



MONT-MÉGANTIC INTERNATIONAL DARK-SKY RESERVE

2016 ANNUAL REPORT

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Summary

Nine years ago this fall, the first IDA International Dark Sky Reserve was created in Quebec, Canada. Officially certified in September 2007 by IDA (International Dark Sky Association) and RASC (Royal Astronomy Association of Canada), the Mont-Mégantic International Dark Sky Reserve (MMIDSR) covers a territory of 5,300 km², including two RCMs (Regional County Municipalities) as well as the City of Sherbrooke. It unites 35 municipalities and over 225,000 citizens.

This report aims to summarize the year 2016 for the MMIDSR.

On the outreach level, the ASTROLab visitor center saw a 15% increase in attendance for a second year in a row, and a 25% increase for the Mont-Mégantic National Park which constitute the heart of the MMIDSR. Light pollution awareness and information about the creation of the DarkSky Reserve still constitute the introduction of the evening talks done at the ASTROLab, helping educate people about the effects and solutions of artificial light at night.

On the regulatory side, an important milestone was achieved this September with the publication by the Bureau de normalisation du Québec (BNQ) of a provincial level Standard to control light pollution. Also, the reserve is working with municipal officers to update two of the three light pollution regulations currently in place in the region. The reserve also continues to assist many towns and villages with the interpretation and compliance of the regulation for different lighting projects.

The work of converting light fixtures to low blue-light content pc-amber LED continued in 2016, with both important projects and smaller retrofit in the towns and cities of the MMIDSR.



Outreach

- More than 23,000 people participated in the ASTROLab's astronomy outreach program at Mont Mégantic
- We had around 100 000 visitors in the national park, which constitute the core of the reserve and where the Mont-Mégantic Observatory sits. Many international visitors were attracted by the DarkSky Reserve status
- Outreach activities at two majors exhibits for the Reserve's touristic stops (Woburn's rest area giant sundial, Notre-Dame-des-Bois' rest area 3D Big Dipper constellation) were held this autumn
- ASTROLab's Facebook page is quite popular: more than 13,000 followers, with 1,350,000 of reach since January 1st 2016
- Last year's activity that we produced for the network of Quebec's national parks (an astronomy & light pollution activity) has been held for a second year in more than 15 parks, reaching more than 4,000 visitors of both remote and urban national parks this summer
- Continued updates on the Reserve's website: ricemm.org
- A dozen media interviews
- An urban astronomy evening held in Sherbrooke this summer for people passing by
- A formation was given to the City of Boucherville, near Montreal, about good lighting practices and how to mitigate light pollution. The formation was based on last year's eco-lighting program for municipalities.
- Recommandation and material was provided to the Amateur Astronomers Club of Laval
- Advices and recommendations was given to the project of creating a dark sky place at Saint-Pierre-de-la-Rivière-du-Sud, Qc.
- We were approached by an individual seeking information and advices about extending in some way the Reserve across the Canada-USA border towards the town of Pittsburg, NH. We are following the development of this project while it's being proposed to town officials and people of interest across the border.



