all night is the aperture, which is set at wide open and left there. Next, set the shutter speed based on the shooting conditions.
If using Manual Mode and there is a bright moon, exposure times will need to be decreased so that neither the foreground or the aurora is overexposed. Manual does take a bit more work in that exposures will need to be checked fairly often if the intensity of the

aurora changes frequently.

Aperture priority is another option for which exposure mode is chosen. Here, you set the f/stop and the camera will automatically determine what the shutter speed needs to be. Which metering mode is used will help in determining the shutter speed. The one drawback to using aperture priority is if the aurora fades a bit and a shutter speed of longer than 30 seconds is needed a photo can't be taken due to the combination of the needed time for the given f/stop shutter speed combination. This works best if shutter speeds are more in the five to 15 second range where slight changes in brightness will not result in a 30 second exposure.

The first consideration is the speed of the lens being used and the ISO the camera is set at. A good starting point for a slower lens and lower ISO is about 20 seconds. Adjustments can then be made from here based on the brightness of the review. If using a very high ISO, 10 seconds would be a good starting point to adjust from.

Throughout the night, adjustments to the shutter speed will need to be made based on the brightness of the aurora and how much it fills the sky. As the intensity of the aurora changes, check the LCD review to see how the exposure looks and make needed shutter speed changes. Because of the inherent nature of the aurora and there being quite a bit of darkness in the composition, when using aperture priority it's always best to add +1 stop of exposure compensation. To make changes in the shutter speed alone when using aperture priority, adjust the compensation up and down. If not really familiar with doing these adjustments, practice this a little before going on a trip.

Both of these modes take a little bit of work to get used to as they aren't used for a lot of other types of photography.

METERING MODE

Choosing a particular metering mode is dependent on which exposure mode is chosen to be used. If manual mode is used, the different metering modes do not play a part in determining the exposure.

Metering modes work best in conjunction with one of the auto exposure modes (aperture or shutter priority). Metering mode options include evaluative (Canon) / matrix (Nikon), center weighted or spot. For the aurora, the best option is evaluative as it will read the entire scene and not just part, which if the aurora

is quite bright in the center could lead to an overall underexposed image. Again, because there is going to be a bit of dark areas in the composition, overexposing by about +1 stop

is a good starting point.

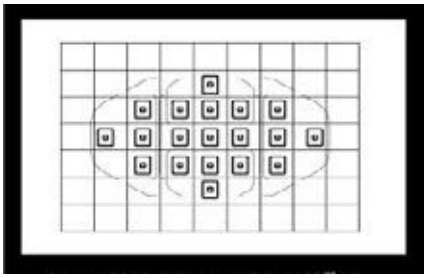
When working in manual mode and evaluative metering, the scale in the viewfinder will show whether the scene is over or underexposed but that means having to look through the viewfinder and losing your night vision when the light shines in your eyes to read this.

MIRROR LOCKUP

Most DSLRs offer a Mirror Lockup setting where the mirror can be locked up before the shutter opens to take a photo, helping reduce camera shake during long exposures. Most of the mechanical vibration moving the camera is caused by mirror slap so locking this up before the exposure helps reduce this. It is usually not required for wide angle images of the night sky. If Mirror Lockup is turned on, when you push the shutter the first time the mirror will lockup. You then need to press it again to fire the shutter. If you use the self-timer and have Mirror Lockup on, most cameras will move the mirror when you push the shutter button, and the shutter will activate after the delay you have set. In this case there is no need to press the shutter a second time.

AUTO-FOCUS POINTS

For most aurora photography, the lens is usually set for manual focus. If you opt to use Live View for focusing, use the central spot as it is the most sensitive and accurate of all of the focusing points. For those times when you are trying to auto-focus at night, select just the center focus point. Make sure you line up the



star, moon or other bright light you are focusing on under this spot before you attempt to auto-focus. Every camera has a different layout for selecting focus points, but whatever the layout, select the center point.

VIEWFINDER

When photographing the aurora at night and the weather is cold, do not breathe on the viewfinder as it will fog up easily. Be careful when looking in the viewfinder that you do not press the shutter button as cameras have lights inside for showing f/stop, shutter speed, frame count and other things that can be quite bright. While they display a variety of useful information, these bright lights make it hard to see and compose a scene as well as reducing your night vision. Do this once and you will see why it is important to not press the shutter button when looking through the viewfinder!

DATE AND TIME STAMP

Some photographers who travel a lot adjust the date and time stamp of when photos were taken to the current location's time zone. While not a critical item to set, it can be useful for knowing exactly when a shot was taken.

OTHER SETTINGS QUICK CHECK

• Set image quality to RAW or RAW + JPEG
• White Balance to Auto or Daylight
• Image Stabilization off
• Self-timer to 2 seconds if not using a remote
• Decrease LCD brightness
• Drive Mode to Continuous
• Exposure Mode to Manual or Aperture

Priority
• Metering Mode to Evaluative / Matrix
• Auto-Focus Point to single and center square
• Date and Time Stamp to current time zone
• Cover the LED write light

COVER LCD LIGHT

Just about every camera body today has a red light which comes on through the exposure and writing to the memory card process. This bright LED light can both mess with your night vision and create problems for those shooting nearby. Some heavy dark tape over this can be very helpful.

Check and Clean Sensor

66

Another thing that can ruin a perfectly good aurora shoot is a dirty sensor. While spots can be removed in post processing work, it's better to get rid of them before the shoot ever starts.

This is a problem digital photographers have had to deal with since the early days of DLSRs. Spots get on the sensor due to the changing of lenses. The best way to avoid constant problems is to make sure the camera is turned off before changing lenses as this deactivates the sensor so it does not act like a magnet.

Another thing to do is have the new lens ready to go on the body and get it placed there first before worrying about getting caps in place and the first lens put away.

There are a couple of ways to check for sensor spots. The easiest is to take a photo of something very solid in color. The best is of a blue sky. Take a look at the shot and see if there are any of those annoying spots.

The second is with a viewing tool such as the Delkin SensorScope. To use, go into the Menu and set the camera to manually clean the sensor. When you click the shutter button, you set the device on the opening as if it was a lens, press the button and a light comes on

to allow you to look at the sensor. The device has 5X magnification so it does a great job of showing any dust spots that just won’t go away. Even on cameras with automatic sensor cleaning there are spots that can just be obstinate.

For cleaning the sensor, you have several options. Many photographers do not want to have anything to do with trying to clean the sensor themselves and this is understandable. The thought of damaging the sensor causes dollar signs to flash in front of their eyes.

Rest assured, cleaning a sensor is very easy and very safe. When I go through the cleaning process, the first tool I use is called an Arctic Butterfly by Visible Dust. They have a good line of products for cleaning sensors and their latest butterfly shines a light on the sensor.

If this fails to get the spots off, it is time for the liquid cleaner to be brought out. Every year there are several new cleaning systems to coming on the market but the combo I have been using for quite a few years is a drop or two of Eclipse Cleaner onto a Pec Pad cloth wrapped around a spatula swab. Most camera stores have all of these items and will know what you are talking about when you ask for them.

Another good use for the Eclipse Cleaner is to instantly thaw out a lens that has been frozen when brought indoors from the cold. Since it contains methanol it will clean the frost off of a frozen lens instantly.

Years ago, some people were using a LensPen to clean their sensors. In fact, this is what Canon used at one time when people would send their camera in for cleaning. If using the original LensPen, tap it on the table to remove any carbon on it from inside the cap. The company has now come out with a device specifically designed for sensor cleaning.

There are plenty of other options on the market for sensor cleaning equipment.

Know Your Camera

No matter what type of photography work you want to do, before any trip you need to know what your camera is capable of doing and how to make changes. With northern lights shooting this is even more important as the conditions outside will be dark and tougher to see and to use the multiple buttons and controls.

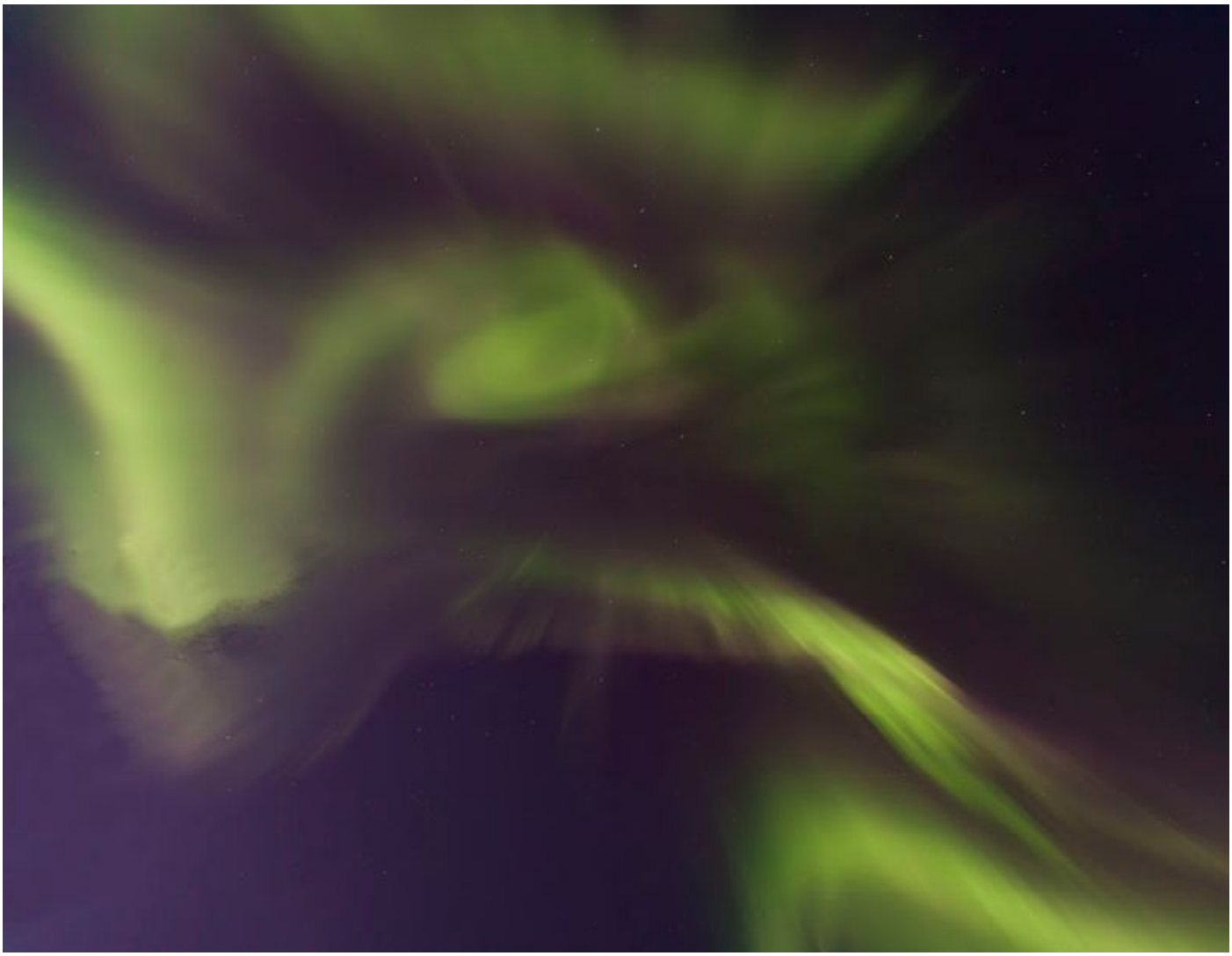
Thick gloves also complicate matters and is one reason why also having a good pair of liners is important as you never want to spend much time with bare hands handling the camera. It’s best to be able to do this without the use of a flashlight so a lot of light is not going out to others around you. If off by yourself, cutting back on the light helps with maintaining night vision.

