AiC Report to NOT STC
33^{rd} meeting 2001.03.18.

Edited version for public release.

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La Palma

March 21, 2001

Contents

1 Staffing

1.1 Current Staff

Name		Job
Tim Abbott	I	astronomer-in-charge
Paco Armas	L	administration
Peter Brandt	L	mech. workshop
Jacob Clasen	I	software eng.
Graham Cox	I	electronics eng.
Loida Fernandez	L	administration
Amanda Kaas	I	support astronomer
Roy Ostensen	I	software specialist
Carlos Perez	L	electronics tech.
Ingvar Svaerdh	I	software eng. TCS
Thomas Dall	I	student
(Ana Garcia Perez		student

key: I = international staff, L = local staff.
Note: Ana Garcia Perez is based in Sweden.

1.2 Staff Movements

- Tim Abbott took over as AiC, effective 1 Oct. 2000, having acted as AiC from July 2000.
- Claudio Moreno resigned his contract and departed NOT & La Palma end of December 2000.
- NOT Council has approved the hiring of a Support Astronomer in addition to the previous levels. A successful job search has ended in the acceptance of offers by John Telting (ING, to arrive 1 June 2001) and Tapio Pursimo (Tuorla, to arrive 1 Sept 2001).
- A search for a new system manager & software specialist has closed and candidate selection is under way.
- Rami Rekola will return to the NOT from 1 October to 31st Dec 2001 for an additional period as a student support astronomer.
- Swedish undergraduate students Bjarne Andersson and Anders Magnusson will visit NOT for a 2 month period (from mid March) to work on the fast serial link for CCD controllers and the mirror vibration damping system.
- Roy Østensen joined NOT at the beginning of February for a 1 year term as software specialist.
- Thomas Dall's term as NOT student ends at the end of March.

2 Down Time

Tables 1 & 2 on the following pages distill all downtime recorded in end-of-night and end-of-run reports for the period 2000-09-18 to 2001-03-01.

- Technical failures on scheduled observing nights: 32 hr ($\sim$ 2%, assuming an average $\sim$ 11 hr night)
- Technical failures on tech nights: 4 hr
- Technical failures with visitor instruments: 6 hr

The major failures are associated with repeated building crashes arising from three possible independent sources:

1. misalignment of the main hydrostatic bearing causing excessive friction and
2. possible electronic noise in the building/telescope servo loop supplying incorrect data to the TCS.
3. possible problems with the safety system.

Table 1. End-of-Night Fault Reports, 2000-09-18 to 2001-03-01

System	Severity	Date	Hrs Lost	Observers	Details
Telescope	1	2001-02-26	0	Dahle	Building crash due to possible safety system error.
ALFOSC	1	2001-02-19	< 1	Feltzing & Lundstrom	FITS file header write failure.
Telescope	2	2001-02-14	< 1	Holman, Aksnes & Grav	3 Building crashes due to main bearing misalignment.
Telescope	3	2001-02-13	4	Vega	Multiple building crashes due to main bearing misalignment. (Most of night lost to weather.)
FIES	1	2001-02-12	(2)	Frandsen, Lindberg & Dall	Tech time “lost” to instrument development work.
Telescope	2	2001-02-12	2	Frandsen, Lindberg & Dall	Building crashes due to bearing misalignment.
FIES	1	2001-02-11	0	Frandsen, Lindberg & Dall	Tech time lost to instrument development work.
Telescope	1	2001-02-10	0	Abbott & Østensen	2 Building crashes.
ALFOSC	1	2001-02-07	0	Dall	BIAS crash, fixed with restart.
ALFOSC	1	2001-02-06	< 1	Cox	Grism wheel timeouts.
Telescope	1	2001-02-06	0	Cox	Autoguider jumps.
ALFOSC	1	2001-02-02	< 1	Perez-Fournon	Operator error (observer thought that flat-topped calibration lines were indicating a problem).
ALFOSC	1	2001-01-13	< 1	Kaas & Cox	BIAS initialization failures, grism wheel timeouts, variable bias level.
Telescope	2	2001-01-01	5	Rodriguez Gil	Broken safety system relay.
ALFOSC	1	2000-12-30	0	Takalo & Pasanen	Variable bias level.
Telescope	2	2000-12-28	7	Takalo & Pasanen	Multiple building crashes.
Telescope	2	2000-12-27	7	Takalo & Pasanen	Multiple building crashes
Telescope	1	2000-12-17	< 1	Kochukhov	Guide star server timeouts.
Telescope	1	2000-12-17	0	Ilyin, Kochukov & Duemmler	Guide star server timeouts.
Telescope	1	2000-12-09	< 1	Dupree & Ilyin	Operator error (misunderstood TCS catalog format).
Telescope	1	2000-12-04	< 1	Schultz & Shahbaz	Operator difficulty (couldn’t focus with calcite plates in).
ALFOSC	1	2000-11-24	< 1	Nigoche & Usero	Filter wheel timeouts.
ALFOSC	1	2000-11-19	0	Abbott	Grism wheel timeouts.
ALFOSC	1	2000-11-18	0	Abbott	Grism wheel timeouts.
SOFIN	1	2000-11-05	4	Montes & Ilyin	Camera 3 CCD failure.
ALFOSC	2	2000-10-15	2	Dall	Instrument setup error - wrong (Østensen) controller card
Turpol	1	2000-10-14	0	Berdyugin & Villar-Sbaffi	Polarimeter chopper moved.

