EXPERIENCING THE MIDNIGHT SUN IN BETTLES, ALASKA

By Mike Earl

The “Land of the Midnight Sun” has been mentioned many times in folklore, bringing up thoughts of miners trekking to locations such as Alaska and the Yukon Territory with hopes of finding their financial salvation in the form of gold nuggets.

Why does the Midnight Sun occur? Some might wonder why there are places on Earth (like Alaska) where you will be able to see the Sun for 24 hours straight on June 21 (or December 21 in the case of the southern hemisphere). The answer is the same as the answer to the question “Why does Earth experience seasons?”

The orientation of the Earth’s rotational axis allows the Midnight Sun to happen. Earth’s rotational axis is inclined at about 23.5 degrees. If it were not inclined, the days (and nights) would last 12 hours on every location of the Earth no matter what time of year it was. The Earth’s axis tilt is what allows the Sun to remain in the northern hemisphere’s sky longer in the summer, shorter in the winter, and giving us the seasons we all know.

The Arctic Circle is that imaginary line on the Earth that demarcates the “Midnight Sun” border. Those locations south of this border (Ottawa included) will experience sunset at some time. Those on the northern side of this border will see the Sun 24 hours a day during the summer solstice. The cities of Anchorage and Fairbanks lie just south of the Arctic Circle, so the Sun will actually set at both locations, but only for a few hours.

Figure 1 illustrates the Earth’s axis tilt and the Arctic Circle in particular. As the Earth rotates, locations will trace out a large circle along its specific latitude. In the case of the Arctic Circle and north of it, daylight is seen to be constant over an entire Earth rotation. In the case of the Antarctic Circle and south of it, there is no daylight for 24 hours straight during the Summer Solstice. Those locations south of the Antarctic Circle will experience their Midnight Sun near December 21 (winter solstice). The penguins really love it too!