The following are the main set of buttons and features you need to know how to find and push while it’s dark outside when wearing a pair of glove liners. The ability to do a quick push of the review button with thick gloves is better.

Image review button
Which way to turn dial to change shutter speed Button and dial combo for ISO change
White balance setting
Motor drive
Changing a battery
Comfortable changing focal length of a zoom lens without changing the focus ring
Illumination button
67

Note that after the camera has been out in the cold for awhile, there can be a delayed reaction to some changes, such as dropping or raising the shutter speed. It could take a second before the change appears on the LCD so knowing which way to turn the dial to change shutter speed will help know if you set it correctly. If using a cable release and it freezes up, which happens quite often, know how to take it out and then switch the camera Drive Mode to two second timer if available. Most now have this instead of just a 10 second timer as you don’t want to see a good display going off in the sky while you wait

10 seconds for the shutter to open. The best shots could be over by then.



Focusing Your Lens

The most critical step for a night of aurora photography is getting the lens precisely in focus. Getting a close focus is not going to work as foreground subject will look soft and make the whole image look bad. While a longer exposure of the aurora will look soft around its edges that can be acceptable, but not the foreground. No matter which way the focus is obtained look at the test shot closely to make sure the foreground is in sharp focus.

One of the ways not to get a focus is to turn the focus ring on the lens to the infinity mark and leave it there. In all the years of leading northern lights workshops I’ve only seen one lens, one time, where infinity focus was right on the infinity mark. For some reason, infinity is just a little off this mark.

The following are three ways to obtain a good infinity focus for your lens.

Set pre-focus using auto-focus

• Before it gets dark for the night, go outside with the lens set to auto-focus and the

camera to single-point focus on the center square. Focus on something a good distance away. Make sure the subject has contrast, such as a mountain ridge and skyline. I suggest getting a focus first on something very close and then on the distant subject to make sure the focus distance changes. Most cameras have a light inside the viewfinder that indicates when focus has been 69

 obtained. Make sure this has triggered showing focus has been achieved.

• When your are sure about the focus, switch the lens to manual focus.

• Take several shots with the new setting both of a distant subject you got the initial focus on and then on something about 20 feet away. Look at the images on the LCD review to make sure you are comfortable the focus is sharp. Enlarge if necessary. If not sharp, turn the lens back to auto-focus and repeat the first couple of steps.

• Take a look at where the infinity line / symbol is and where the lens lines up for future reference. More than likely this is where infinity is all the time and if the lens somehow gets off of this you can use that as a starting point.

• Now is the time to cut off a piece of the tape mentioned earlier and place it on the lens where it overlaps the focusing ring and lens barrel. This will make sure the focus stays in place and you don’t accidentally move it when intending to change the focal length of your zoom lens.

You will need to redo these steps each evening if the lens is used for other shooting throughout the day.

Night-time Focus

If for some reason your focus gets off during the night or if you forget to get a pre-focus, you are not entirely out of luck. There are two options for getting a focus.

AMBIENT LIGHT

Depending on the location where you are shooting, there's a good chance there will be a cabin or vehicle nearby. Go to one of these and turn a light on inside. Get about 10 yards away and using the center focus square get a focus on an area where there is good contrast between the light and dark areas.

If this is not convenient, a strong flashlight can be used. As with the steps for getting a pre-focus, take a shot and review it to make sure you have a good focus with any of these options.

LIVE VIEW FOCUS

Many of the newer camera bodies have a feature called Live View where the LCD screen projects the image rather than you looking through the viewfinder. To use Live View to obtain a focus, follow these steps:

20 feet away and illuminate it with a flashlight. If unable to see it well enough, move a little closer or use a stronger light. Zoom in as far as you can on the object you're illuminating in your foreground via Live View not with your zoom lens. On a Canon camera, this is accomplished by using the buttons with magnifying glasses and + or – symbols on them. Holding your flashlight in one hand, use your other hand to manually focus your lens on the object until you get your focus sharp.

The second option is to find the brightest planet / star in the sky and place it in the center of your frame. Adjust your exposure until you can see the dot and zoom all the way in. If the dot is too bright or has a halo, reduce the exposure a slight amount. Manually focus the lens until the star looks sharp. If there is a little bit of a moon out, you could try to get a focus on a snow covered mountain ridge or other object where there is some contrast.

• After focus has been obtained, turn off Live View, take a couple of images (close and far) and review them to make sure they are sharp.

• Turn off auto-focus on the lens and turn on Live View on the camera.
• As with setting a pre-focus, tape the lens so the focus is maintained the rest of the night.

There are two ways to find out what the hyperfocal distance is for the wide angle lens you will be using.

While in the field, if you have a SmartPhone, there is an app called DOFMaster that walks through the steps for obtaining precise focus. It allows you to select the camera body, the focal length of the lens and the f/stop. It then does the calculation and gives you the hyperfocal distance. You manually focus to that point and halfway between that out to infinity is in focus. Because some of the distances are further than what is on the lens' scale, you will need to use a light to shine on an object at that distance to get the focus.

For example, for a Canon 5D body with a lens set at 20mm and the aperture at f/2.8, hyperfocal distance is 15.5 feet. Focus at that and from 7.75 feet to infinity is in focus. If you plan on using the same focal length all night, this is a good way to get a focus.

The second way to do this is by creating your own chart from numerous online sites that provide the info needed. One is from the maker of the phone app and can be found at http:// www.dofmaster.com/dofjs.html.

• Set the lens to the infinity mark so you are near the point of where sharp focus will be.

• For this next step, there are a couple of ways to go about getting a focus.
One, find an object in the foreground about

Setting Hyperfocal Distance

A final way to set lens focus is to use hyperfocal distance. This is defined as the closest distance a lens can be focused while keeping objects at infinity acceptably sharp. When the lens is focused at this all objects from half of the hyperfocal distance out to infinity will be sharp. The only problem with using hyperfocal distance is if you are using a zoom lens for shooting the aurora and change focal lengths, focus will need to be changed as well. With needing to do a test shot for every change, this can lead to a bit of extra work and some lost time if the aurora is active.

Setting Correct Exposure

71

Look at a variety of charts found on the web regarding what the proper exposure is for shooting the northern lights and you will get as many different settings as you do charts you look at.

Here are what was suggested from three different web articles of what the correct shutter speed should be for ISO 800 at various f/stops. For your first aurora shots, use that ISO and maybe one step lower to help mitigate some noise and start with a test exposure of 10 seconds if using somewhere around ISO 800 for a lens of f/2.8. Gauge the brightness of the aurora and after looking at the LCD review adjust the shutter speed accordingly. This works if you are using Manual exposure mode.
some exposure compensation could be required, but the guesswork and constant changing of shutter speeds would be gone.

Unfortunately, the aurora is always moving and shifting from low on the horizon to directly overhead. Then there is the brightness factor. Because of this, there is some compromise to determining the right exposure.

f/1.4 10 seconds f/2.0 20 seconds f/2.8 40 seconds f/4.0 80 seconds

f/1.4 3 seconds f/2 6 seconds f/2.8 15 seconds f/4 25 seconds The aperture needs to be wide open to allow for the fastest shutter speed to freeze the movement and a long enough shutter speed is needed to get the brightness properly exposed. If there is a moon out, you have to compensate for its brightness, especially if there is snow on the ground.
If using Aperture Priority and letting the camera pick the exposure, adjust Exposure Compensation as needed from the +1 starting point.

As the aurora intensifies and weakens throughout the night, the shutter speed will need to change with it. Periodically check the review to see what the shots look like.

f/1.4 6 seconds f/2.0 15 seconds f/2.8 30 seconds

The numbers are all over the place. If you rely only on a chart and use those settings exclusively, the chance for lots of good shots diminishes. There will be some good shots

with these settings but not as many as you desire.

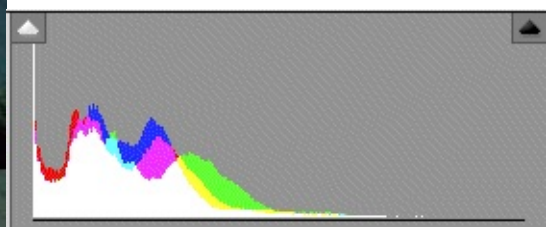
So, what is the proper exposure? That depends. If the aurora didn't move and kept the same brightness, getting the proper exposure would be simple. All it would take would be setting the camera to Aperture Priority and Center-Weighted. A test frame might show Then there's the third variable working together with aperture and shutter speed - ISO. On the plus side, the higher the ISO the faster the shutter speed. The minus, more noise leaving less room for error to getting a proper exposure without much cleaning up in post processing.

While there is latitude for adjusting the exposure in post processing when shooting in RAW, you don't want to have to add much exposure as this introduces more noise.

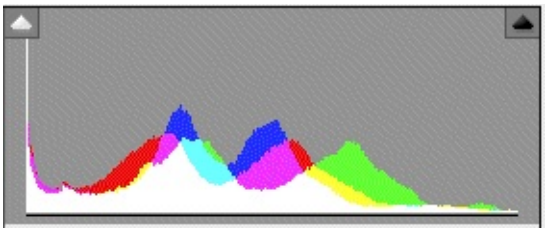
What I recommend doing is testing your camera and lens combo at several ISOs at night before your trip to see what an acceptable ISO is. See how much noise is produced at 400, 800, 1000, 1250 and 1600 to see what works best. Some web discussions talk about relying on the histogram to get the correct exposure. When the corresponding image is looked at, it can seem quite bright and any visible colors lost in the sky.

Unless the sky is completely filled with the aurora, there will be a good bit of darkness in the shot and the histogram will be skewed more to the left of center than centered or to the right. If you try to get this histogram centered, when you look at the image on the computer it will be extremely overexposed.

The next page is a photo right out of the camera with data to the left and after work was done to show a centered histogram.



This is the exposure and histogram right out of the camera. The image was shot at ISO 2000 at f/2.8 for 2.5 seconds. Notice the separation seen in the curtain along the top while it somewhat disappears in the image below. The clipping on the dark side of the histogram (left side) comes from the silhouetted foreground trees. There will be some of this in just about every aurora photo. Somewhere in between these two with moving the exposure slider would be the best result.



This is the exposure and histogram after adjustments were made in Camera Raw to center the histogram to what some would think is a proper histogram. While there is brightness to the snow, some areas of the aurora are too bright for presentation. All photography is subjective and what one person likes another might not. This could be acceptable for some people but to me the exposure is a bit too bright, especially the area in the upper left hand corner.