Fault Severity: 1 = minor, 2 = severe, 3 = night lost

Table 2. End-of-Run Fault Reports, 2000-09-18 to 2001-03-01

System	Severity	Date	Hrs Lost	Observers	Details
Telescope	1	2001-02-24	0	Dahle	Single building crash due to noise in servo-loop.
ALFOSC	1	2001-02-19	10%	Feltzing & Lundstrum	FITS file header write failure.
Telescope	1	2001-02-14	10%	Aksnes, Grav & Holman	Observations interrupted by emergency bearing alignment work.
Telescope	2	2001-02-11	10%	Frandsen & Dall	Building crashes during FIES tech time due to main bearing misalignment.
FIES	1	2001-02-11	10%	Frandsen, Lindberg & Dall	No details available.
ALFOSC	1	2001-02-07	0	Dall	BIAS crash, fixed with restart.
ALFOSC	1	2001-01-03	0	Johansson, Kun & Nikolic	Fault report made in error.
Telescope	2	2001-01-01	20%	Rodriguez-Gil	Broken safety system relay.
Telescope	2	2000-12-27	20%	Takalo & Pasanen	Multiple building crashes.
ALFOSC	1	2000-12-04	0	Schultz & Shahbaz	Fault report made in error.
Telescope	1	2000-11-24	10%	Nigoche & Usero	No details in EOR
ALFOSC	1	2000-11-15	0	Abbott	Multiple grism wheel timeouts.
ALFOSC	1	2000-10-15	10%	Dall	Instrument setup error - wrong (Østensen) controller card
Turpol	1	2000-10-08	0	Berdyugin & Villar-Sbaffi	Multiple Turpol control program crashes.

Fault Severity: 1 = minor, 2 = severe, 3 = night lost

3 Telescope

3.1 Pointing

Telescope pointing is now at 8.42" rms. New automatic pointing model data collection routine installed.

3.2 Mirror cleaning

Combined M1, M2 reflectivity was measured at 60% in January 2001 down from 66% in May 2000. Given the demands on technical time to be made by commissioning of NOTCam and MOSCA, it was decided not to realuminize M1 this summer, but we will explore the possibility of realuminizing M2 as time allows. The reflectivity testing scheme is under suspicion as indications of an uneven decay of M2 reflectivity have not been borne out by strongly defocussed stellar images which appear quite uniform. (PB)[1]

3.3 Mirror Damping

Experiments using both the experimental adaptive optics system JOSE, and raw data from the telescope load cells indicate the presence of a vibration mode in the telescope system of around 12 Hz (probably generated by the active optics system). A DSP-based digital filter system will be implemented in the previously abandoned load-cell/voice-coil mirror damping loop which will have a natural frequency in this area. The visiting Swedish electronics student Anders Magnusson will assist in this project. (GC)

See Appendix A for details.

