

WORKING GROUP ON CONTROLLING LIGHT POLLUTION

*(GROUPE DE TRAVAIL POUR CONTROL DE LA CONTAMINATION
LUMINEUSE)*

PRESIDENT: Malcolm G. Smith

MEMBERS: Pierantonio Cinzano, David Crawford, Don Davis, Javier Diaz Castro, Isobe Syuzo, Richard Wainscoat, Margarita Metaxa, John Percy, Enrique Piraino, Nigel Pollard, Elizabeth Alvarez del Castillo

CONSULTANTS: Robert McLaren

1. Controlling Light Pollution

A full-day meeting on Controlling Light Pollution was held on Tuesday 22nd July 2003, bringing together roughly equal numbers of people from the international astronomical community and lighting engineers from Australia, Chile and the United States.

The opening talk by Bob Gent (International Dark Sky Association) set the theme. Mr. Gent discussed the progress, on an international scale, in protecting the night sky. The IDA works in a context that includes astronomy as only one of the many drivers towards protecting the natural night sky. Astronomers have other allies. Glare, light trespass and energy waste are the primary ingredients of poorly designed outdoor lighting. Mr. Gent provided detailed evidence that, as a result, significant movement towards quality lighting has started to occur. Ongoing studies indicate that there may be serious impacts on human health resulting from departing from nature's "bright days and dark nights". Recent biological and environmental conferences have also been exploring the adverse impact of light pollution on many forms of nocturnal wildlife.

The next talks covered ongoing work in parts of the world that are critical for astronomy, including two that are among the IAU's highest priorities: Hawaii and Northern Chile.

Sr. Pedro Sanhueza (National Office for the Protection of the Skies of Chile, OPCC) explained the work being carried out within the framework of Chile's recent environmental legislation, in particular the "Norma Luminica" that sets standards for external artificial illumination in the 2nd, 3rd and 4th Regions of northern Chile, the locations of existing and potential sites for the major international observatories in that country. The initial stages have involved extensive outreach to all levels of Chilean society, from the President of the Republic to large numbers of small school children, with special emphasis, of course, on advising, supporting and securing compliance with the "Norma Luminica" by the various municipalities and private companies (especially mines) near the major astronomical sites in Chile that the Government of Chile and the IAU wish to protect. Enforcement, as well as education, is an essential component for success, so the OPCC has been working closely with the Superintendent of Electricity and Fuel and his employees who are empowered to enforce compliance with the "Norma Luminica".

Dr. Richard Wainscoat (IfA, Hawaii, USA) described recent work that has been following on from one of the first lighting control ordinances. Although the early work in the 1980s has been highly successful in containing the spread of light pollution around

Mauna Kea, levels of pollution, though still very low indeed, are increasing. Mauna Kea itself is protected in large part by thick cloud that normally covers the most significant potential sources of artificial light, including the largest town, Hilo. Nevertheless, sources on the west side of the island are more readily visible and tighter control and enforcement are becoming necessary. The ordinance for the island of Hawaii does not apply to the rest of the state, so the glow of Honolulu is now (very faintly) visible from the summit of Mauna Kea. Haleakela, on Maui, is significantly more threatened at this stage by unregulated lighting on the island and on the mountainside itself. Steps are being taken to introduce a lighting-control ordinance for the island of Maui.

2. Educational Outreach

The second session focused on international networking in educational outreach as a way to secure long-range widespread understanding of the issues by subsequent generations.