The Aurora Histogram

Everything you have learned about reading a histogram can be thrown out the window when it comes to photographing the aurora as shown by the image on the previous page. That perfect bell curve may not result in the best looking image!

While the histogram is a useful tool for most shooting, it does not necessarily have to be used for night sky images. It is a graph which shows the distribution of brightness values throughout the image, from the blacks on the left side of the graph to the whites on the right.

The height of the distribution shows the quantity of the pixels there are at each corresponding brightness value.

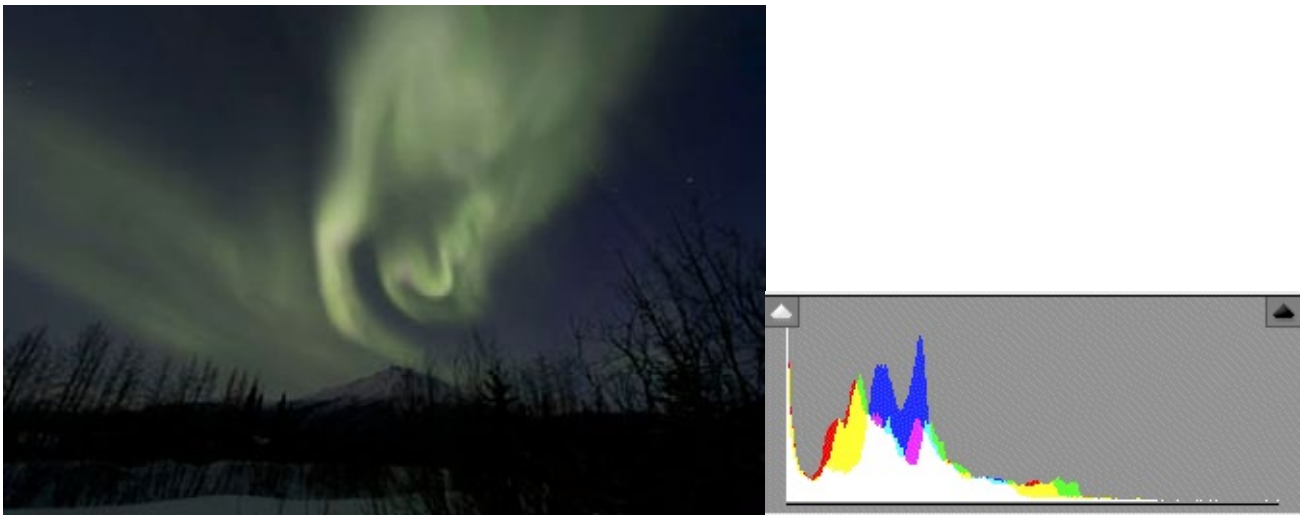
When shooting the aurora, there will not be a high pixel count in the whites as there is with daytime photography of snow or white clouds. Again, most of the histogram will be to the left of center as there will be more darker elements than there are white elements to the photo.

If using the histogram in the field as a good gauge, having some pixels throughout the middle third of the graph can be helpful as this shows there is enough in the mid-tones to work with.

The peak at the left hand side of this histogram shows the pixels in the dark area of the foreground. They have a very similar value and are almost completely black. The second broader peak covers the larger number of pixels across the sky not containing the aurora.

While this is still in the darker half of the histogram, it is clearly separated in brightness from the foreground and you can see this in the image, looking at where the sky meets the trees. This is important as the night sky is not completely black. On the right hand side of

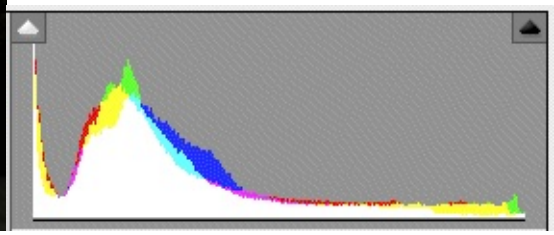
the broad peak for the night sky, there 73



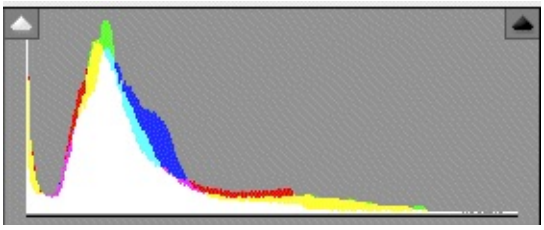
is a flattened area that represents the brighter pixels of the aurora. The aurora is certainly a brighter feature of the night sky but not compared to the bright white of a cloud in a daytime image that would bring peaks to the right hand side of the histogram. The bright part of the aurora is quite bright, but is a small percentage of the image and the number of pixels it covers barely shows up in the histogram and therefore the right hand side of the histogram in this case is mostly flat and concentrated in the middle.

The histogram for the cover photo shows a very good balance for an aurora borealis image. There is the peak to the darks as expected from the trees in the foreground, but the remainder is very balanced as the aurora fills most of the sky with a little snow at the bottom. The brightness of the aurora has good separation due to slight variations in the color and intensity allowing the curtain to have separation and no one area being too

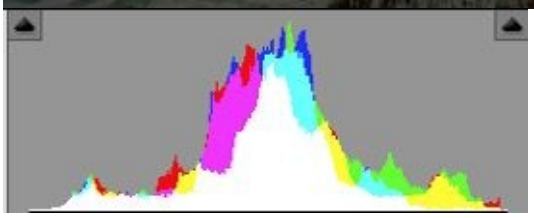
bright.



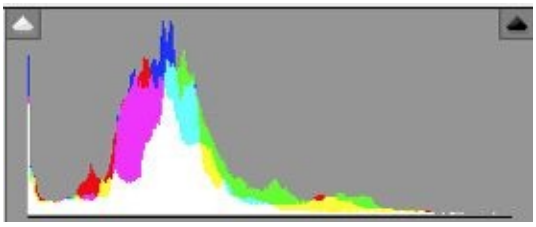
For a majority of images this would be a pretty good histogram as there is balance from left to right as the peak on the left would work for more of a dark toned image or for saturating colors. While the histogram looks good, the brightness to the lower portion of the aurora on the left is a bit too bright and pulls your eye there and away from the reds and nice tone of the green on the right. Remember the rule to not have too bright a portion of your photo as the viewer's eye will gravitate to that spot more than to the area you want them to look at.



After adjusting the Tone Curve in Camera Raw and adding a little bit of Saturation, the area of extreme brightness has been toned down to create a balance to the overall aurora. Bringing down the Lights and Highlights in the Tone Curve helped the aurora, it also took some white off the snow in the foreground. Whenever one area is compensated for the positive in post processing, something else has to be given away.



A perfect histogram. But not for an aurora as this image is very overexposed. With a moon out, which by itself needs less exposure for a good shot, along with the aurora getting brighter almost makes this look like it was shot during the day because of the white snow and nice sky. When going through images, this would seem like an obvious deletion because of how poorly it looks. If there wasn't a lot of shape to the activity this might be the case, but with some adjustments it can be recovered into a good shot.



While more will be explained in the section on Image Processing, this image now appears usable even though the histogram is mostly to the left of center. The snow is still white, there is darkness to the sky and the aurora has good color. The adjustments made in Adobe

Camera Raw were to lessen the Exposure a good bit, increase the Blacks and up the Clarity, Saturation and Luminance a little bit. A full step by step of an image will be done in the Post Processing section.

Don’t Know What to Expect

77

When shooting long exposures of the aurora borealis, you never know exactly what to expect when you finally look at the images on a computer. Just like a child can lie on the ground and try to make objects of the clouds, the same can be done with shots of the aurora.

If the aurora is moving really fast and going all over the place, your imagination can run wild over what you see or a very plain object might come into view. The multiple movements and shapes is precisely why so many shots should be taken while it is active as no two will be the same.

Even with using a high ISO and a shutter speed of just a couple of seconds to freeze the action, the resulting shots can still amaze you since your eye sees a continuous flow of action rather than frame by frame. That is one of the best things about shooting the northern lights - you don’t know what to expect.

Let your imagination run in the next few pages and think of what you see in each of the shots. After the last one, I will say what I see in each one. How many will we agree on?

A two-second exposure for the image on this page freezes the movement of the aurora and provides detail your eye will not see as it dances around. For the other images in the section, for the first shot, I call this Surfer Boy, with the head and long flowing hair, a body and arm and surfboard at the bottom. Next - Shark Attack. I see the open mouth and teeth and the outline of its head. Finally, Ghost Face with the eyes and mouth peering down at us.

Planning

There's no escaping the fact that most people's brains don't work their best late at night. Part of this has to do with the cold temperatures dealt with for aurora photography. The simple act of thinking things through and formulating a plan for your compositions and settings will make a big difference.

Getting ready for night sky photography involves thinking about the location around you and where in the sky the aurora should be active. Here are some things to consider:

Your Location
• Which directions give good views in multiple directions when the aurora gets active both to the east and then the west?
• Which directions have the darkest skies when shooting anywhere near city light pollution?
• Where can I park? Will the vehicle be in the shot or cause light problems if someone has to get back into the vehicle?
• Does the area have more than one good foreground to incorporate into the shot?
• If the area has some bad elements in the foreground, can they be worked around or eliminated in post-production?

The Sky
• If there is a moon, what time does is rise and how long for it to crest a nearby ridge line? Where in the sky will it be?
• Is the Milky Way visible? Which direction? Can it be incorporated with the northern lights?

Location Scouting
Exploring and visiting locations during the day can make life much easier when you go there at night. Finding the easiest way to get access and exploring different angles beforehand can save a lot of precious time at night.


A great view in all directions, but one area had poor foregrounds with plowed snow piled up. A little cropping cleaned up the shots in that direction.

Understanding the Aurora Getting Ready - Body Getting Ready - Camera Shooting the Aurora Image Processing

Foreground

Finding something strong for a good foreground subject with northern lights photography is more important than with other landscape photography shots. Unless the shot is directly overhead of a corona forming, some type of foreground is always needed to have a contrasting element in the composition. It is very rare to see a photo of just an aurora with nothing else in the frame.

While the aurora is primarily the main subject in the photo, a good foreground can make or break the shot as it can add more impact or take away from the shot, especially if the aurora is not very strong.

Like with most landscape photography where a lot of moving around to be done to find just the right composition with foreground and background subjects working together. The same is true when looking for the right shots with the aurora.

Knowing an area will help in finding good foregrounds. Taking time during the day to scout an area to find spots for potential compositions is key to coming away with strong images.

As shape and orientation of subjects in landscape photography help determine if the orientation should be horizontal or vertical, the same rules apply to the northern lights. Because activity is often lower on the horizon depending on how far north you are and the position of the aurora, it lends itself to a horizontal format. The foreground subject can cause a switch to vertical, especially if the aurora is taking up a lot of the sky, such as image of the trees on the right. Also, if the auroral band is directly overhead a good vertical can be used.

Because the aurora is located in high latitudes, there are usually mountains nearby. These make for a good anchor foreground subject but trees and cabins make for great second elements.

Wherever you get set up for aurora shooting, make sure you move around and get different foregrounds so that every image has a different look to it.