3.4 TCS II

Some progress has been made with the TCS upgrade project. Hardware I/O tests are complete and coding has begun. Delays due to normal TCS work now imply a project completion date of July 2003. (IS)

3.5 TMS

Project on hold due to lack of manpower.

3.6 Building crashes

The bursts of building crashes experienced in December 2000 and February 2001 have been cause for concern. Their definitive cause is still not known, but a number of possible causes have been addressed already.

The December instances appeared to have been associated with noise in the building/telescope position sensors, as a small modification to the electrical grounding of these devices seemed to have a positive effect. One curious characteristic of these crashes was that the building and telescope remained in alignment throughout.

The February crashes occurred after the (~200kg) thermal insulation jacket was installed on FIES, and were more normal in that building and telescope were found to be out of alignment after each crash. Investigations showed that the hydrostatic bearing pads were out of alignment, one seriously so. This was probably at least contributory as the azimuth currents during slews were found to be anomalously high indicating excessive friction. Discussions with Torben Andersen and Niels Christian-Jessen helped us with diagnosis and brought to light the original alignment jigs. Two of the three the bearings were then realigned (the third is not perfect, but within spec) and appear to be stable. Azimuth currents are now more normal.

[1] When one or two specific personal have made majority contributions, they are identified by their initials at the end of the paragraphs concerned. In most cases, all staff were involved to some extent.

Occasional unexplained building crashes (without telescope/building misalignment) suggest that all is still not well and investigations continue. The latest theory is that they are not building crashes at all, but arise from anomolous responses from the safety system, causing immediate power downs that appear like building crashes. As it is, the crashes all seem to take place without the building and telescope losing alignment as they would in the case of a true crash.

FIES, as a possible cause, was removed from its mount during this work and remains off until we can be sure we have solved the problem and may therefore monitor its effects more confidently. Expert advice has been sought on the ability of the hydrostatic bearing to carry its additional load and appears optimistic at the time of writing.

4 Instruments

4.1 ALFOSC

4.1.1 Grism wheel timeouts

ALFOSC has performed well with the exception of the occasional timeout from the grism wheel. Normally this is easily solved by stopping the user interface and initializing on restart, occasionally the telescope must be brought to zenith first. The final cause of these timeouts is not clear due to their sparsely intermittent nature, but is believed to be linked to unevenly distributed weight when only partially populated, and appears to depend on telescope altitude. Close inspection has yielded no anomalies.

4.1.2 Mounting

CUO/IJAF noted that the ALFOSC flange did not fit snugly to FASU due to the absence of a mounting bolt at the detector end of the instrument. The resulting lever arm made it impossible to completely close the gap between the flange and FASU. This has been a known problem at the telescope for some time and was not believed to be a significant issue. However, CUO/IJAF were concerned that the FASU flange would be permanently bent so a fitting was produced to allow the inclusion of a mounting bolt near the detector. The flange and FASU are now flush when the instrument is properly mounted and no permanent damage can be discerned (CP, PB).

4.1.3 Cleaning

During January technical time ALFOSC was thoroughly cleaned and inspected. A considerable amount of dust was removed from the interior and most particularly from the upper surface of the folding prism. The resulting flat field shows considerable improvement – where there were as many as one hundred dust donuts, immediately after the cleaning there were less than 10. Complete removal of dust was not possible without dismounting the CCD, which was not considered necessary.

4.1.4 MOS Mode

In collaboration with Per Kjaergaard (CUO), the MOS mode is now nearing the condition at which it may be made available to the community. We expect to announce this in the call for proposals made in April and support runs in the semester beginning October 2001. Remaining work is primarily in the area of documentation. Runs will require significantly more support than usual, and we recommend a restrained response to demand in the first instance. (JC)

4.1.5 Zero-Point Monitoring Programme

Data has been collected over several months and is being reduced by Andreas Jaunsen (ESO) as part of the gravitational lens monitoring programme led by Jen Hjorth (CUO). Some results are already posted on the NOT web pages. (AK)

4.2 TurPol

New ND filters installed and calibrated (VP). New document set available on web (AK). Data reduction programmes now available on web page (AK). The “circular polarimetry only” mode has been tested and reduction software written by A. Berdyugin is available.