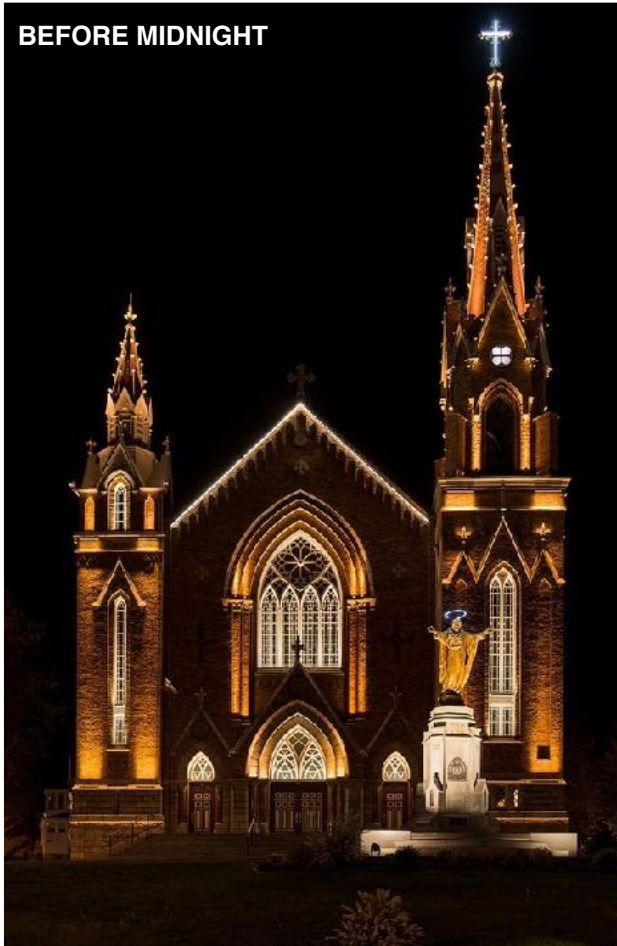


Regulation

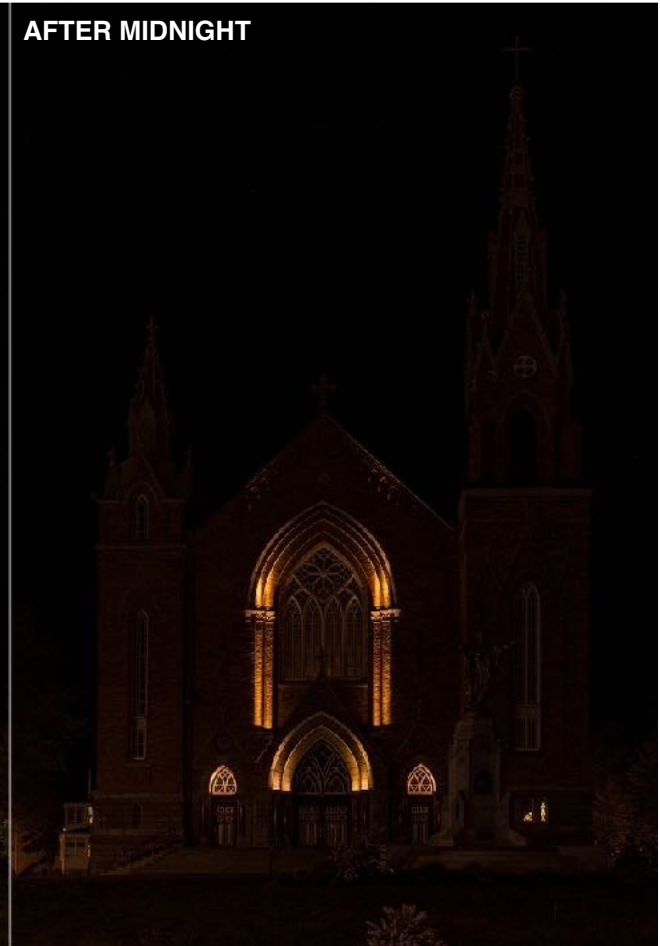
- A statewide light pollution Standard has been published by the Bureau de normalisation du Québec (Quebec Standards Bureau) for the Province of Quebec. This new Standard states good practices of exterior lighting, can serve as a basis for new regulations and gives a direction for the lighting industry to follow.
 - The MMIDSR and Mont-Mégantic National Park were both members of the committee. Other members included representatives of IDA-Québec, Hydro-Québec, the city of Montreal, Québec's ministry of transports, Québec's ministry of energy and natural resources, manufacturers, lighting experts and light pollution expert from the CEGEP de Sherbrooke.
 - Similarly to our regulations in the MMIDSR and the eco-lighting program we produce in the last years, the Standard address light pollution by controlling 4 aspects of lighting : Timing, Orientation, Color and Intensity of light.
 - Best practice for color temperature have been set to 2200K or less for most applications, except where color rendering is important (gaz pump, sport terrain) where 3000K or 4000K may be permitted.
 - When more latitude was given for some parameters like color or intensity, more restriction where put on other parameters like orientation of timing or vice-versa.
- The regulation in the Granit County, which dates back to 2005, is currently being updated. The regulation is one of the three currently in force on the territory (covering mostly the eastern part of the Reserve). Following the update previously made on Sherbrooke's regulation, this update aims to :
 - Better control the color of light by using the color temperature and the % of blue-light content instead of using the names of technologies. This will prevent that the regulation become obsolete and difficult to apply to changing technologies (e.g. LED technology).
 - Simplify the tables used by having one summary table where an individual can easily read what parameters to look for and apply them to a specific lighting application.
 - Using the 4 aspects of lighting (Timing, Orientation, Color and Intensity) to continue our efforts to make good lighting practices easy to understand.
 - Provide a better control and guideline for architectural.
 - Adding a town to the reserve which is part of the Regional county municipality but not yet in the MMIDSR. This would bring the total protected area from 5300 to 5500 km².