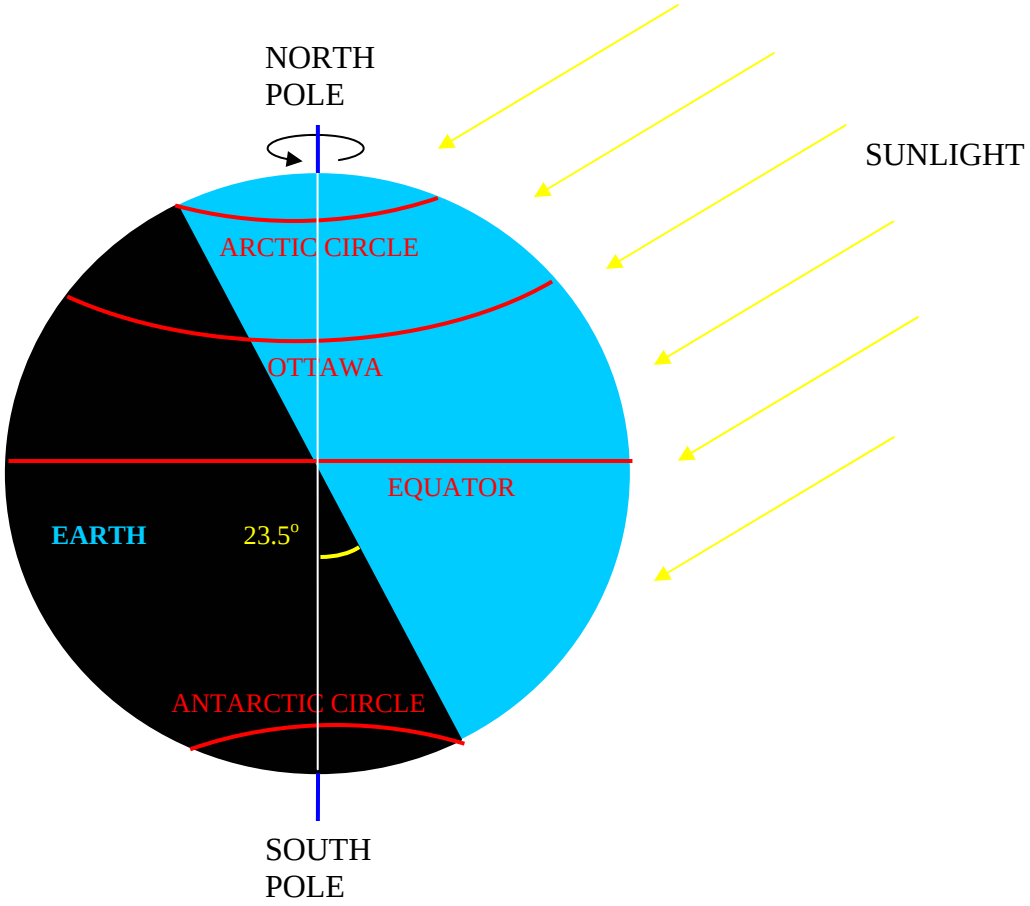

Figure 1: The Earth, as seen at the Summer Solstice. As the Earth rotates on its tilted axis, Ottawa will inevitably experience night, but a location on or north of the Arctic Circle will be sunlit for an entire Earth rotation. Note how the Equator will experience equal portions of day and night (12 hours). During the Summer Solstice, locations on or south of the Antarctic Circle will experience no sunlight at all. The Antarctic Circle will experience its Midnight Sun at the Winter Solstice (on or about December 21).

I know what you're thinking. Why in God's name would I travel to Alaska in June, a time when it is nearly impossible to see the night sky? The answer is actually to observe and experience the Midnight Sun for the first time.

To plan for this event, I knew that I had to travel north of the Arctic Circle (+66.5 degrees latitude) on June 21 (the summer solstice). I could have traveled to the Antarctic Circle (-66.5 degrees) on or about December 21, but the northern method was much cheaper to observe the very same effect.

In 2006, the Summer Solstice occurred on June 21 at 12:26 p.m. AKDT (Alaska Daylight Time), 08:26 a.m. EDT. I therefore could see the Midnight Sun on the 21st or

the 22nd without much of a difference. At its lowest elevation the Sun would appear to be a few degrees above the northern horizon.

I had to worry about mountain ranges, since a large mountain range in the north might cover the Sun easily when it is at its lowest elevation; just ½ degree above the horizon at the Arctic Circle, if atmospheric refraction is considered.

I also had to worry about the weather. Alaska's rainy season occurs in June, so I had to closely monitor the weather reports and especially the flying conditions. I asked several pilots who were flying that day what the weather would most likely be at their respective destinations. If I had to fly to my location, I had to make sure that the pilot would be able to get me there.

I had originally intended to travel to Barrow, which is located at the extreme northern coast of Alaska at 71 degrees latitude, about 4½ degrees north of the Arctic Circle. Its weather forecast was bleak, however, and the flight would take several hours from Fairbanks. Any location to the north-east of Fairbanks was forecasted to be overcast for the latter half of June, based on trends for that month. Add to that ferocious smoke from forest fires that had been burning since the beginning of the month.

One pilot was flying to a very small town called Bettles, which is located about 35 miles north of the Arctic Circle, which certainly fit the bill. The town is located to the northwest of Fairbanks, which avoided both the clouds and the smoke. The pilot told me that the weather was forecasted to be partly cloudy for the next two days (from June 20 to June 22). Clouds were forecast to move in on the 23rd. I found that this was the best chance to observe the Midnight Sun without clouds getting in the way much.

Figure 2: The state of Alaska, indicating the location of Bettles and the Arctic Circle. It can be seen that both Fairbanks and Anchorage are located below the Arctic Circle and therefore do not literally experience the Midnight Sun at the Summer Solstice.

The only way to get to Bettles in the summer months is by aircraft. Alaska boasts the most experienced and reliable small plane pilots in the world simply because most of Alaska can only be accessed by the air.

I flew to Bettles from Fairbanks (a one hour flight). I found that the Arctic Circle is not marked at all. I somehow expected to see some kind of structure on the ground to mark the line where the true Midnight Sun actually begins. When we landed, I saw the following sign, which pretty much said it all.

Figure 3: The sign that greets visitors of Bettles, Alaska. As the sign says, Bettles is located at latitude 66.9 degrees, which is about 0.4 degrees north of the Arctic Circle.

The equipment I used was simple: one digital camera, a tripod, a digital watch, and a piece of Baader AstroSolar film. The plan was also simple: take an image of the Sun every hour for 24 hours straight to obtain a complete record of the Sun's position over one complete rotation of the Earth.

I used my Nikon CoolPix 4500, fitted with the Baader solar filter sheet, which was stored conveniently in my jacket pocket. Every hour on the hour, beginning at 10 a.m. AKDT June 21, and ending 10 a.m. June 22, I placed the Baader film in front of my camera lens and took a 1/15 sec. exposure of the Sun (no zoom).

