Following the mercury spill last year, we purchased a Jerome 411 Gold Film Mercury Vapor Analyzer and proceeded to log readings of twelve locations in our Summit building. With a permissible exposure level of 0.05 mg/m^3 the readings ranged from a high of 0.099 mg/m^3 last October to an absolute zero in February this year. When we dismantle the Cassegrain environment during our July shutdown, we must look carefully for any minute drops of mercury which may be lurking away in some nook or cranny.

Last month I attended an employer workshop at the Consultation and Training Branch, Division of Occupational Safety and Health, located in Honolulu. The topics for discussion ranged from an overview of OSHA and DOSH activities, enforcement policies and procedures, DOSH consultative services, safety and health programs, hazard communication and introduction to DOSH standards. From what I learned at the workshop, I am presently working on a safety policy statement and would appreciate advice and input toward this objective from any member of our staff. The three main components of a good safety and health policy statement should be management's concern and interest, direction, and expectations.

Interesting to note that in the violation and penalties section of our workshop, we learned that OSHA has already increased its penalties seven-fold and DOSH will introduce the same increases in 1992. The Congressional Budget Office estimate the fines could net $180 million a year, up from $30 million in fiscal 1990.

Here in Hawaii, DOSH's Safety and Health Compliance Officers found six of every ten employers guilty of worksite hazards in fiscal year 1990. They conducted 2,704 inspections and uncovered 7,649 violations, 791 serious. Penalties assessed totalled $241,521 vs. the previous year's $164,510.

Back on the Mainland, laboratories such as Lawrence Livermore and Oak Ridge National are not amused by the latest crack down on violations of the federal regulatory code. A special inspection force called "Tiger Teams" have been set loose to stalk and destroy bad old habits and enforce a new ethic of strict compliance with federal rules on environmental purity, worker safety and public health. In Oak Ridge National Lab's case, there were 413 adverse findings which would require somewhere in the region of $1 billion to comply (i.e. the Lab's estimated costs spread over several years).

And finally, my emphasis in the next few months will be on *work site analysis:*

1. Identify existing and potential hazards;
2. Perform periodic inspections;
3. Provide a reliable system for employees to report hazards and to receive timely and appropriate responses;
4. Investigate accidents and "close-calls" to determine causes and corrective actions. Use the "3 W approach:"
   - What happened
   - What caused it to happen
   - What can be done to prevent recurrence
5. Analyze injury and illness trends, so patterns and common causes can be identified and eliminated.

Good Health & Safety

Peter Sydserff

Image Quality and High-Resolution Imaging at CFHT

CFHT is one of the telescopes that provides the best image quality obtainable from the ground. Figure 1 (cover) shows statistics of image quality for the second semester 1990 and the first semester 1991. Histograms of the full-width-at-half-maximum (FWHM) of stellar profiles measured on images obtained during HR Cam and FOCAM runs are presented. Median values of FWHM are given for each run. The FWHM was measured on all the images containing at least one suitable unresolved object, whatever the airmass, the time of the night, the external seeing conditions, etc..., i.e., there is no data selection. The images are long exposures, with integration times of 100 to 1800 seconds. All the HR Cam images were obtained at full telescope pupil.

The median seeing is 0.79" with FOCAM, and ranges from 0.56 to 0.66" with HR Cam, an image stabilization device which, at times, provides images with a FWHM as low as 0.4". The gain in image quality obtained with HR Cam thus roughly amounts to 0.2". Part of it, typically 0.05", comes from the larger F/ratio used with this instrument (F/7.8 versus F/4.3 for FOCAM), which provides a better sampling of the stellar profiles on the detector; the rest (typically, 0.15") results from image stabilization. Note the steep gradient in the histograms at 0.4" for HR Cam (0.55" for FOCAM). The lack of lower FWHM values may reflect the current limit set by telescope optics on "passive" image quality.

Optical tests and studies of the properties of turbulence above the site have led to the following estimates: the telescope optics contributes some 0.35" to image degradation (primary mirror surface defects), while the dome and mirror seeing enter for typically 0.4", and the free atmosphere contribution varies between 0.25 and 0.50".

Closely linked to the development of an adaptive optics (AO) system, the reduction of local sources of image degradation has been defined as a primary goal at CFHT. This decision was motivated by the fact that an AO system will yield the best results when the seeing "starting value" is the lowest. The two major sources of local image degradation are mirror and dome seeing, the latter being much less significant (typically 0.40" and 0.1", respectively, see R. Racine's previous contribution).