- The lighting fixtures survey project in the Granit County is continuing. Municipal assessors are now required to include lighting fixtures in the properties database. This is to help with regulatory enforcement in regard to vested rights and to know if forbidden fixtures have been installed before or after regulation implementation.
- With the recent announcement by the American Medical Association about the blue-light effects on health and the new provincial light pollution Standard by the BNQ, the cities of Montreal, Québec and Trois-Rivière have decided to put city-wide conversion projects to white-LED on hold for now, seeking more information before taking more decisions.
- The collaboration for the Lac-Mégantic church's architectural lighting project has been completed and the results are great! Warmer colors, individual dimming of sources, precise orientation and turning off most of the lights after midnight all contributed to make this project a perfect exemple of how it's possible to do beautiful architectural lighting and also protect the nighttime environment.
 - The project received a Darc architectural award for Best Exterior Lighting
 - The Church's new lighting also received an award from IDA-Quebec

BEFORE MIDNIGHT



AFTER MIDNIGHT



- The projet that involve the collaboration with the cities of East-Angus and Westbury regarding the construction of a new rest area service center featuring a restaurant and a gas station has been completed. The average lighting levels were brought down significantly, from 40 lux to less than 20 lux for the parking area, and now lit with pc-amber LED instead of the 4000K initially planned. Many changes where made from the original plans with many lights removed, warmer colors sources used around the buildings, height and size reduction of the commercial signs, and great reduction of lighting levels for the gas pump area. The municipal inspectors from both cities have proven to be great allies for our cause.
- Continuation of the Granit Night sky Preservation Committee with officials from the neighbour County that joined the committee to extend it's actions.
- Some non-compliant fixtures are reported by individuals. A few simple modifications have been done to address some of those in Island Brook, Milan and Westbury and reduce light pollution at practically no cost. Others will be address very soon, especially those that are near the Mont-Mégantic. Notre-Dame-des-Bois will also offer some cutoff HPS fixtures that were replace by pc-amber LED to remove bad fixtures on it's territory.

Conversion

2016 has also been a good year for the conversion of luminaires in the MMIDSR. More pc-amber LED fixtures were installed to either replace old fixtures of as new lighting in developping areas.

- Sherbrooke has continued the gradual implementation of the 700 pc-amber LED fixtures bought in 2014 on its territory. Most of them are used to replace aging 100W to 250W cobrahead HPS fixtures with 60W or 90W PC-amber LED depending on the light levels necessary. Additionally bought fixtures of a different model were also installed on the extension of an important commercial boulevard, showing the continuous efforts of Sherbrooke, the largest city in the MMIDSR, to preserve the night's intergrity.
- Following the work done last year with the city of Lac-Mégantic and the engineering firm on the planification for the reconstruction of the downtown area, 54 pc-amber luminaires were installed on these streets (mostly new full-cutoff luminaires wiht low mounting height, but also a few retrofit). With the previous commercial area that was rapidly built after the 2013 tragedy already lit with pc-amber LED and HPS, Lac-Mégantic's new downtown is now a great example of good exterior lighting, especially with the new lights for the church.
- The small, but very close to the Mont-Mégantic, towns of Notre-Dame-des-Bois, Val-Racine and Scotstown have also continued to replace old HPS luminaires with new pc-amber LED ones that offer better uniformity, lower power consumption and very low blue-light content

(<1%). The modus operandi for these towns is now to replace older HPS fixtures with new pc-amber LED every time they need to send an electrician in the poles in order to reduce the maintenance cost in the long term.

