

**Report for NiS+TS “Narratives in Space+Time Society”  
on observing circumstances for the Halifax Citadel  
in connection with the *Downhill from Here* public art walk**

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**Space:** N 44° 39' W 63° 35' altitude 120 m

This location is on Earth, the third planet of Sol, in the Milky Way galaxy, halfway between the centre and the edge of the galaxy. The earthbound site is approximately halfway between the Equator and the North Pole, a little more than 1/6 of the way around the world relative to the Greenwich Meridian, about 120 metres above sea level.

**Time:** 2016-09-18, 12:00–14:00 Atlantic Daylight Time (Universal Time minus 3 hours)

**Time + Space**

The standard longitude for the Atlantic (Q) time zone is 60° west, which passes through Sydney, NS. Halifax is 3.58° west of there, so Local Mean Solar time in Halifax is 14 minutes behind Standard Time. There is an additional delay of 1 hour to account for Daylight Saving Time, which is in effect on today's date.

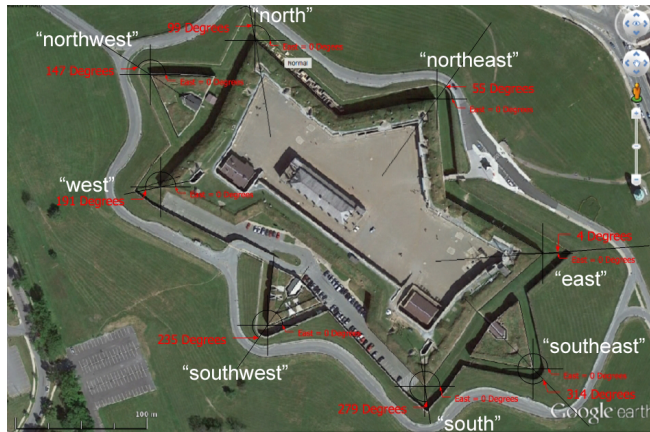
Furthermore, the true Sun does not appear travel uniformly along its ecliptic path, owing to the eccentricity of the Earth's orbit. On today's date, the actual Sun is 6 minutes ahead of the “mean Sun.”

Accordingly, although the Noon-day gun announces 12:00 Noon ADT, the Sun in fact does not transit the southern meridian until  $12:00 + 00:14 + 1:00 - 0:06 = 1:08$  p.m. ADT. For navigators and surveyors in Halifax on the 18<sup>th</sup> day of September, 2016, Noon occurs at 1:08 p.m. in the afternoon! The solar astronomers will have their telescopes tilted up nearly 47° from level to (safely) view the Sun.

In this month of September, 2016, there are two New Moons, one on September 1 and the other on September 30 (in the Americas, anyway). There is no special significance to this, astronomically, as it is simply an artefact of most months of the civil calendar having more days than the 29.5-day lunar cycle. It happens every 2–3 years, during some month (but never February). There are those to whom the second New Moon is significant, and they sometimes call it the Black Moon.

**Orientation and Shape**

The Citadel has the form of an elongated star, not for aesthetics, but for ease of defence against attack. The long axis is oriented roughly northwest to southeast, probably to best conform to the contours of the hill. The points of the star imply directions in azimuth, and only nominally align with the cardinal points of the compass, which will nevertheless be used to conveniently label the sectors of the sky in those directions. The following table summarizes this correspondence, including the directions counterclockwise from east (as supplied) and clockwise from north (the astronomical convention).



Nearest Cardinal Direction	Implied Direction CCW from E	Implied Direction CW from N	Associated Declination
north	99°	351°	+45°
northeast	55°	35°	+36°
east	4°	86°	+3°
southeast	314°	136°	-31°
south	279°	171°	-45°
southwest	235°	215°	-36°
west	191°	259°	-8°
northwest	147°	303°	+23°

In addition, there is a column of numbers “Associated Declination”—these are the lines of celestial latitude relative to the celestial equator that intersect the horizon at the prescribed azimuthal directions. For example, an object of declination  $-31^\circ$  would rise in the “southeast” at azimuth  $136^\circ$ , and an object of declination  $+23^\circ$  would set in the “northwest” at azimuth  $303^\circ$ . Through these declinations, we will connect azimuthal directions around the compass to objects out in space in the celestial sphere, according to where and when they rise and set. This is the astronomical-mathematical basis for what follows, and it is not necessary to understand the details. The circumstances of the sky described below are appropriate for the date 2016 September 18, at key times during the day or night.