There are times when the aurora is not as strong as others regarding colors and shapes. It’s at these times when finding a good foreground is important. You always want the aurora to be the strongest element in the image, but when it isn’t overly active it can be the second element to the scene such as with this cabin with its lights on being the strong focal point and the aurora the second feature.

Mountains make for a good base to the aurora borealis. Just because the beauty of the aurora might captivate you while standing there watching it, don’t forget compositional rules when taking photos. Here, the rule of thirds is followed but because the sky holds the stronger part of the scene, a bit more of it can be included in the photo rather than the foreground.

Test Shots

Throughout a night of northern lights photography there will be numerous times when things change, both from a composition aspect as well as with the brightness of the aurora.

Because some people have a harder time looking through the viewfinder at night than others, it could take several tries to get the composition just right when moving to change foregrounds.

Because it can be harder, a few test shots might have to be taken to get the horizon level. There are some cameras out now which have a built-in level that can make this much easier than it used to be. These tests can be used to ensure there is not too much foreground as the sky and the aurora needs to be the main emphasis.

Along the same lines of testing, periodically check the LCD review when the brightness of the aurora changes. Throughout the night as the aurora changes, it will fade and get brighter in its intensity. Because of this, shutter speeds will need to be adjusted to compensate.

As time goes on it will become easier to gauge how much change in shutter speed is

needed. When a good breakup starts and the aurora gets brighter, do a test with your current shutter speed, make an adjustment, check again and then fine tune the speed to get it right for the rest of the breakup display.

Setting the shutter speed and just using that for the night will cause a loss of shots as there will be some that end up over-exposed and some under-exposed. You could recover a few shots in post-production work but if an image is too far off, even if it’s worth a lot of work, it can be too far gone.

As the aurora kicked in with more color and brightness, the above was taken at ISO 2500 at 6 seconds. Wanting more definition in the curtain I dropped it to 4 seconds.

As the aurora is constantly changing where it looks best, when changing the direction you're shooting do a quick check of the LCD review to see if the composition looks good and make adjustments as needed. If able to see well through the viewfinder and you trust your instincts, go with that if the aurora is really active.

Accentuating Form

Because the aurora is so lineal, learn the area where you are shooting in order to move around and take advantage of one of the strongest design elements of composition - line. This image shows a strong feeling of line as the bands of the aurora are positioned to look as if they are coming out from the top of the trees.

Good composition is key to drawing viewers into a photo graph. There has to be a point of interest so when a viewer looks at your image they know exactly what your intention was in taking the shot. What makes a good shot a great shot? You'd be surprised to learn that it's just a handful of some very basic things put together in a basic manner.

You want people to look at your work and know they like the shot, but they might not know the reason behind it. You will know by the way you incorporate different ele

ments to help them concentrate on the main subject and how they got there. Most every photograph, intentionally or not, will contain one or more different design elements.

Line is one of the strongest yet most basic elements and can be very important in helping the viewer work their way through your image. Without line, many of the other ele ments such as shape or shadow can’t exist. Without shape and shadow there can be no form to the image. Of course, the aurora itself has the impact of color and creating an abstract.

Props

There are lots of images of the aurora with overviews of cities, old cabins and other buildings in the foreground. Lots of different elements have been used. Remember, having a good foreground is important to anchoring a photo of the aurora whether it be trees or an old cabin.

Photography, especially wildlife and nature, has evolved to where trends lead to natural

settings. While you would think this means leaving props to die a normal death, we just can’t help ourselves from wanting to add a little extra something every once in a while.

As an aurora photographer, the logistics of getting something extra in an image and having it look natural can be a bit complicated. Particularly with the hassles of taking extra luggage to the airport to carry these items. But if done right, a little something extra adds…….a little something extra.

Photographing the aurora with props comes down to one basic thing: how can you make this interact with that? With this photo, the tent situated out in the wild is far from out of place, even in the snow since many people camp during the winter. The perfect touch is the tent being green to match the green of the aurora.

Even though totally staged, the green tent fits naturally. In addition, it adds an interesting foreground subject that has had many people ask if I actually was using the tent to camp out at this spot.

Night Sky Pollution

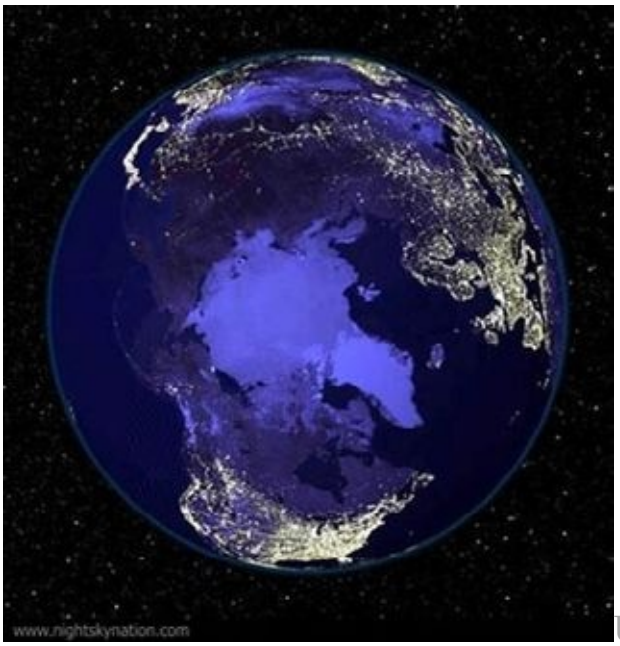
There are some places in the country where even if there is a strong enough aurora to reach that area on a given night it would be difficult to see due to the night sky light

pollution present. In areas where there is a moderate amount of light pollution it does have a little bit of effect but not all of the time. Because the aurora is 60 miles above the Earth, the amount of light pollution needs to be very strong in order to completely block out the view, unlike the ability to see the Milky Way.

Where the aurora is strongest in the auroral band, most of the band is situated away from major producers of light pollution. There are cities within the auroral band that put out a bit of light but because the aurora is stronger in these spots it does not block out its viewing. While on a

low activity night it will make it a bit dimmer, there are times the mixing of the light pollution and the aurora can create an interesting effect.

There are also times when the aurora is so strong that the nearby city lights do nothing with the colors, bands and curtains. Fairbanks, Alaska is a good example of a city where the light pollution has little to no effect on the aurora. Depending on where you’re situated when photographing the aurora and the direction you’re shooting, the city lights may be seen in the photo or they may be behind you. These globes show where the major amount of light pollution is in the United States and in the Northern Hemisphere.



Understanding the Aurora Getting Ready - Body Getting Ready - Camera Shooting the Aurora Image Processing

Taken just 10 miles north of Fairbanks and shooting to the southeast. There are still strong colors to the aurora but it would have been even stronger had there been no light pollution which is evident through the lower part of the trees on the right side.

This image was shot from the same location as the one on the previous page but in a northwesterly direction. By shooting away from the city lights the intensity of the aurora is stronger and the sky a bit darker.

There are times when picking up light pollution from a nearby city is unavoidable. When it does become quite apparent when taking shots, depending on the color of the glow it can actually appear to be part of the aurora. The rose color on the right side of this photo is actually city light haze from the lights in Fairbanks in some clouds hovering over the town. Because of its location, there can be clouds over the city but clear a few miles north where the elevation rises and the clouds and haze disappear.

“The Moon and the Aurora

Moonlight

To go and photograph the aurora when the moon is out or not is a question everyone has to ask when planning a trip to shoot the northern lights. Some people don’t want anything to do with a full moon phase and want the sky to be totally dark during a new moon while others love the effect the moonlight has on the foreground subject. I’m in the second group.

There are some things written about how the moon takes a lot away from the intensity of the colors of the aurora in the night. There is some truth to this but on the other hand, a moon in the sky can allow for some very interesting aurora images.

When visiting an area in spring when there’s a good bit of snow on the ground, the moonlight reflects off of it and adds shadows and detail to everything in the foreground.

Just because a full moon is scheduled for a particular time it doesn’t mean it will be out all night every night for the days leading up to it and the few days afterward. Just like the sun does not crest the horizon north of the Arctic Circle for part of the winter and stays up continuously during the summer, there are also times when the moon does the same.

I have experienced times just a day or two after the full moon where it did not rise until close to the time we were finished shooting. I have also seen days where the moon did a complete circle just above the horizon.
94

Credit: http://www.astronomy.ohio-state.edu

The main thing to keep in mind when there is a moon out is that exposure times need to be decreased a little bit so as not to over-expose both the moon and aurora but the foreground as well. Conversely, longer exposures are required when the sky is dark around the new moon phase.

If going when the moon will be out, check to see what time moonrise and moonset will be for the location you are visiting. Having led as many as four workshops in the month of March in a single year, I have shot during every moon phase and have captured good shots during each variation. The aurora does not wait for the moon and if there’s a great display going on when the moon is out, you shoot with what is provided. Use the moon to your advantage to light up the foreground to make a photo more interesting. Use light angles to create shadows from different directions just as you would with sunlight during the day.

When shooting without the moon near or above the horizon, realize that your foreground subjects are going to be more of a silhouette and you need to find situations where the shapes are strong enough to carry the base of the photo.

Even though it appears there is a full moon in the image, the moon was a little less than half but because of a longer exposure it illuminated the full disc of the moon. The amount of stars visible show that it was not a full moon as there would be even fewer stars in the sky. The partial moon was still enough to put nice light on the foreground and bring out the snow.

The moon is just below the horizon in this image but there was enough light from it to bring out the white of the snow on the ground and mountains. The red that appears at the top of the curtain on the left side shows that a moon doesn’t necessarily take away from the color and intensity of the display.

When the moon is not present in the sky, foreground subjects are not lit up and shape is what needs to be accentuated to have a good anchor for this portion of the shot. It just happened that the form of the aurora fit nicely around the taller tree in the middle of the composition.

Moon Phase and Time Sample[98]

First Quarter Moon through Third Quarter Moon for March 2014 with rise and set times for Fairbanks, Alaska. Date Moonrise Moonset Illuminated Phase
Mar 8, 2014 - 4:01 AM 56.1% First Quarter at 4:27 AM

9:58 AM
Note: hours shift because clocks change forward 1 hour for Daylight Savings Time
Mar 9, 2014 - 5:49 AM 65.7%

11:51 AM
Mar 10, 2014 - 6:23 AM 74.6%
12:54 PM
Mar 11, 2014 - 6:47 AM 82.5%
2:05 PM
Mar 12, 2014 - 7:04 AM 89.3%
3:21 PM
Mar 13, 2014 - 7:17 AM
4:39 PM

Mar 14, 2014 - 7:27 AM 94.5%
5:59 PM
Mar 15, 2014 - 7:36 AM 98.1%
7:20 PM
Mar 16, 2014 - 7:45 AM 99.8% Full Moon at 9:09 AM
8:42 PM
Mar 17, 2014 - 7:54 AM 99.4%
10:06 PM
Mar 18, 2014 - 8:04 AM 96.9%
11:32 PM
Mar 19, 2014 8:17 AM 4:01 AM 12.5° 240,061 92.1%
Mar 20, 2014 12:58 AM 8:34 AM 4:51 AM 9.4° 237,899 85.3%
Mar 21, 2014 2:22 AM 9:00 AM 5:44 AM 7.0° 235,777 76.5%
Mar 22, 2014 3:37 AM 9:38 AM 6:39 AM 5.6° 233,721 66.3%
Mar 23, 2014 4:39 AM 10:34 AM 7:36 AM 5.4° 231,775 54.9% Third Quarter at 5:46 PM

Where there are dashes for moonrise times, the moon rises the day before. Notice the rise time gaps each day. Unlike most of the U.S. where rise times are usually about 30 to 40 minutes later each day, in Alaska the times can be more than an hour each day and up to an hour and a half. As you can see, just a few days after the full moon, it does not rise until after the normal time for aurora activity to be finished for the night. For those not wanting to spend a week in these locations because of the problems a moon might cause, you can see it really doesn't effect the images.

