AUGO II: a comprehensive subauroral zone observatory

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ABSTRACT

A new geophysical observatory dedicated to studying the aurora borealis will be built 25 km southwest of the town of Athabasca, Alberta, Canada. **It is anticipated to see first light in the fall of 2011 and be fully operational in the winter of 2012**. Based on the highly successful Athabasca University Geophysical Observatory (AUGO), opened in 2002 at Athabasca University's Athabasca campus in Athabasca, Alberta, AUGO II will have expanded observational capacity featuring up to six climate-controlled domed optical observation suites, on-site accommodation for up to nine researchers, and most importantly, dark skies free of light pollution from urban development. AUGO II will share the same advantages as its predecessor, one being its location in central Alberta, allowing routine study of the subauroral zone, auroral oval studies during active times, and very rarely of the polar cap. Like the original AUGO, AUGO II will be in close proximity to major highways, high-capacity network bandwidth, and be within two hour driving distance to the city of Edmonton and its international airport. Opportunities are open for space physics researchers to conduct auroral studies at this new, state-of-the-art research facility through the installation of remotely controlled instruments and/or campaigns. An innovative program of instrument development will accompany the new observatory's enhanced infrastructure with a focus on magnetics and H-beta meridian scanning photometry, and provide a training ground for the next generation of space physicists.

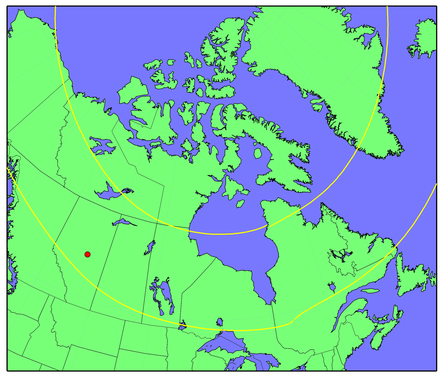
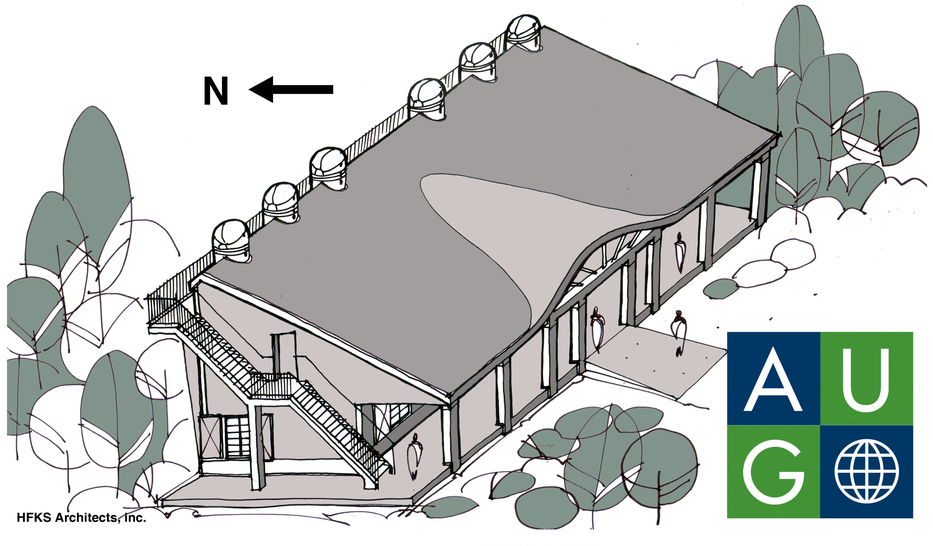


Figure 1: AUGO observatory sites, located in central Alberta, Canada. The original AUGO facility is located on Athabasca University campus in Athabasca, AB, while AUGO II is 25 km southwest of the town of Athabasca. Both facilities benefit from being located on the edge of the auroral oval (outlined in yellow), offering excellent views of auroral substorm activity.



ORIGINS

Opening in 2002, the original AUGO has achieved remarkable success as an auroral observatory drawing guest researchers from Canada, United States, Japan and Norway. Situated in central Alberta (figure 1), it benefits from dark skies due to low surrounding population density, while being conveniently located on the Athabasca University campus allowing access to electrical power, high-capacity network and roads. Light pollution from nearby town development has forced the decision to construct a new observatory further from town.

SITE

The AUGO II site is located in rural Athabasca County, approximately 25 km southwest of the town of Athabasca. **Geodetic coordinates: latitude 54 36' 10", longitude 113 38' 40" west. CGM coordinates: latitude 61.7, longitude 306.8, L-value 4.5**. The surrounding area is largely free of development. The observatory site is several kilometers from a major highway leading to Alberta's provincial capital, Edmonton, and the Edmonton International Airport 185 km to the south. Electrical power and maintained roads extend to the property (one of the major factors leading to the decision to select this site). CANARIE Infrastructure Extension Program is funding the construction and operation of a 50 mbit/s wireless network link between this site and the Athabasca University Campus.