- The lighting for the ASTROLab/national park parking was also updated with new fixtures. The previous LPS fixtures, which were certainly a great choice near an astronomy observatory, didn't offer good illumination of the parking. The light levels under the luminaires was over 100 lux, but less than 1 lux on the borders of the parking, creating strong contrasts and low visibility condition. Also, because of the proximity of the ASTROLab and the need for a very dark area for our observation sessions, the area where pedestrians and cars share the road needed a better lighting to avoid any accidents. In the parking area, the LPS fixtures were replaced with full-cutoff and far-throwing pc-amber LED fixtures to offer better illumination, better uniformity and globally lower levels of light. A dozen of bollards were also added to both provide better lighting but without creating glare. All of the new luminaires are equipped with dimmers to manually control the intensity depending on the season, tourist traffic or to accommodate for our different operating hours. For example, we can reduce the light levels to a minimum when there is snow on the ground, to produce less reflected light and because the ground is easier to see in these conditions, or we can leave them on maximum intensity during the perseids meteor shower when there is a lot of in-and-out traffic during most of the night.



- We continue to update our website with commercially available low-blue-light content LED fixtures to make them easier to find. Of interest this year, we met with a company from the USA (CW Energy Solutions) that have installed filtered LED fixtures in Hawaii and that will add in the next update. We also had meetings with large lighting companies interested in the market of low-blue-light content LED fixtures. If new models become available after engineering and testing, we will add them to our website in the future.



Monitoring

While it can still improve, monitoring of light pollution around Mont-Mégantic saw good progress this year. Better measurements and continuous efforts will give us a better knowledge of the evolution of the sky brightness inside the Reserve.

- The monitoring made by professor Martin Aubé, from the CEGEP de Sherbrooke, is still underway. The data is acquired with two instruments installed at the ASTROLab (a photometer and a spectrometer). These instruments have been taking nightly measurements and spectral data of light pollution at the base of Mont-Mégantic since 2011 and might offer interesting data for long-term trend.
- Because of the proximity of the instruments to the ASTROLab and its nighttime activity that might affect the measurements, plus the fact that the measurements of these instruments require extensive data analysis, we decided to install our own SQM-LE on the summit of Mont-Mégantic. While we had some measurements with a manual SQM in the past, changing weather conditions, small number of measurements and variation in data acquiring, can all affect the readings of a manual SQM. We now have more than five months of continuous data from the the SQM-LE at the Popular Observatory. The new data and graphs will allow us to more easily see trends, changing conditions and variables affecting the reading. For

example, we can easily see from the graphs the difference between a clear night compared to a cloudy night, the presence of the Moon or when the Milky Way is at zenith. We plan on using this data after 1 year of collecting them to identify light levels in the park, and how it's changing depending on the conditions. This data could also be use by international researchers and/or displayed live on our website.

- A study on the attraction of insects to different light spectrum was done this summer in the park. The research was made by Alexandre Chéné, a student of Johanne Roby at the CEGEP de Sherbrooke, and involved the comparison of 4000K LED, HPS and pc-amber LED fixtures with similar light levels and seeing how it could affect the number of insects trapped under the lights. Three different areas in the park, on three nights each, with three fixtures of each models were used during the summer months. Sadly, it was discovered very late in the process, after all the data was acquired, that the supposedly pc-amber LED provided by the manufacturer were in fact monochromatic amber LED. The data showed no significant difference in the numbers of trapped insects between the amber LED and HPS fixtures, but the 4000K white LED attracted twice as much insects. This data is available in the internship report of the student and might be published in a scientific paper in the future, but the CEGEP might do a followup next summer. Proper pc-amber LED fixtures and possibly 3000K LED or other types would be added for this second phase. Nonetheless, the results are already very interesting and show how white light from area/street fixtures attract significantly more insects than amber sources with similar light levels.



Management

Since the retirement in 2015 of Pierre Goulet, one of the main leaders and founders of the Mont-Mégantic's International Dark Sky Reserve, Sébastien Giguère and Rémi Boucher are now continuing the activities of the Reserve. Operation of the Reserve is carried out by the ASTROLab corporation, with support of the Mont-Mégantic National Park.

Early this year, Rémi Boucher and Guillaume Poulin both received the 2015 IDA Dark Sky Defender Award in appreciation of their efforts to preserve night skies by promoting quality outdoor nighttime lighting over Mont-Mégantic, Sherbrooke and other areas in Canada.