Persistence

Some nights it takes time to get the perfect shot of the aurora. While there are times our workshop group will hang around the cabin and village area because of its con venience, there are times we will head out on the road to one of several spots where there is a great foreground for aurora shots.

One such time we had an incredible display that seemed to go on all night. Actually, the big breakup lasted about 45 minutes at our new destination after we had already had a good 30 minute display around the cabins.

When the action died down this second time we waited around for about an hour and a half to see if there was going to be another big blast right after solar midnight. Most people in the group were getting weary so we headed back to the cabins. There was still nothing in the sky. As we were getting our gear inside, there were signs directly overhead that something might kick up.

There was one hearty soul who decided to set his gear up and go for another round. And he was very glad he did as

during the next 20 minutes a corona formed overhead and the bottom dropped out with some red and deep purples accentuating this incredible breakup.

Several others were kicking themselves the next morning when he told of what he saw after they called it a night.

On another occasion I had a group of six women from Australia who had travelled to Alaska for their northern lights adventure of a lifetime. I had told them about solar midnight and that within 20 minutes or so on either side of this there is a better than likely chance there would be a good bit of activity. The first couple of nights out several of them called it an early night while others waited for that magical hour and were rewarded for their efforts.

Near the end of the week I was finally able to get everyone to stay outside and wait for solar midnight. Just like everything in nature that can be unpredictable, the time for solar midnight came and passed with a blank sky. I urged them to hang in there but they were getting a little anxious about wanting to get some sleep before our planned drive later that morning. They were eventually paid off by a very good display about 20 minutes after solar midnight when it appeared from almost a blank sky right near the end of the window I told them about. And sometimes the start is even later than that. Patience!!!

Shooting Etiquette

When out photographing the aurora with one or more people, there are a few good do's and don'ts to consider to make the night enjoyable for everyone around. These tips can apply to just about any photography trip you take.

WATCH WHERE YOU WALK / SET UP

With numerous people shooting in the same area it is very easy to accidently move around for a different angle and get in someone's shot. With the aurora being wide angle photography, the field of view can be pretty wide. When moving to a new spot, always take a look behind you to see if you are setting up in front of someone, or even better, call out to ask if you have moved into anyone's field of view.

While a dark body might be able to be cloned out, it's tougher if there are bright LCD

screens or flashlights that make this more difficult.

If you are on the receiving end of someone getting in your shot, call out to remind them they have moved into your composition.

LCD ALWAYS ON

Some cameras are designed where the rear LCD is always illuminated. While there are some where a search through the menu can get this turned off, some have it on all the time. It's not noticeable during the day, but at night it is very evident This can be frustrating for the shooter with the light on in front of them constantly and for others nearby with the light that shines and can reflect off the snow.
101

The best way to remedy this is to cut out a piece of thin cardboard to a size just a little larger than the LCD area and tape it to the back of the camera. Tape it across the top so the cardboard can be lifted up when you do need to take a look at the LCD for review.

SOMEONE ALREADY THERE

You have done some day scouting and found a great spot with wonderful foregrounds with enough space for you and the group you are with to have a good session that night. When you arrive that night, there is another vehicle there. If it's a large public space, feel free to park off to the side and set up so that you don't interfere with their space.
But, if the area is secluded and they got there first, as much as it hurts, move on to another area you've scouted and come back later to see if they have left or come back another night.

SMALL FLASHLIGHTS / HEAD LAMPS

You will have to turn a light on at some time during the night to check some settings, find a button, or change a battery. This is a given. Just make sure when you do this that you either move away from those right near you or ask if anyone has their shutter on and if it's okay to turn a light on for a moment. Try to be as quick as you can if the aurora is quite active but if it's during a lull, it's safer to turn a light on and check things out.

The double whammy of someone moving in front of others as well as having a red light looking at their camera.

Image Processing

Going from the before to the after on the computer and a few special techniques.

Walking Through the Workflow

The first thing to consider as you begin post processing work on an image is knowing what it should look like when you have completed working on the file. There is always room for artistic interpretation, but it is best to present it based on what you saw when the image was originally taken.

The camera can only capture so much information and when it does, some work has to be done after the fact. With the northern lights, the camera can also pick up more than what the eye sees in real time because of the high ISO and longer shutter speed and your eye only seeing them for a brief time.

Talk to any photographer about which program they use and what steps are taken to get a photo fixed the way they like it after getting it on the computer and it’s likely there will be as many responses as people asked.

Because of that, it helps to understand some of the basic post processing principles and steps as they apply to aurora photography. Even after this discussion, you might want to change things up a little bit with order and magnitude. That’s fine, as long as you like the

final outcome from your work from both behind the camera and in front of the computer.

The following pages contain examples which show how each step can be achieved in Adobe Camera Raw, the program I use. Many other programs offer similar settings to achieve the same outcome. Different work can be done based on the conditions of the sky, primarily if there is a bright moon or dark sky. The next few pages provide detail of several of the steps in the process followed by a step by step of several images, including this before image on the right.

The basic steps needed for most aurora images include:
• Lens profile correction / Reduce vignetting
• Adjust Color: White balance and Tint
• Adjust Levels: Exposure and Blacks
• Adjust Tones: Saturation, Vibrance and Clarity
• Sharpening
• Reduce noise
103

Repairing Vignetting[104]

One fact about shooting the aurora with expensive camera equipment that baffles me is with a full frame camera and some wide angle lenses vignetting occurs in the corners. This happens with my Canon 16-35mm L series lens on whichever full frame body I’ve used, usually at the 16mm end at f/2.8. On some images this is not noticed, but on ones with

snow on the ground or very active aurora on the top, it can be quite evident.

Luckily, this can be corrected in post processing if it’s bad enough to need correction. In both Camera Raw and Lightroom the feature for fixing this is in the Lens Corrections panel. You can choose for the program to fix both this and any other lens distortions automatically or you can fix it manually. The image below is the before shot. Look at the corners here and then at the corners on the photo on the next page. Quite a change. This was done using the auto fix in Camera Raw.

This after correction image shows a lot more detail in the trees on the bottom both on the left and right corners along with more aurora at the top right of the frame and a few more stars in the top left corner.

White Balance Examples

The examples here show how the color and appearance of a night sky image and the aurora is affected by adjusting the white balance setting. 106

Applying the Cloudy setting (6500K) gives the sky and the aurora a warmer cast which is not fully natural for this setting, while the Custom setting (4500K) cools the image down a bit too much and makes the blues bluer and the green of the aurora too bright. The As Shot setting could be considered the most accurate, however, you may prefer the more neutral sky the Auto setting chose for this image using a color temperature of 5950K, not much higher than the As shot of 5400K. Depending on the conditions, post processing Auto will give a different temperature setting.

For these images, no other processing work was implemented so the result of changing the white balance to different presets would not be skewed.

The 5400K As Shot in this example is the camera's equivalent to the Daylight setting in ACR (5500K). Different camera makers have a slight variance in temperatures for the different presets. When doing the adjustments, a change of 100 degrees here and there does very little to the image.

As Shot - Setting in ACR of 5400K - Equivalent of Daylight of 5500K in ACR

Cloudy - Setting in ACR of 6500K

Custom - Setting in ACR of 4500K

 Auto - Setting in ACR of 5950K

Exposure and Blacks

While it is best to get the exposure correct in the camera when taking an image, there will be times where changes to the exposure in Camera Raw or Lightroom are needed. No matter what image has exposure adjustments made to it, the aurora or anything else, make sure the final presentation does not appear like it was altered.

When adjusting the aurora, most times the correction is to the over-exposed side of the scale as the image might be a bit too dark. Remember that when adjusting the histogram to the right from the left side, more noise is added. While this can be accounted for in Luminance (page 112), it's best not to add too much exposure. There are times when this is necessary, such as when some colors that showed up in the camera but not the eye need a bit of a boost or the overall image is a bit too dark.

When a plus exposure adjustment is made, it's also good to use the Blacks slider to help balance the sky and make it a little darker due to the increased exposure so it does not become too bright.

An early test exposure image showed the original exposure of ISO 1600 at 15 seconds was not enough. Work was done on this image because of the reds and yellows that appeared in the aurora.

With the two images on the right, the top is the way the photo was taken with no adjustments. The bottom images used an Exposure increase of +1.5 and the Blacks left at the preset of 5. The Blacks were left the same because even an increase of one caused the trees to be lost against the sky.

The increase in exposure not only made the aurora brighter but it also brought out more stars in the sky, especially to the bottom right section.

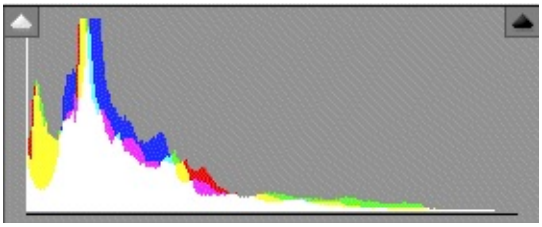
Bringing down the exposure happens frequently as there are times when a portion of the aurora gets brighter than expected during the time the shutter is open.

Even though the top image was shot at just 4 seconds at ISO 2500, it was a bit too bright and lacked definition in numerous places. When the aurora is dancing a lot exposures change quickly. In this case it became quite a bit brighter than with preceding shots.

To help tone down the bright areas, the Exposure slider was brought down to -1. If shot at 2 seconds originally, this is what the detail and brightness of the aurora would have looked like. Besides toning down the bright spots, it also provided more detail to the curtain.

To help the sky, Blacks were increased to +20, an amount higher than typically used (10 to 12) but because of city light pollution on the right side, it helped diminish this and darken the sky to the left of the aurora.

Below is the histogram of the final image. While there are still a lot of pixels shown on the dark side, there is an even amount on the right half showing even tone to the aurora.



Saturation

The one area of Camera Raw that can come in handy quite often is with the three sliders in the saturation area at the bottom of the Basic panel - Clarity, Vibrance and Saturation.

Saturation will be the slider that helps bring out the colors more than the other two but they will also be used most of the time whenever the saturation is increased.

With the two images on the right, the top is the way the photo was taken with no adjustments. The bottom images used a Blacks adjustment of 14 from the preset of 5 to help darken the sky a little bit. Although the Saturation slider is the last one on the menu, this is the first one I use to help bring out the colors in the photo, followed by Vibrance and then Clarity.