FACILITY

The 4187 sq ft (389 m^2) facility will contain **six 82 square foot (7.66 m^2) observation suites** on the upper floor (figure 2), each equipped with a 1-m spectrally flat transparent acrylic dome, providing an unobstructed view of the night sky and the northern horizon. The domes are fabricated from GS2458 acrylic plastic that passes 90% of 380 to 780 nm wavelengths. It is well suited for multispectral auroral imaging, and in our case, the development of next generation H-beta meridian scanning photometers.

Each observation suite is divided into separate compartments separated by a light tight door. An outer room contains rack and bench space for computers and other electronic equipment, while the inner room contains the optical instrumentation, mounted underneath the 1-m acrylic dome. Both rooms are temperature controlled with forced air heating and air conditioning, maintaining ~10 degrees C in the winter and ~25 degrees C in the summer. Cooling has proven in the past to be the most difficult factor to control. Future plans may include installation of retractable blinds to be installed above each dome to shield the acrylic domes from solar radiation during daytime hours.

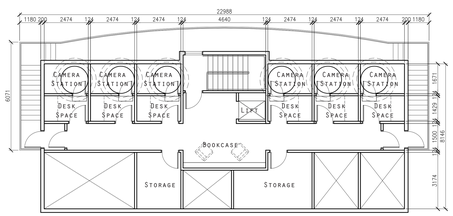


Figure 2: Second floor of observatory housing six 82 square foot climate controlled observation suites. Each suite is isolated from each other by light tight doors. Conduits allow easy passage of cabling between the upper observation rooms and the lower main floor.

The ground floor (figure 3) will have residential facilities for up to nine persons (six comfortably). The second floor is reachable by elevator (which will also serve as a freight elevator) as well as stairs. In addition to the large kitchen, the living room and office areas provide work and conferencing space. Wi-fi access is available throughout the facility.

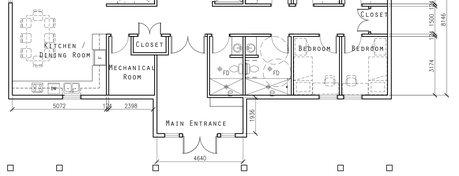


Figure 3: Floor plan of AUGO II ground floor. Up to nine persons (comfortably up to six) can be accommodated. A wheelchair accessible ramp leads up to the main entrance, while stairs and an elevator lead to the second floor.

RESEARCH

The current AUGO hosts a combination of radio, magnetic and optical instruments at the Athabasca University Campus. Nagoya University's Solar Terrestrial Environment Laboratory (STELAB) operates a multispectral (incl. H-beta) all-sky imager and meridian scanning photon spectrometer along with a 64 Hz induction magnetometer for proton precipitation and Pc1 band studies (Shiokawa 1999). University of Calgary (U of C) and University of California Berkeley operate a THEMIS Ground Based Observatory (GBO) all-sky imager (Mende 2008). U of C Department of Geomatics Engineering operate a GPS scintillation experiment (Skone 2008). Athabasca University (AU) with U of C operate a multispectral NORSTAR all sky imager (Donovan 2003). Recently, Tohoku University deployed a VLF/LF radio experiment for radiation belt studies. AU also operates a 1 Hz UCLA-built SMALL fluxgate magnetometer (Gao 2000) and has an ongoing testing program for low-cost school magnetometers. AU will deploy and test two new optical instruments: an Keo Sentry 3" (PI Acton ProEM 1024 EMCCD) all-sky imager and a Keo solid state H-beta meridian scanning photometer (MSP) equipped with a Hamamatsu multinode R7600U PMT (www.keoscientific.com).

On April 5, 2010, the THEMIS orbital footprint passed over central Alberta (Athabasca) during a notable auroral substorm resulting in a rare occurrence where simultaneous ground and space observations were made. The upcoming Radiation Belt Storm Probes mission (RBSP) is expected to spend considerable dwell time over central / northern Alberta, where AUGO II is based, presenting similar research opportunities.

We anticipate that our research partners will migrate their current optical instrumentation to the new observatory. With increased research space, there will be as many as four additional research suites available for hosting guest experiments. **We are looking for new research collaborations to fill these empty spaces**.

ACKNOWLEDGEMENTS

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REFERENCES

Donovan, E., et al., All-Sky Imaging within the Canadian CANOPUS and NORSTAR Projects, *Sodankyla Geophysical Observatory Publications*, **92**, 109-112, 2003.

Gao, Y.F. et al., Sino-Magnetic Array at Low Latitudes (SMALL) including initial results from the sister sites in the United States, *Advances in Space Research*, **25**(7/8), 1343-1351, 2000.

Mende, S.B., et al., The THEMIS Array of Ground-based Observatories for the Study of Auroral Substorms, *Space Science Reviews*, **141**(1-4), 357-387, 2008.

Shiokawa, K. et al., Development of Optical Mesosphere Thermosphere Imagers (OMTI), *Earth Planets Space*, **51**, 887-896, 1999.

Skone, S. et al., *Investigation of Scintillation Characteristics for High Latitude Phenomena, 21st International Technical Meeting of the Satellite Division of the Institute of Navigation (ION GNSS 2008)*, Savannah, GA, September 2008, 2425-2433, 2008.