The Sun began to exhibit its normal orange sunset colour at about 11 p.m. The Sun did not set, however, but came very close to the horizon, actually hiding behind the far away Arctic National Park mountains for about ½ hour before it reappeared at about 3 a.m. The Sun steadily rose in elevation once again. Although not surprising, it was an interesting thing to see firsthand.

It was an amazing experience to see the Sun near due north at 2 a.m.! To actually see your shadow at that time is certainly different too. Birds are still flying around at that time as they eat the millions of mosquitoes that inhabit the area. If you do go there, bring the strongest bug spray you can find and the netting!

In the end, the entire 24 hours was partly cloudy (mainly broken cloud), which allowed me to take images of the Sun between the clouds throughout most of the images,

except for one. At 3 p.m. I had to wait 12 minutes for a large cloud to get out the way. Other than that, I was able to get an image every hour, and in some cases, every half hour. After 8 p.m. the sky cleared completely and allowed me to capture the Midnight Sun in its entirety. A composite image is shown in Figure 4.

The experiment was a success in the sense that I did see much of the Midnight Sun, except for ½ hour in which the Sun hid behind a far away mountain range. It was much better than taking a huge gamble with the weather northeast of Fairbanks or in cloudy Barrow.

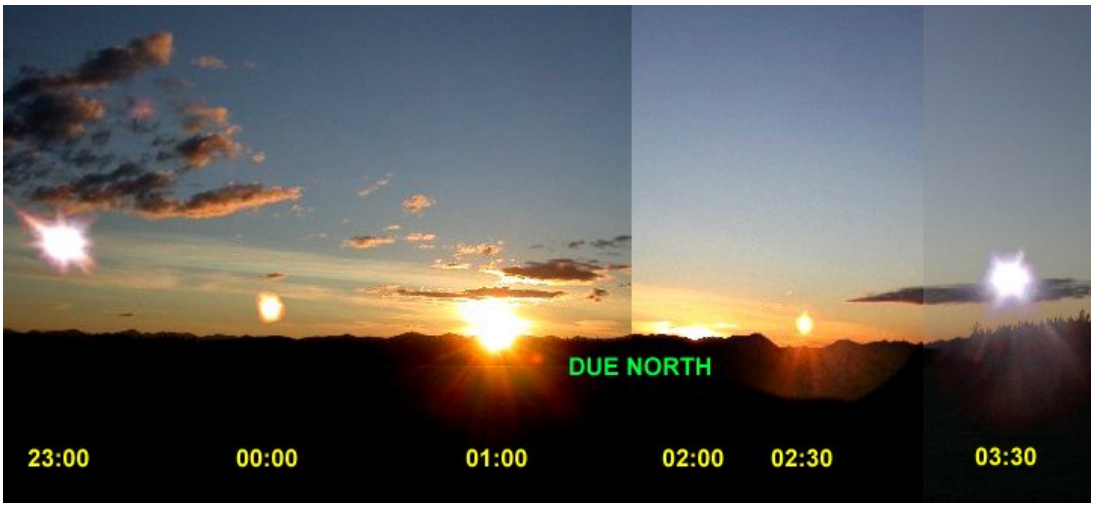

Figure 4: The Sun as seen from Bettles, Alaska from 23:00 to 03:30 AKDT. This image is the addition of 6 different images, four of which were taken using Baader AstroSolar film (23:00, 00:00, 02:30, and 03:30) and two of which were taken without filtering to show the terrain and sky (01:00 and 02:00). Note how at 02:00 the Sun did appear to set, but the mountains were high enough to hide the Sun for a brief time. At that time, the Sun was actually about 1 degree above the sea level horizon, allowing for atmospheric refraction.

I was in Alaska for four weeks and I did not see a single star (other than the Sun) during that time. There were times in Ottawa where the skies nearly matched that record, but those times were due to consecutive cloudy nights. When I flew to Edmonton, Alberta on June 26, I saw the Big Dipper for the first time in 4 weeks, and stared at it for a longer time. It seemed strange that I could actually see it again.

I found that viewing and imaging the Midnight Sun is more challenging than originally expected. Weather was the biggest concern, as Alaska is quite cloudy during the month of June. As with eclipses, occultations, etc., it is better to actually experience the Midnight Sun than to simply know it happens. It is truly a spectacular astronomical event. The great thing is that it happens every single year!