4.3 HiRAC

There is no change in the disposition of HiRAC – observers are being requested to use ALFOSC where possible and so far this has always been the case. No attempt has been made to rectify the soaking problem due to lack of manpower and the anticipated imminent arrival of MOSCA which will make HiRAC redundant.

4.4 StanCam

StanCam continues to operate without problems.

4.5 FIES

A new fibre-viewing mirror and mount have been installed in the telescope instrument adapter, including new StanCam reimaging optics to aid target acquisition. A new fibre mounting plate has been installed. Target acquisition procedures have been established and test observations made under real observing conditions.

Now FIES is ready for final commissioning: All hardware is installed. Target acquisition procedures have been described and tested, and can be easily carried out by the observer.

FIES still needs a new CCD, as the test-chip proved to have very high dark current. The mounting of a new CCD will not interfere with normal telescope operation. On the software side a smoother interface to BIAS would be desirable but not critical. Also the instrument needs to be put back on the telescope pier. Apart from this, FIES is ready for use. (TD & FIES team)

4.6 SOFIN

One SOFIN CCD suffered mechanical destruction and both have been replaced with a similar devices donated by Isaac Newton Group. (GC)

4.7 NOTCam

The mechanically destroyed engineering grade device has been replaced. Before it is installed, the CUO/IJAF group are investigating detector mount redesigns so as to avoid repeating the circumstances which destroyed the first. A delivery date to La Palma is unknown at this time.

4.8 MOSCA

Five (U’, B, V, R and SDSS z’) of the interim filter set have been received and test data collected in parallel with the ALFOSC zero point monitoring programme.

4.9 FRed

See Director’s report.

4.10 CCD Acquisition

In line with the working group’s recommended priorities, we have given priority to obtaining state-of-the-art detectors first for MOSCA and next for ALFOSC. The best candidates for MOSCA are currently Marconi (ex-EEV) devices with integrated anti-fringing technology, but the possibility of a good device (4k$\times$4k monolithic) and price from Fairchild prevent us from committing to Marconi. Fairchild could also provide a replacement detector for ALFOSC.

All investigations of best-effort, wafer-run purchases have been postponed in the apparent absence of a suitable path of manufacture, packaging and test. Moreover, we are not aware of any suitable partners available to share the expense and risk at this time.

4.11 High speed CCD controller serial link

See detailed status report from GC in Appendix B.

Progress is being made. A visiting student, Bjarne Andersen, will assist with the project from mid-March to mid-June. It is hoped that CUO/IJAF will integrate this design into their planned improvements to their system.

5 Computers

With the absence of a formal System Administrator, significant development of the computer system has been put on hold. Nevertheless, progress has been made in:

- Introduction of centralized software serving which will be extended to serving home directories,
- Regular backups (previously, all NOT staff have been entirely vulnerable to data loss through disk crashes).
- A new printer has been purchased for the SLO.
- An internal domain name server has been setup to avoid dependence on ING (who, in principle, could interrupt observations and other work at NOT with a failure).

The reliability and bandwidth of network connections to the outside world have improved considerably.

A security hole which allowed the theft of usernames and passwords (but not their actual use) has been closed.

6 Infrastructure

Two new, 60L dewars have been purchased for the transport of LN_2 given the anticipated increased demand from NOTCam and MOSCA. These will also be useful in supplying SOFIN.

NOT has also participated in the joint purchase of a new LN_2 production plant together with TNG and ING. This project became necessary after ING identified that they were overrunning their existing system and would be forced to cut back in production, effectively cutting off NOT and TNG. ING will continue to service the new plant as with the old. The expense to NOT is expected to be recouped within 3.5 years, given current commercial vendor prices.

NOT has indicated its intent to rent premises from IAC in its new Sea Level Base to be constructed near San Antonio. We are not properly satisfied by the details provided so far, but expect the conditions to be considerably elaborated within the contract which is currently under draft.

Astra 1 has been replaced with a new Opel Astra.