In an attempt to reduce local "seeing," a cooling experiment has been carried out during the last HR Cam run, from April 11 to 23, 1991. The experiment essentially consisted in activating the air cooling units on the mezzanine level in the dome during day-time, so that, from 7am to 5pm, the air in the dome was actively cooled. The volume of air throughout the dome was simultaneously mixed by actionning the fans. The aim of the experiment was to prevent the primary mirror to heat-up during day-time, so that its temperature hopefully remains lower than that of the ambient air at night, thus preventing mirror seeing.

The results of this experiment are illustrated in Figure 12. Figure 12a shows the vertical thermal structure in the dome at 2pm, 8pm, 12am, and 4am, averaged over the period when the day-time air cooling was activated (13 days). This figure is to be compared with Fig. 12b which shows the vertical thermal structure in the dome at 2pm, 8pm, 12am, and 4am, averaged over the period when the day-time air cooling was not activated (fiducial period, 12 days). The 1σ temperature variations around the mean values plotted in Figure 12a and 12b are typically 0.5°C for the air inside the dome.

During the fiducial period (no cooling), the temperature of the air in the dome is homogeneous and closely follows the variations of the outside air temperature. Then, because of its large thermal inertia, the mirror is cooler than the ambient air during day-time but warmer at night, which induces mirror seeing. The mirror and ambient air temperatures are similar only at the very beginning of the night, which accounts for the often-heard report that image quality at CFHT is usually the best just after sunset.

Activation of the cooling units drastically changes this picture. During day-time, a strong temperature gradient develops at the top of the dome (see the 2 pm curve in Figure 12a). However, this gradient does not affect the lower air layers whose temperature remains a few degrees below that of the outside air. As a result, the mirror does not heat-up in the day-time (it actually cools down during part of the day) and its temperature remains the same or less than that of the ambient air during the whole night. The global warming of the air in the dome observed at 8 pm is due to the fact that the cooling is stopped at 5 pm and the dome slit opened, so that the warmer outside air blows in.

The experiment was thus quite successful in preventing mirror seeing. Indeed, 3 of the best images ever obtained with HR Cam (FWHM ≤0.4") were recorded during this period. This experiment will be pursued during the next imaging runs, so that, by increasing the image quality database, subtle effects of mirror seeing on image quality can be studied for small temperature difference between the mirror and the ambient air (DT≤0.5°C).

J. Bouvier

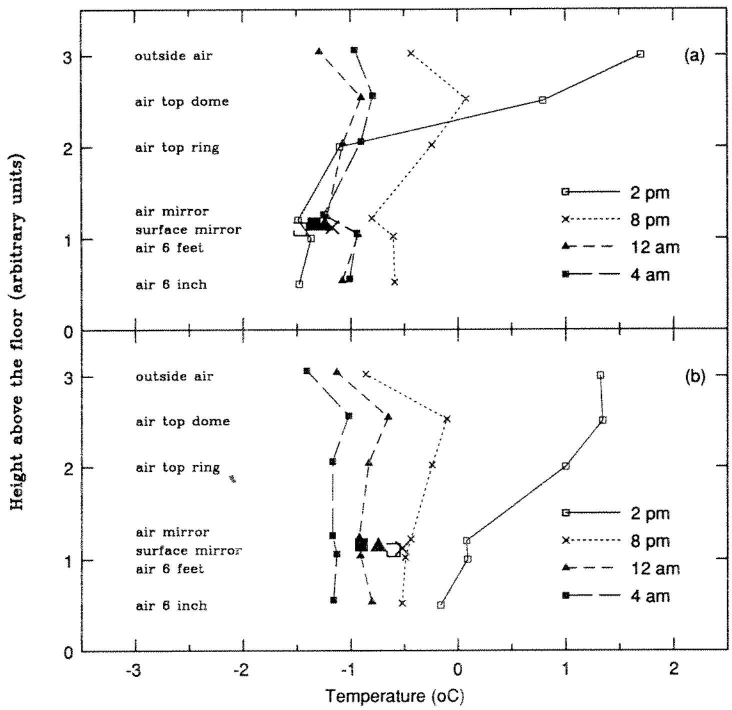

Figure 12: Vertical thermal structure in the dome during the cooling (a) and the non-cooling (b) periods. Temperature averages are shown at various height above the floor at 2pm, 8pm, 12am, and 4am. Typical 1σ temperature variations around the mean values are 0.5°C for the air inside the dome. Larger symbols show the surface temperature of the primary mirror. Note that during the non-cooling period, the mirror is warmer than the ambient air during most of the night, while during the cooling experiment, the mirror was most often cooler than the nearby air at night.