Cassegrain Bonnette Control System Upgrade Project

After nearly twelve years of service, the control system that governs the moving components in the cassegrain bonnette (CB) is getting a well-deserved upgrade. Although the performance of the system from a scientific point of view has been quite good, operationally the CB control electronics has been difficult to maintain due to its layout, construction methods employed and the poor state of the bi-lingual documentation. These limitations have lead to lost observing time. The good news is that with the incredible advancements made in the electronics field over the past decade, there are many highly integrated and well-documented control systems commercially available that could alleviate the operational problems of the current control system. Based on our positive experiences with the servo control modules from Galil Motion Control Inc. on the Coude F/4 spectrograph, the new F/35 upper end and the new F/8 upper end, we have selected a highly integrated version of Galil's servo control system for the cassegrain bonnette.

The new system will condense the control electronics that is presently distributed between the cassegrain environment and the fourth floor back observing room through the CAMAC data acquisition system, into one enclosure mounted along side the bonnette. The new control system will continue to employ linear servo amplifiers (for X, Y and Z axes) mounted off the telescope to minimize radiated electronic noise and power dissipation near the light path. This upgrade will significantly reduce the amount of cables and electrical connectors, thus increasing system reliability and maintainability. This new control system will be a slave device to the TCS computer, through it's main RS-422 serial communications link. Communications from data acquisition computers to the bonnette will continue to be passed through TCS to keep the controller slaved to only one master.

A diagnostics interface console, that accesses the CB controller through an auxiliary serial port will be available for use during bonnette setups and troubleshooting, without going through the TCS computer. Appropriate communications interlocks between the TCS and diagnostics interfaces will be in place to insure the controller remains as a single user system.

No significant changes in the cassegrain bonnette functional specifications are planned for this system upgrade. The guide mirror positioning accuracy (for both X and Y axes) will remain at ± 4 microns over its 400 millimeters of X and Y possible motion. The constant velocity creep mode (for X and Y axes) for non-sidereal tracking of objects will remain at a range of 0.0002 mm/sec through 0.48 mm/sec. Guide camera focus (Z axis) will retain an accuracy of ± 4 microns. Full functionality of the guide camera color and attenuator filter wheels, and the CB central mirror will remain intact. The present electro-mechanical based security logic that prevents possible collisions between the guide probe mirror and the central mirror will be retained, although it will be upgraded with current programmable logic technology.

The design of this new control system is presently well underway, with the project's critical design review planned for mid-June 1993. Implementation and testing of this system will be conducted from early June through October. System installation on the telescope will begin on 2 December 1993, and be completed by 7 January 1994, over which time no cassegrain focus observing has been scheduled. With the exception of contracting out the fabrication of a few printed circuit boards, the entire design and implementation is being conducted by the CFHT technical staff.

S. McArthur

Telescope Oil Spill

Last December, as the CFHT Board, just happened to be taking their annual stroll through our summit building, we were subjected to the ultimate embarrassment of the year. A Board Member casually mentioned that there appeared to be a pool of oil at the base of #7 coudé turret in the 3rd floor inner coudé!

At first, we thought this must be a leak from the small hydraulic hoist used in setting up the F/4 coudé train but alas - our worst fears were confirmed when we traced the source, all the way up to the south pier of the telescope bearing support!

Our telescope right ascension travel, moves very smoothly on a film of hydraulic oil 0.004" thick, introduced onto the bearing surfaces via seven hydrostatic oil pads, i.e., four journal types on the large horseshoe and two journal and one thrust type at the south pier. All seven bronze pads are mounted on pivots such that they are always self aligned to the surface they are supporting. The high pressure oil, 600 psi, is introduced through an aperture in the center of the pad and in theory the oil should return via a moat type groove near the edge of each pad.

In practice, a fair amount of oil gets past those grooves and especially in the case of the horseshoe with its large surface area, quite a bit of oil is left on the bearing surface and eventually runs into a large catchment tray below the horseshoe.

At one stage, the oil from this tray was allowed to flow directly into the gravity feed/return line to the reservoir tank in the first floor area. Since this fairly large volume of oil ran over most of the south side of the horseshoe, plus various parts underneath, before going to the collecting tray, the practice has been to empty the tray frequently, run the oil through a filtering process and pump it back into the reservoir.

However, in the case of the south pier, being so much smaller in surface area, the excess oil from the three hydrostatic pads, was allowed to feed directly into the gravity feed return line and be filtered with the remainder of the oil returning from the hydrostatic oil pads. Prior to entering the reservoir, all this oil has to pass through four, 10 micron filters. Conclusion from December '92 oil spill:

The accumulation of foreign material (paint flakes, dirt, water) plus filters overdue for replacement resulted in the 10 μ filters being clogged. Oil built up in the return line to the fifth floor level and then 'cascaded' down the coudé stove pipe to the third floor level.

The clean up at third floor involved the assembly of a safe platform above the M7 coudé turret to enable optics crew and daycrew to disassemble the coudé stove pipe and all optics below, before any optical clean up was attempted. So, after all that was completed and back in place, #2 oil spill reared its ugly head! (late February). Three sources of oil were revealed from this leak.