To help bring out the purples within the band on the left, Saturation was increased to +18. While wanting to bring out the purples, the greens in the right auroral band did not to become too bright so I moved the slider until the greens were too bright and brought the slider down until they looked good. Vibrance was taken until it was too much and then backed down to +13 and Clarity was increased until there was a little more detail in the bands above the mountain to +8.

As you can see, the Blacks slider also darkened the snow a little bit but this can be taken care of with other settings.

Sharpening[110]

Because a pre-focus was set on the camera before shooting, most everything in the image being worked on should be pretty sharp. A little bit of sharpening needs to be done due to the nature of shooting in RAW mode. As with any workflow, sharpening should be done before reducing the noise as sharpening in and of itself adds some noise to a night sky.

Do not use the aurora as a guide for determining when the image is sharp as it will have soft sides, even with capturing a distinct curtain pattern. Instead, look at the foreground, whether it be some trees, a mountain ridge line or a building. Whenever doing fine detail work on a file, enlarge the image size to 100% to work this adjustment and pick an area that has a good bit of detail. For this image, the trees in the aurora were used as there was plenty of contrast and detail. With aurora images, increase the Amount until more noise starts appearing. Increasing Radius and Detail is a personal preference and I usually leave Radius at the preset of 1 and if there is a lot of detail, I'll bring it up until the increased noise is apparent.

Sharpening Amount - 63
Radius - 1.0
Detail - 32

Luminance

Related to the items discussed in the section regarding Noise Reduction in Getting Your Camera Ready, no matter which is used, there will be noise in the resulting photo. Depending on the camera settings and how many megapixels the camera has there could be quite a bit of noise, but there are post processing tools to help offset this.
111

a tendency to interfere with the sharpening done previously.

It’s worth seeing how far the Detail sliders can be pushed to decrease noise. If there’s any color noise, dial up the Color slider until that disappears.

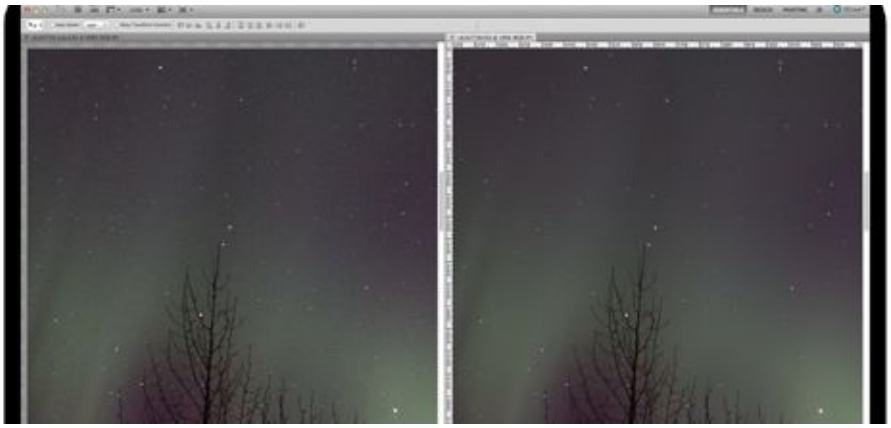
Luminance is a feature found in both Adobe Camera Raw and Lightroom that will help take away if not eliminate noise created due to the use of long exposures and / or high ISO. I use it on just about every aurora image I do processing on. Besides these two programs, plug-ins from Noise Ninja and Nik also work well.

In ACR, the noise reduction features are found in the Detail section, which conveniently contains both Sharpening and Noise Reduction. In Lightroom the Detail panel is found in the Develop module. We’re trying to avoid two things: too much noise in the pixels (some is okay, as long as it is not color noise), and sharpening impacts that produce visible halos at the edges of subjects, especially in the foreground.

With color noise reduction you may introduce saturation issues, color blending, and other problems related to the color values within the image. With luminance noise reduction you can rather dramatically reduce the level of detail and perceived sharpness within the image. So noise reduction is generally best applied to the minimum extent necessary to get acceptable results.

Apply Sharpening before using Luminance. First, make sure the image is at 100%. Drag the Luminance slider until the noise disappears and then back it off a little more. Adjust

the Detail slider to preference. This is where things get a little touchy as using too much Luminance Detail has Tip: Once you determine the Luminance Detail setting for any given camera and ISO value, save them: pick Save Settings (in the tab name bar), select as a subset Detail, then save these under a name like 5DIII_



ISO2500. Next time a convert from this combo is done use Load Settings and it should be fine. Even with loading settings like this, it’s best to do a 100% view evaluation to double-check.

Side-by-side comparison in Photoshop of part of an image enlarged to 200% to accentuate the before and after of adjusting Luminance in ACR.

The photo on the next page is the full image with the only adjustment done being to Luminance. There was no Sharpening, White Balance, Saturation or Exposure adjustments made.

Image Processing Steps - No Moon[113]


Image 1 - RAW file with no processing work done.


Step 1 - You can manually adjust the vignetting or let the pro

gram do automatically with Lens Profile Correction. This was done checking the box to do adjustments automatically.

Step 2 - Tried various white balances. Looked at As Shot (5800K and Tint of -3), at Auto (4800K and +29) and picked an in between white balance of 5300K and kept Tint at +29 to accentuate the purples.

Step 3 - Change exposure. The image was originally shot at ISO 500 but could have been a bit higher. Compensated by increasing Exposure by +.85, Blacks to help sky to 7. On the Tone Curve panel, increased Highlights +5 and dropped Shadows -10.

Step 4 - Back on the Basic panel, adjusted the Saturation first by going all the way to +100 and backing down to acceptable level. I do this for all settings here. I use a little higher for night shots than day photos. Saturation +20, Vibrance +15, Clarity +10.

Step 5 - Sharpening and Noise. Increase image to 100%. Increase sharpening until foreground crisp. Sharpening here to 56, Detail increased to just before noise increased, 45. For noise, Luminance up to smooth and back off a little bit, 70, and Color to 40.

Step 6 - Final adjustments in Photoshop. Remove red light next to tree and clone snow off roof of cabin. If there were dust spots on the image they would have been cloned out here but there were none.

Side by side comparison of before and after. Everything appearing in the final image was there in the original but needed bringing out with a bit of adjusting. Would have done aurora a bit dimmer for final usage but wanted to show all that is capable.

Image Processing Steps - Moon[117]

Before - RAW file with no processing done to it. The steps for this image will be a bit different because of the moon and some clutter in the foreground. The position of the aurora changed from overhead and north to the south. When the composition is not ideal, shooting can still be done.

Step 1 - Crop the image in Camera Raw. This is accomplished by selecting the crop tool on the Tool Bar and then clicking inside the image, choose Custom and type in the dimensions you want the photo to be. You might have to adjust this a time or two to get the proper setting as it does not allow for custom dragging.

,

Right after doing the crop to combine a step, I went to the Lens Correction panel and checked the Lens Profile Correction box for auto lens distortion and vignette repair.

Step 2 - Auto White Balance was used to take the image and after several tests with some slight changes I liked the appearance of this best so kept this the same, allowing me to move to the next process - Change Exposure. I switched the order of Exposure and Blacks and did the Blacks first, increasing it to 9 to make the sky richer a little bit but maintaining the blue because of the moon. Now I worked the Exposure to help bring out the purples by adding +.25. Went to the Tone Curve panel and moved the sliders and found the only one I liked any changes to was the Shadows to -5. This helped separate the aurora from the sky a slight amount.

Step 3 - On the Basics panel, slid the Clarity tool all the way to 100 to see what effect it had and liked the change to the detail on the mountain. Moved it back down until some definition was lost at +40, much higher than the usual high of +15 I try to restrict these settings to. Knew I wanted the purples more saturated so used the arrow key to go up one step at a time until the greens started to get to bright; +18. Moved the Vibrance slider right until it was too much and then backed it down until it looked nice and the bright green spot on the left side was acceptable; +12. Because I wanted to accentuate the purples a bit I went to the HSL panel and adjusted the purples to +30 Saturation and +10 Luminance.

Step 4 - The file was able to handle a good bit of sharpening before any banding or noise was introduced. Set Amount to 90 and Detail to 50. In the Noise Reduction section, slid Luminance up to 70 and worked back down to 60. Color needed very little adjustment moving up from its original setting of 25 to just 30.

Step 5 - Final adjustments made in Photoshop. Used the Spot Healing Brush Tool to remove a dust spot in the cloud on the lower left and the Clone Tool to eliminate the top of a sign and a snow covered roof from the bottom edge of the framing.

Original shot from the camera for comparison. The main thing done with this image was the cropping of the bottom as well as bringing out the blue sky caused by the moon and popping the purples a bit. The snow is still a good white and there is even a bit more detail on the side of the mountain from bumping up the Clarity.

Preparing a Finished Product

121

Your final steps in post processing work is dependent on what the planned usage will be. Is your plan for putting it online to share with friends and family, creating a presentation for display on a TV, computer or LCD display or making a print to hang on a wall?

Each of these has some final steps to get the file prepared just right for each situation. While there is some overlap, there are a few different steps for each output.

GENERAL - Archive your images in a lossless format since you never know if you'll need to edit the images for another purpose in the future. The most common of these formats are TIFF, PNG, and PSD at the size the file was imported into Photoshop. This way you have a full sized final product you can then make multiple sizes and formats from later. Never save the JPEG twice. If you do it will re-compress the data, causing file

degradation.

ONLINE - Images should be the smallest file size possible. This protects work from people clicking on the image to save and use for other purposes. It will look fine on another web page but they can't use it as a screen saver or make a print of it. Using 72 ppi is good as this is what most computer screens present. Set the Color Space to sRGB and the file will match the computer output. For the long side of the image, set the size to between 600 to 900 pixels.

How you sharpen for the web matters both for visual impact and for transfer speed. Use an all-over sharpening and then use selective sharpening of the important elements. This will give the impression of sharpness. **PRINT** - The first big difference for creating a file for print is the color. For a print, the final file should be saved as Adobe RGB as this has a larger color gamut than sRGB.

Review the image at 100% after resizing because the image is displayed at 100% online.

Photoshop has a Save For Web control which allows you to test various modes and parameters of saving and shows what the size and final appearance will be. Some pictures need higher quality to avoid artifacts in areas like the sky. Other pictures look just the same at quality 3 as they do at 30, and take much less storage.

PROJECTION - Depending on how old or new a projector is, different projectors call for different image sizes. Below are the best file sizes based on the type of projector. All work with the sRGB color space. Again, do your final sharpening and review at 100%. Set the ppi to 94 for these larger displays.

• For new high-resolution digital projectors, images should be 1920 wide by 1200 pixels high.
• For XGA size projectors, limit the width to 1024 pixels by 768 pixels high.
• For older SXGA size projectors, limit the width to 1400 and the height to 1050 pixels.
• For the new WUXGA projectors, limit width to 1920 pixels and the height to 1200 pixels.
• For full HDTV, limit the width to 1920 pixels and the height to 1080 pixels. Convert your colors to the HDTV color space for TV display. Work in 16-bit color and TIFF as the file format for more robust control than JPEG, especially when doing a lot of image manipulation. This translates to better color, sharper details and smoother tonality for your final product.