Dr. John Percy (University of Toronto) illustrated how light pollution is an excellent subject for science education and outreach. It touches on science, technology, society and the environment, all key areas of interest in modern education. The study of light pollution develops students' skills and attitudes, as well as their understanding of the concepts and their applications. Light pollution also connects with other disciplines in the arts, humanities, and social sciences. It has aesthetic and emotional dimensions. It is relevant to informal education settings such as youth groups, camps, science centers and public observatories. It interests females as well as males, and it crosses cultural and geographic boundaries. In the context of the working group's plans for international educational networking, Dr. Percy shared his thoughts and plans as to how a set of activities and resources, carefully chosen and designed by a multi-disciplinary group of educators and scientists, could be used effectively around the world, especially if they were available in electronic as well as print form. Local educators and astronomers (both professional and amateur) could be trained in the use of these materials, as part of the international educational work of the IAU, IDA, UN and other organizations. Successful environmental action eventually relies on effective enforcement, but effective education and outreach is an essential, much earlier step along this road.

Dr. Connie Walker (NOAO, USA) outlined the work being done collaboratively in the USA and Chile by an NOAO team taking advantage of the videoconferencing capabilities already installed between the Northern and Southern parts of the organization. Dr. Walker mentioned the initial two, "proof-of-concept", teacher-professional-development videoconference workshops (in October 2002 and February 2003) linking teachers in Tucson, Arizona, and La Serena, Chile. The teachers exchanged methods and ideas about how to explain and demonstrate the nature of light and color to students of various ages. The workshops were conducted in Spanish with four bilingual science teachers from the Tucson area discussing pedagogical approaches with their teaching counterparts in Chile. The workshops included demonstrations, project presentations, and the construction and calibration of spectrometers. The Chilean teachers used these spectrometers to examine a number of light sources in their town and presented their findings at a third workshop in May. These three workshops have developed into cross-continent planning for larger light-pollution education efforts to be led by teachers. These efforts dovetail with previous light-pollution efforts in Austria (described at the La Serena conference on light pollution) and a network in Greece (including a UNESCO programme led by Dr. Margarita Metaxa). North and South-based programmes are designed to take advantage of successful efforts in the United States such as Project ASTRO, and efforts in Chile, like RedLaSer, by merging the strategies and techniques from each into a cross-cultural exchange. Dr. Walker examined the history of the collaboration and the synergy of the different approaches based on the Chilean and U.S. educational systems.

3. Posters

The poster session covered a range of topics spanning a wide selection of geographical locations. A report on efforts by a team in the UK included parliamentary testimony by the Astronomers Royal of England and Scotland, accompanied by input to long-range planning for the Mayor of London and citizen-led efforts to protect dark skies in rural England. An exterior-lighting inventory was presented for the first IDA "Dark-Sky City" - Flagstaff, Arizona. ESO's extensive experience in large projects was illustrated in a poster covering the strategic importance of communications in achieving successful results. Another poster covered in more detail the NOAO's initial videoconferencing experiments in international educational networking. Progress at the AURA Observatory in Chile in automated monitoring of light pollution of the skies over Cerro Tololo and Cerro Pachon - displaying the images in real time on the web near the period of new moon each month - was described. A key poster from Italy included a description of a new Laboratory of Photometry and Radiometry of Light Pollution which forms part of the new Light Pollution Science and Technology Institute (ISTL) in Padua. Its equipment provides portable capability for measurement and calibration of low light levels, as is required for on-site measurements. The laboratory provides photometric and radiometric calibration services in order to ensure that instruments are accurate and traceable to the National Institute of Standards and Technology (NIST). Its instruments have been used in various studies and collaborations. Two examples are "Global Monitoring of Light Pollution and Night-Sky Brightness from Satellite Measurements" supported by the Italian Space Agency and the project "Light Pollution and the Situation of the Night Sky at Astronomical Sites" carried out at the University of Padua. A final poster at the meeting demonstrated panoramic, city-wide imaging as a pragmatic tool for monitoring enforcement of light-pollution controls in Chile.

4. Outdoor Lighting

The meeting moved next to consider engineering and management aspects of outdoor lighting. A series of distinguished Australian lighting engineers led the morning session, providing the astronomers present with a good overview of efforts in Australia to control light pollution. Several of the Australian engineers, like some of the members of the Working Group, are prominent members of the Illumination Engineering Society of North America (IESNA) and of the International Lighting Commission (CIE).