- Oil was still migrating from the 5th floor level down the outside of the "stove pipe"!
- The space around the "stove pipe" between 3rd floor ceiling and 4th floor, had been stuffed with cloth, and of course, over the years, this cloth was now oil saturated and continuing to drip.
- Also, a short piece of tube, at 5th floor level, had not been in place, hence, oil spray from the telescope bearing area found its way right down the vertical tube, right onto the optics at 3rd floor level! Once again, big clean up!

Meanwhile, all the necessary arrangements were being made, to dispose of (correctly), all the contaminated waste materials resulting from the clean up. In essence, we are looking at $5K for the disposal of eight 55 gallon drums of waste material, plus a lingering ninth drum of $2K.

After yet another clean up, along came #3 oil spill! (Early March '93) So now, with nice new 10 micron filters in the line, coudé train all cleaned up, we had -10°C temperatures, with the net result, whatever moisture was mixed into the hydraulic oil from previous wet, soggy, dome conditions, once again the 10 micron filters were unable to handle the sluggish oil; result, oil once again on the third floor optics.

#3 (Final ?) Clean Up Procedure & Conclusions

- A seal/catchment tray was designed and fitted to the outside of the stove pipe at 4th floor crawl space level to prevent oil spillage getting any lower 4th floor level.
- Return oil from the south pier surface area is now piped down to the 1st floor level, held in a 44 gallon drum, filtered, and then pumped back into the telescope hydraulic oil reservoir on a daily basis.

P. Sydserff

Detector Developments

Through a collaboration with UH/IfA, we are offering a second 2048x2048 15 μm CCD to offset the demand on the Lick2 CCD. This new chip, known as Loral3, is a thick, front illuminated device with a blue sensitivity enhancement coating (Lumogen). Cosmetically, this chip is quite clean with performance very similar to the Lick2 CCD. We recommend this device in place of the SAIC1 1024x1024 CCD on HRCam projects and offer it with a 1200x1200 subarray that includes overscan in the row direction.

After a long and treacherous development path, we are now in the testing phase with a thinned 2048x2048 15μm pixel CCD, Loral4. As this chip requires UV flooding to stabilize QE, we will study the technique and results to ensure that when it is released it produces repeatable results. We hope to complete lab testing and release the Loral4 CCD during the summer. In parallel with on the development of the Loral4 CCD, we will continue progressing on the development of another camera built around a thinned Tektronix 1024x1024 24 μm CCD, Tek3. Both of these cameras will be operated with the new Generation III controller.

The baseline form of the Generation III controller has now been in use for several months and is working well. We have released it for operation of the Loral3 CCD as well as the Redeye IR cameras. Current efforts in this development are centered around improvements in the focusing software, system overhead optimization, expanding the use of multiple amplifier readouts (Redeye uses 4 amplifiers), developing lower noise techniques such as "skipper" readouts, and implementation of more utility card functions. Currently two Generation III controllers have been released at the telescope, one is stationed in the Waimea lab for detector development, and one is on loan to the MOCAM development team. Installation of a telescope-wide fiber optic cable network for use with the controller is underway to replace the temporary fibers now at all foci.

The CCD cameras now offered and those under development include those shown below.

C. Clark, S. Smith

Name	Format	Pixel	Noise	Controller	Comments
Loral3	2048x2048	15 μm	~7 thick	new	Lumogen coating for glue response
Lick2	2048x2048	15 μm	~7 thick	old	backup to Loral3
SAIC1	1024x1024	18 μm	~8 thick	old	backup to Loral3 on HRCam
PHX1	512x512	20 μm	~7 thick	old	Metachrome coating for blue response
RCA2	640x1024	15 μm	~50 thin	old	highest QE CCD
RCA4	640x1024	15 μm	~60 thin	old	flatter than RCA2, slightly lower QE
Loral4	2048x2048	15 μm	<10 thin	new	possible summer release
Tk3	1024x1024	24 μm	<10 thin	new	possible summer release

The New f/8 Focussing Mechanism Installation

The installation of the new f/8 focus mechanism has been completed and put into operation as of the 10th of May as scheduled. Removal of the old focus mechanism, component installation, cabling, testing, and the addition of balance weights to the top end ring were completed during an eight week period concurrently with the aluminizing of the f/8 mirror. Balance weights were added to the top end ring to compensate for the 1700 kg reduction of the new focus mechanism.

Once on the telescope, initial alignment checks indicated the focus mechanism had been fixtured into position within 1 mm of the desired translated and collimated location. Mirror cell translation capabilities were incorporated into the focus mechanism enabling final translation to within 0.1 mm of center. Collimation was accomplished by machining spacers which position the height of fixed pads located in the mirror cell. Using this procedure angular alignment was adjusted to within 5 arcsec at zenith.

Two nights were scheduled and used for tuning and testing the focus mechanism with excellent results. All design specifi-