There are three primary steps to preparing a photo for printing. An important first step is to calibrate your monitor. Most screens have a strong color cast and without calibration your prints won't match the display. Calibration is easy with a device such as those made by Spyder.

Second, adjust the brightness of the image. Monitors tend to be too bright for printing. Start by reducing the brightness of your monitor to around 40%, then brighten your image. It will seem strange at first, but if you don't do this, your photos can come out too dark.

Finally, the image needs to be sharpened. Use your preferred sharpening techniques to accomplish this. Trial and error is required as the amount of sharpening needed varies according to subject matter, paper surface, and print size.

Create a file for each size of print you plan to make, starting with the largest. If printing yourself, a final JPEG file will make printing go faster.

Creating a Time Lapse

Some people have brought small video cameras for capturing a streaming video of the amazing activity going on overhead. Others have tried using the Movie Mode on their cameras to do the same thing.

Both have resulted in the same outcome - no video of the aurora. The problem with small video cameras is the same as with point and shoot cameras, the sensor is not large enough. With Movie Mode, the capture is a series of individual fast shutter speed shots.

Time lapse is a technique becoming popular to allow you to create a movie of the aurora. While it is an interesting thing to do, I wouldn't devote full shooting to this as you usually have to change position to get the best action going on overhead and exposures change when the aurora gets intense so there can be segments where the activity is blown out. If a second camera set-up is available, it could be a good thing to do or let it run all night or until the battery in the camera dies. Another option is to have it set up near to the main camera and when a good burst is going on to start it and let it go for a certain amount of time.

The steps for creating a time lapse of the aurora can be applied to other subjects you want to stream a series of action together. Remember, if photographing something where very long exposures are not required, lower ISO and faster shutter speed times can be used to accomplish this.

Camera setting - For shooting the aurora, the typical settings for getting a good shot are ISO 800 and a shutter speed around 10 seconds. For doing a time lapse, the ISO should be bumped up. The newer cameras can allow for very high ISO with low noise capability and since a Canon 5D Mark III was used for the example on the next page, the ISO was set at 3200 and the shutter speed at 15 seconds because it had been a quiet night and the intention was for doing a stacked star trail image. A cable release was used and locked in and the two second timer turned on to allow for the short write time from camera to card, thus there was a little break between images. Drive mode needs to be set to Continuous so that while the cable release is locked in shot after shot can be taken. 122

After the images have been taken the work begins in post processing. First, convert all images from RAW to JPEG. A good PC viewing and converting program for this is BreezeBrowser. Next, resize all of the images to a moderate size of a resolution of 180 pixels and a width of 1070 pixels. There are a variety of ways to go about doing a batch resize for this. A free utility for this is Multiple Image Resizer. This program has several features, but for this project all that's needed to be done is to select the folder with the images, select resize option to scale to width and type in the desired size, select the save option and hit go.

For creating the movie, Windows Live Movie Maker is a free, easy to use program that can put everything together to create the files for viewing later. In Movie Maker, select the files to include in the movie. Once all of the images are loaded, select all and go to Edit.

Set the duration each image is shown to a time of 0.2 seconds. On the Home tab there are several options for saving.

On the Mac, iMovie is where a time lapse can be created. Import the images into a new project and use the desired settings. Do a select all, choose the crop tool and use Fit to turn off the Ken Burns effect of it zooming in and out during the time each frame is up. When hovering over any of the images, three icons appear on the left side of the frame. To set the duration of each image which appears in the final movie, click on the Preference tool on the bottom and select Clip Adjustments. You can set the time here. You can also click on the Inspector icon on the tool bar in the middle of the screen to reach this.

In the time lapse on the next page, there is a portion where shorter shutter speeds would have been used for individual shots because of the intensity of the aurora, but the shot was set up for star trails. There are a total of 398 images included in the sequence with each having the aurora dancing through.

Creating Star Trails with the Aurora[124]

Picture two different scenarios. One, the aurora activity is very slow and the aurora has not appeared, not even the wisp of a homogenous band. The second is that a night of shooting the aurora seems over as it's close to 3 a.m. and the activity has been quiet for close to an hour. If staying at a safe place where the camera can be set up outside for the remain der of the night until the battery dies or a card gets filled, the shooting does not have to come to an end.

Besides using Photoshop, one option is StarStaX, a free program that works on both Mac and PC platforms. It's available at http://www. markus-enzweiler.de/software/software.html. Another free program, Startrails, can be found at http://www.startrails.de/html/software.html but it only works on the PC. A third program is call Image Stacker from TawbaWare found at http://www.tawbaware.com/imgstack.htm.

From testing each option, StarStaX seems to do the best job.

With the ability of camera bodies to shoot at high ISOs, creating star trails with the chance of the aurora coming into view during a sequence of shots is worth the effort. Until recently, to create a star trails image, Bulb setting would have to be used with a cable release attached and locked in for an exposure of 30 minutes or longer. That's changed as there are programs that allow for taking a series of individual shots and stacking them together to create a single photo with quality results. CONVERT FILES TO JPEG. The one drawback is that most of these programs only work with jpeg files. On a PC, a great program for batch conversion is BreezeBrowser. Digital Photo Pro, a Canon utility program, allows for both converting and resizing to be done at once should you wish to work with smaller files for the stacking process. Other options can be found in Bridge and Lightroom.

To create a star trails shot with the chance of the aurora appearing in it, first, find a location to set up the camera with a good foreground and a portion of the sky where the aurora will appear. Set the ISO at 800 and the shutter speed for 15 second exposures. Set the motor drive to Continuous High and lock the cable release so the shots will be taken one after another. Putting a new battery in before starting the series of shots as well as a fresh CF or SD card will allow for a lot of shots to be taken the remainder of the night.

In the morning, it's very important to transition the camera and lens from the cold to the warmth as discussed previously as they will be colder when left out for the duration of the night. Also, take the battery out and charge it during the day so it will be ready for the next night's shooting.
STARSTAX QUICK OVERVIEW. Once open, there are three Preference tabs - Blending, Images and General. Under Images, it has the option of Fast, Smooth and Automatic. Smooth is the best option.

In the Blending tab, options include Lighten, Gap Filling, Darken, Add, Subtract, Multiply and Average. Lighten or Gap Filling work best. If Gap Filling is used, a button appears for going to a Tools section.

Here, Threshold, Amount of Gap Filling and Brightness can be adjusted. Threshold of just to the Low side and Amount just to the More side work best to fill in any gaps that might have occurred between clicks of the shutter. There is very little difference in the saved file for viewing on the computer for Lighten or Gap Filling using Smooth, but Gap Filling does a little better job for making a print.

After having a group of individual shots, post processing to stack the images together will need to be completed. There are a variety of programs and options for stacking the group of images into one shot. Even though lots of single shots may be taken, not all have to be used for the final image, but those that are used need to be sequential so that gaps in the trails don't appear. The images on the following pages are of varying numbers of shots showing what can be accomplished trying this technique. StarStaX was used for compiling the final stacked image.

On a night when the aurora did not appear and it was about 1:30 a.m., several people set their camera up outside of our cabin in northern Alaska to take a stacked star trails shot and if the aurora did appear it would be an added bonus. The full set of images I ended up with totaled 417 for the night with an exposure time of 15 seconds each. This compilation was a selection of 198 images stacked together using StarStaX. When doing set-ups such as this it’s possible to pull individual shots where the action is good. Because the intensity of the aurora varies at different times, a 15 second exposure can be too much or too little so there is a chance to have several over-exposed shots in the sequence that can cause problems for doing a full stack. If there is a sequence you like that has one or two over-exposed images in it, these can be eliminated from the final output.

An even shorter portion from the full set of photos. This image has 21 15-second exposures. The shorter compilation lets a slight tinge of red appear along the top right edge of the aurora. This section of shots was also during a time when there was very little definition to the band putting more emphasis on the short star trails.

As compared to the first compilation of a stack, a smaller selection of images can result in

more definition in the separate bands that appear. This set of 39 15-second exposures had a bit of definition within the bands, even showing a bit of the curtain in the lower two sections on the left side.

These three images were all taken from the same sequence showing that a variety of very different results can be pulled for a series of individual shots. It’s also possible to just pull out one shot for a nice aurora capture instead of a star trails stack.

Bring out the Milky Way

What better element to compliment the aurora borealis than the Milky Way? These are the two phenomenon in the sky that draw our attention more than anything else. When the opportunity arises with both visible, there are some settings that need to be used to put everything together.

Star photography of the Milky Way is best handled with a very high ISO. My preference is between 2500 and 4000 with 3200 being used quite a bit. Shutter speeds of about 25 seconds are also best for getting more stars as well as the depth of the Milky Way.

Depending on the brightness of the aurora, this might be too much exposure so the combination has to be when the Milky Way is out and the aurora is in the general direction of it and not overly bright for this combination of ISO and shutter speed.

Post processing is where the remainder of the work comes. The steps included here were done in Adobe Camera Raw first with some followup in Photoshop, my two post processing programs of choice. The image on this page has had nothing done to it except being converted to JPEG from RAW.

If just shooting the Milky Way the exposure and ISO would have been different for the image on the left to bring out the Milky Way more. This image was one of a large series for a star trails stack.

The following steps were made for the finished images on the next page. 1. Go to the Lens Correction Panel and selecting Enable Lens Profile Corrections.

2. Back to the Basic Panel, the following settings were adjusted. Exposure to +1.15, Blacks to 8, Clarity to +13, Vibrance +1 and Saturation +7.

3. Tone Curve Panel - Highlights to +10 and Lights to +10 to bring out the stars.

4. Detail Panel - Increased the image size to 100% to work with the noise and adjusted Luminance to 58. After dropping the image size back to Fit in view, worked with the Sharpening sliders. First I found I liked Amount at 73 and Detail at 49.

5. Clicked Open Image so the updated file would be opened in Photoshop.

6. In Photoshop, the only processing work done was with the Dodge Tool. I use an Exposure of 25% to paint over areas of the Milky Way to bring out the brightness to what it should be. You have to be subtle here so you don't make it too bright.

When using the Dodge Tool over the Milky Way, only parts that have data embedded in the image are brought out. It will not pull brightness to material that is not there so what is shown in the final image is what was there in the sky. Because of using a high ISO and long shutter speed, more color and stars are captured than what the eye can see. The Milky Way is visible in different parts of the sky at different times of the year depending on where you are located. It does take a dark sky for it to be visible to the eye so areas with lots of light pollution obscure the Milky Way.

Single Shot HDR

When taking photos of the aurora it is not possible all of the time to get the exposure just right for the aurora and for the foreground. If we try and take two or three images to use as

an HDR, the movement of the aurora would be extremely blurred and any detail would be lost. In these cases, if we want to process a single picture as an HDR, we have to take our shot in RAW mode and make two or three copies of the RAW file, depending on the amount of exposure differences there are in the image.

Adjustments can be made in Camera RAW to the files based on the other controls available in the program discussed earlier.