Aspects covered included luminaire design for quality roadway lighting (a highly non-trivial subject), illumination quality standards (such as those drawn up jointly by the CIE and the IAU for areas near observatories), trends in lighting design and the degree of compatibility between the requirements of astronomers and the needs of the public for a safe night-time environment ("challenge and compromise"). A spectacular presentation of the illumination of Shanghai, China provided the most extreme example of astronomy-unfriendly, upwardly-directed, large-scale, city lighting that any Working Group member had ever seen; it made a strong impact on all of us to see this demonstration of the importance of cultural factors in addressing issues of what in the public mind constitutes quality lighting. Another presentation showed us that the Australian Constitution is such that it is for the New South Wales Government, rather than the Commonwealth Government in Canberra, to take the action required to protect the area around Siding Spring Observatory under the international agreement with the United Kingdom that covers the operation of the Anglo-Australian Telescope.

Sr. Enrique Piraino (Universidad Catolica de Valparaiso, Chile) described a quantitative design and verification approach for flood lights. Flood lights are widely used in Chile, particularly for sports lighting. Currently, large amounts of light are spilled

above the horizontal at these sports events; these lights are legal even in areas covered by the “Norma Luminica” .

Dr. David Crawford (IDA) discussed the controversial effort being carried out to develop a satisfactory model lighting ordinance based on quality lighting. Significant differences exist between the extreme positions of those who prefer near total darkness (including some IAU members) and those, including most members of the public who have not been introduced to these issues, who wish to satisfy their perception that as much light as possible is better for safety (without considering the subtleties of glare, reduction of visibility, cumulative energy wastage and other negative consequences associated with non-uniform lighting).

5. Sky Brightness

Opening the final session of the meeting, Dr. Syuzo Isobe provided us with an update on his detailed work with data from the US Defense Meteorological Satellite Program (DMSP). He confirms that Japan’s upward light-energy loss is of order US\$100M-200M per annum. (The IDA usually quotes a number well over US\$1,000M per year for the USA). Using data that he has been able to obtain from Japanese generating companies (who wish to remain anonymous), he found a linear relation between the upward light seen in each area and the energy generated by the companies for that area. The energy lost to space is about 0.1-0.2% of the total energy generated (for all purposes, not just for lighting). The linear relation has a positive intercept on the “upward light energy” axis at zero generated energy. Dr Isobe speculates on the effects of such additional sources as car headlights. A paper was presented on behalf of Dr. Pierantonio Cinzano (Light Pollution Science and Technology Institute, Italy; Dr. Cinzano was unable to travel to Australia), describing work carried out at the Institute over the past year. The top priority of the Working Group is to obtain a second version of the DMSP-based World Atlas of Artificial Night-Sky Brightness to compare with the first map; this will provide a pragmatic, world-wide map of the trends in light pollution and will illustrate results of the efforts in different countries to control the problem. Prof. McNally (U. of Hertfordshire, UK) discussed some of the significant issues related with the effects of the atmosphere on levels of light pollution which reduce the accuracy that can be assigned to results from monitoring programmes.

6. Summary

Dave Crawford summarized the meeting. He then noted that only ~20 (highly committed) IAU members attended most of the meeting; their numbers were matched by the lighting engineers - drawn mainly from a much smaller community. Dave appealed to the international astronomical community to get involved. He himself sets an outstanding example of such commitment - he is a retired professional astronomer, a member of this Working Group, as well as Executive Director of the IDA. He has become proficient in illumination engineering at professional level (he is a Fellow of the Illumination Engineering Society of North America). Above all he has been the initiator and leader of the modern effort to contain light pollution through advocacy and action to promote glare-free, waste-free, quality lighting in a way that can benefit everyone.

For abstracts and PowerPoint presentations, visit:

http://www.ctio.noao.edu/light_pollution/iau50/manchester.html

Malcolm Smith
Chairperson of the Working Group