## North

In this sky sector, there is no rising, there is no setting, only endless circling of the “circumpolar” stars and constellations. Here we find Ursa Major (the Great Bear, including the Big Dipper asterism), Ursa Minor (the Little Bear, including the Little Dipper asterism). The stars in the sky appear to circle around Polaris, the lucida (brightest star) of Ursa Minor, at the end of the handle of the Little Dipper. Polaris happens to lie close to the North Celestial Pole in our epoch, but this has not always been so, as the Earth spins like a top and

“wobbles,” precessing around a large circle in the sky over a period of 26,000 years. The earliest inhabitants of this land would have seen an altered sky, in which Vega was the pole star, and they might have glimpsed the Southern Cross!

This is the sky sector in which the Mi'kmaw story of Muin and the Seven Bird Hunters unfolds. Muin is a she-bear, and the bird hunters pursue her from spring into fall, when she is killed, but her spirit passes through the winter and re-emerges in the spring. It is remarkable that both the Graeco-Roman and Indigenous stories identify the principle stars of the Big Dipper bowl with a bear, perhaps testimony to a common ancient origin of this star group. Central to the Muin story is the endless, annual, cycling of the tale through the seasons, a reflection of the circumpolar motion of the stars in this northern sector of the sky. It is a story with no beginning, and no end.

As dawn begins, high in the north, almost at the zenith, is Capella, the lucida of the constellation Auriga (the Charioteer).

## Northeast

At the end of astronomical twilight, we would see the Milky Way ascend straight up into the sky in the northeast, form an arc overhead, then descend directly downwards to the southwest, dividing the sky into two halves. This swath of milky light, intertwined with dark lines of dust that obscure the background galactic glow, is made up of millions of distant stars, unresolved to the naked eye, which a telescope or even binoculars would reveal as tiny points of light. It's a magnificent sight—**or would be if it were not for the glare and sky glow of urban lighting:** light pollution. Perhaps sentinals on the Citadel walls hundreds of years ago enjoyed this sight? But no more.

## East

Generically, celestial objects rise somewhere in the eastern half of the sky and set in the western half, but on this day near the Equinox, the Sun rises at azimuth 86°, the exact azimuth of the “east” battlement.

Astronomical Dawn breaks at 5:18 a.m., Nautical Dawn (when the sea can be distinguished from the sky) begins at 5:53 a.m., Civil Dawn (outdoor lights off) starts at 6:28 a.m., and the Sun (in the constellation Virgo, the Virgin) rises at 6:57 a.m.

The Moon, in Pisces (the pair of Fish), rises in the evening twilight at 8:39 p.m. at azimuth 80°, extending the twilight into the night. It is 2 days after the Full Moose-Calling Moon of the Mi'kmaq (see the proposed reading in the Appendix), and will transit the meridian at 3:20 a.m. This same Moon is 2 days after the “Harvest Moon” of the Settlers, allowing some work to be done into the evening by Moonlight. Note that the Settlers were farmers, while the Indigenous inhabitants were hunters—their Moon-names reflect this.

The Belt of Orion, comprising the three stars Mintaka, Alnilan, and Alnitak, rises due east nearly an hour after midnight, and sets in the west during the day, nearly an hour after Noon. The group rises in the east from every location on Earth, regardless of the observer's latitude, as they themselves are on the celestial equator (particularly, Mintaka, which is less than half a Moon diameter south of the celestial equator). The rising and setting of this prominent group surely must have been used by ancient navigators to orient themselves.

### **Southeast**

In the evening twilight, high in the sky, we still see the so-called "Summer Triangle" of Deneb, Altair, and Vega, the luminae (respectively) of the constellations Cygnus, Aquila, and Lyra (the Swan, the Eagle, and the Lyre).