After each RAW file has been adjusted, an HDR program such as Photomatix or the Merge to HDR feature in Photoshop can be used to put together the final image.

The first image we will get is the standard one where the exposure was left alone. Saturation levels were set in this first image to the level desired and the file was saved to TIFF, as were all images adjusted. Exposure was left alone on the first image shown on the right. The same amount of noise reduction / luminance was used for each image (+70).
130

The second image will be our over exposure. So we have to increase the exposure by 1 stop to bring out the detail in the snow.

The third image will be our under exposure. So we have to lower the exposure by 1 stop to help darken the sky around the aurora.


A view of the original image prior to any adjustments being made.

Merged photo using Photomatix to bring together the three saved TIFF files. Notice the pop in the aurora color and white to the snow.

Revealing Camera Problems[133]

There are times when night photography, and aurora photography in particular, might expose a problem with a camera. Such was the case with my first aurora shoot as all of my images taken at night with long exposures had a line going all the way across each aurora image.

There had been no problem with day photog raphy up to that point but when looking at the aurora images the line appeared. If you look closely to where the arrow is pointing with the image on the right, you can see the line.

After spotting this, the camera body being used was sent to Canon repair services and upon re view of a file with several images they replaced the defective sensor. This was in the early days of digital and it was found that one batch of bodies did have a defective area on the sensors that caused this problem so the likelihood of this happening today is rare but take a look at your images to make sure it doesn’t occur.

What to do if you get home and see a line like this on a lot of shots? You are not totally lost. As the picture on the next page shows, you can get rid of the line very easily one of two ways.

The first was is to use the clone tool in Photo shop. Because this is a very small line and not a lot of room for error, make the clone stamp small by using the bracket tools to change size. Pick an area just above or below the line to clone and draw across the defective area. Increase the size of the image to at least 100%

to make sure to get a good clone. The second way to do a repair is with Fill > Content Aware. This is a great tool to help get rid of lots of things in your images that are out of place. Either use the Rectangle or Lasso Tool and outline the problem area then right click

inside the selected area and choose Fill > Content Aware or select this under the Edit Menu.

References and Resources

CLOTHING
Big Ray's - www.bigrays.com
Sorel boots - www.sorel.com
LaCrosse boots - www.lacrossefootwear.com/performance/winter/ boots/
AURORA FORECAST
University of Alaska Fairbanks - www.gi.alaska.edu/AuroraForecast
NOAA POES - www.swpc.noaa.gov/pmap/
NOAA OVATION Aurora - helios.swpc.noaa.gov/ovation/#
Yellowknife, Canada - astronomynorth.com/aurora-forecast/
Aurora Sentry - www.aurorasentry.com/index.html?ovals.html&1

AURORA CAMS
Fairbanks, AK - salmon.nict.go.jp/live/aurora_cam/live_aurora_cam_e. html

Abisko, Sweden - www.auroraskystation.com/live-camera/9/ **AURORA WEBSITES**
Space Weather - www.spaceweather.com
Aurora Alarm - auroraalarm.net/
SOHO - Solar and Heliospheric Observatory: sohowww.nascom.nasa. gov/
Space Weather Live - www.spaceweatherlive.com/en/

SMARTPHONE APPS
GEOPHYSICAL INSTITUTE AURORA FORECAST - www.gi.alaska.edu/AuroraForecast/MobilePages

TINAC iPhone - itunes.apple.com/app/aurora-forecast./id539875792
ANAGRAM - itunes.apple.com/us/app/auroral-forecast/ id539414185?mt=8
AURORA BUDDY - play.google.com/store/apps/details?id=com.combatdave.aurorabuddy&hl=en
3D SUN - science.nasa.gov/science-news/science-atnasa/2010/17feb_3dsun/
DOFMaster - iPhone - www.dofmaster.com/iphone.html
DOFMaster - Android - www.dofmaster.com/android.html
MoonPhase - itunes.apple.com/us/app/moonphase-moon-info/ id287526650
PHOTOGRAPHY WORKSHOPS
First Light Photo Worlshops - www.firstlighttours.com
PHOTOGRAPHY EQUIPMENT WEBSITES BorrowLenses - www.borrowlenses.com
LensRentals - www.lensrentals.com
BOOKS
Aurora Watcher's Handbook by Neil Davis
The Northern Lights: Secrets of the Aurora Borealis by Dr. Syun-Ichi


Akasofu

Checklist

CLOTHING
• Boots - The thicker the soles the better
• Wool socks
• Thermal underwear
• Hand and foot warmers
• Glove liners
• Gloves or mittens
• Head covering
• Warm shirt / sweater
• Heavy coat - Down works best
• Warm pants - Wool or insulated ski pants

CAMERA ACCESSORIES
• Good tripod and easy to use tripod head
• Padding for tripod legs if using a metal tripod
• Cable release or remote
• Extra batteries - at least one
• Lens cloth

• Memory cards - have plenty of storage space
• Small flashlight or head lamp
• Know what want to do for camera protection

CAMERA EQUIPMENT
• Camera bodies - Have a backup if possible
• Lenses - A wide-angle lens that has a fast f/ stop; preferably f/2.8 or f/1.4
• Know where the buttons used often are located
136

CAMERA PREP
• Remove filters from lens
• Tape over LED light
• Lens hood attached if have one
• Get a pre-focus on lens and tape in place
• Test shot to ensure focus
• Set file type to RAW or RAW + JPEG
• Set White Balance to Daylight or Auto
• Set two-second timer if not using cable release
• Set ISO
• Turn Auto Review off
• Turn Image Stabilization off
• Set Exposure Mode to Manual or Aperture
• Set Motor Drive to continuous
• Decrease LCD Brightness from default
• OPTIONAL - Set Date / Time Stamp to local time
• If using Aperture Priority set Metering Mode to Evaluative and Exposure Compensation to +1

IN THE FIELD
• Scout and find good locations during the day
• Use multiple foregrounds
• Avoid breathing on the viewfinder
• Patience - Stay up until at least Solar Midnight to make sure you don’t miss a good show (at least 2:00 a.m.)
• Have warm drinks nearby

BEFORE LEAVING ON A TRIP
• Review the aurora forecast
• Check the weather forecast
• Know moon phase and rise times
• Determine when solar midnight is

ENJOY THE SHOW
Take the time to watch this amazing event and enjoy its wonders.

Take Time to Enjoy[137]

Don’t get too wrapped up with the details of taking a lot of shots and getting everything perfect. Take time to watch the amazing beauty going on overhead as there’s a good chance you will never have the opportunity to see this again. Luckily, with some camera set-ups, each shot is between 10 and 15 seconds so you will have at least this much time to watch what is going on. It’s all right to miss a few shots to pay attention to the curtain as it ripples across the sky or as the aurora dances all over the place. Let your shots be the exclamation point to the wow you are experiencing.

Choosing an Aurora Workshop[138]

Questions to ask before choosing a northern lights workshop.

• Do I want a workshop or a tour? Because of the increasing popularity of photographing the aurora, more trips are being offered than ever before. Some offer a tour to good locations but do not provide teaching. Tours are great if you don't need any hands-on help or just like going with a group of other photographers for the camaraderie.
• If they write, look for samples. Check previous writing by the instructor. It helps show they know what they are teaching.

• Find out the mix of field and classroom time. You're wanting to shoot and get pictures so you don't want to spend too much time in the classroom. You want some instruction in this form but not too much.

• How many times have they done this trip? Find out how many times the leader has been to the area to ensure they know it quite well. They don't have to live there but they do need to know the location. Knowing the area allows for maximizing of time to be at the right place at the right time.
• Get on the phone and chat. While these questions can be answered by email or looking at their website, talking on the phone will let you get a feel of what the leader is like. You don't have to be best friends, but a good workshop leader will make you feel comfortable and be able to listen to your wants and desires for your time together.

• Do they listen? This is an important aspect. Many people can talk about how to do something but you need to know they are there to answer all of the questions you have.
• Is leading workshops a second career after retiring or leaving another field or is this something they've done for years? Your leader should have a good knowledge and

experience with photography, not something they've picked up recently to earn extra money or as a new line.

• Solid or flexible structure? Some trips have a set structure where you are at Point A at this time and then go to Point B at this set time. Others change things up based on weather, subject cooperation and other factors. One is no better that the other but try to match your preferences.
• Ask how much they've been published. If they don't work at getting published in a lot of magazines and other places, there's a good chance they're leading workshops because it seems like an easy way to make money with their camera.

• Do they ask about your history or expectations? This is an indication of how much you will learn. If subjects covered are based on your needs, there is a better chance the instruction will be helpful. Some cover this on the first day of a workshop.
• Ask for references from others who have done this trip. If they have nothing to hide, they will offer contact info from others who have done the trip you want to go on.

• What Is Included? Never make assumptions. Always ask what you receive for money paid. Water? Meals? Internet access? Transportation?

• How long have they been leading workshops? More time spent leading groups is good. If they've been around quite a few years, they should be good enough to have been able to stay in business that long and it shows they love what they do.
• Make sure your northern lights workshop includes these specifics:
- Multiple locations for a variety of landscapes and foregrounds.
- Has at least six nights to allow for periods of low activity.
- Make sure the leader has good experience photographing the aurora.
- Enough shooting during the day to keep you busy.
- Bases within the auroral band and not just hoping it reaches south for where you stay.

Understanding the Aurora Getting Ready - Body Getting Ready - Camera Shooting the Aurora Image Processing

Learn more

Once you are familiar with the settings for northern lights photography and are comfortable working with your camera in the dark, you will be ready to capture the greatest light show on Earth. It's a great skill to learn and allows you to take images of much more than just what the eye can see as the sky erupts in front of you.

Here are some ways you can keep learning more about photography and places to share your images with others who have a passion for 'Photographing the Aurora Borealis.'

Workshops
Whether your passion is northern lights, wildlife, nature, macro or landscape photography,

First Light offers instructional photo workshops to many top spots around the world including the most popular Alaska Northern Lights. Andy's strength in working with participants is composition, exposure and wildlife behavior / techniques.

Online Classes

firstlighttours.com/onlineclasses.html Take your photography to the next level with an online photography class. Watch your skills and techniques improve the further you get into each course with one-on-one access for any questions you have. You'll gain knowledge and learn new techniques as well as learning to get the most out of your equipment. Choose from any of the six-part self-paced classes which have no set start or end dates. All classes include critiques for each lesson.

Facebook Page

facebook.com/firstlightworkshops
Follow Andy and First Light on Facebook where tips and tricks, notes about upcoming workshops and photos from recent outings are posted. Post your image of the northern lights to let others see what you learned.

Sharing

E-mail a Friend

If this book has helped you learn how to photograph the northern lights, I'd love if you could tell a friend about it too by directing them to my website where they too can enjoy this and other learning opportunities.

My Gift to You

After having purchased and read this book, if you would like to join me on an incredible journey to see and photograph the northern lights, contact me and receive $150 off the price of registration for the next northern lights workshop being offered. You can also take $25 off the price of one online class.

Contact Andy

Workshop Web: firstlighttours.com
Stock / Fine Art Web: andylongimages.com Email: andy@firstlighttours.com
Facebook: facebook.com/firstlightworkshops