As dawn breaks, in this direction we will see Sirius, the brightest star in the night sky and the lucida of Canis Major (the Large Dog), well up in the sky. When we see this star in the dawn's light, we know winter is on its way. On New Year's Eve, Sirius culminates due South near midnight. To the right and high up, we see the large and now complete constellation of Orion, with his belt and all appendages.

Also at this time, we would see that the Milky Way has wheeled around in the sky, now ascending directly up from the southeast, arcing overhead, and descending to the northwest (but only during a power outage!).

### **South**

In this sector, there is also no rising nor setting. Stars and constellations enter from the southeast sector and exit into the southwest sector, reaching their highest altitude above the horizon as they transit the north-south meridian. Local solar Noon takes place when the Sun transits. All Full Moons are at their highest here around midnight, 12 hours after local solar Noon; however, when the Sun is high at Noon (summer), the Full Moon will be low, and when the Sun is low (winter), the Full Moon will be high. The Chief Moon of the Mi'kmaq is the Full Moon nearest the winter solstice—it is the highest of the Full Moons, and stays in the sky for the longest time, appropriate to a chief.

At this date, in the evening twilight, the planets Mars and Saturn form a triangle with the red star Antares (the Rival of Mars) in the constellation Scorpius (the Scorpion). They appear in the south but immediately begin descending into the southwest. In this sector resides the centre of the Milky Way, beyond the nearby stars of Sagittarius (the Centaur-Archer). High above, almost at the zenith, is Vega, the lucida of Lyra.

As dawn breaks, the constellation Orion (the Hunter) dominates the southern sector, with bright stars Rigel and Betelgeuse. The line of the Belt of Orion, followed up and to the right, leads to the red star Aldebaran, the lucida of Taurus (the Bull); following the line of the belt to the left and down, we find Sirius, described above.

## **Southwest**

The southwest is a sector of setting. In the evening, the planets Mars and Saturn set here, followed by the Galactic Centre. The Moon will still be  $31^\circ$  high in the southwest tomorrow morning when the Sun rises, and does not set in the west until 10:12 a.m., at azimuth  $282^\circ$ .

## **West**

In the west, the Sun will set at 7:18 p.m. at azimuth  $272^\circ$ , Civil Dusk ends at 7:47 p.m., Nautical Dusk ends at 8:22 p.m., and Astronomical Dusk ends at 8:57 p.m. The day length was 12 hours and 21 minutes. The brilliant planet Venus will appear low in the western sky as the twilight gathers, to the left of the sunset position, near the bright star Spica, the lumina (brightest star) of Virgo. Jupiter is nearby, but too close to the Sun to be seen.

## **Northwest**

The northwest is also a sector of setting. In the evening twilight, the star Arcturus (the Bear Watcher) descends and eventually sets in the northwest, reluctant to take his eye of Ursa Major. During the wee hours of the morning, the Summer Triangle has progressively set in the northwest, marking the beginning of the end of summer—first we lose Altair, then Vega, then Deneb, although the latter is nearly circumpolar and simply fades into the twilight before setting.

## APPENDIX: reading for the East Station

Moose-Calling Moon (Ninth Moon – Micmac): Joseph Bruchac & Jonathan London, illustrated by Thomas Locker

In this season when leaves  
begin to turn color,  
we go down to the lakes  
and with birch-bark horns  
make that sound which echoes  
through the spruce trees,  
the call of a moose  
looking for a mate:  
Mooo-ahhh-ahhh  
Mooo-ahhh-ahhh.

If we wait there,  
Patient in our canoes,  
The Moose will come.  
His great horns are flat  
Because, long ago,  
before people came,  
Gloos-kap asked the Moose  
what he would do  
when he saw human beings.  
"I will throw them up high  
on my sharp horns," Moose said.

So Gloos-kap pushed his horns  
Flatter and made him smaller.  
"Now, Moose," he said, "you will not  
want to harm my people."  
So the Moose comes and stands,  
Strong as the northeast wind.  
He looks at us, then  
we watch him disappear  
back into the willows again.