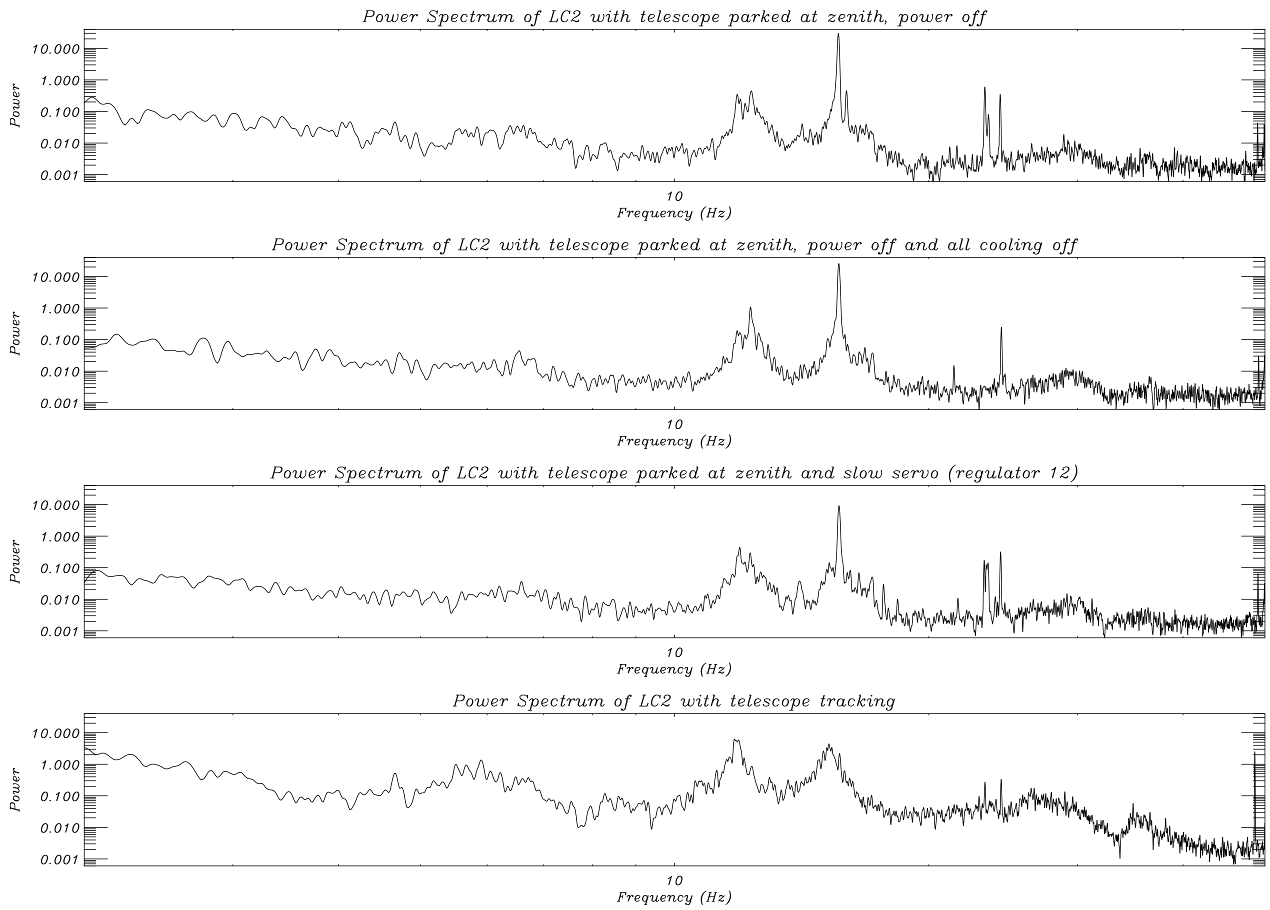

Figure 1: Mirror vibrations, power spectra

A Measurements of M1 dynamics using the load cells

The dynamics of the NOT primary mirror were determined in May 2000 by taking the power spectra of the image motion of several stars. To confirm the finding a different method was later used to measure directly the actual mirror vibrations using its load cells. With the help of Ingvar, who through the TCS logged the values of the load cells at a sample rate of 100Hz, spectra of their readings were produced. The resulting spectra (see figure 1) all show the same modes of vibration at 12Hz and 14.5Hz with some narrow lines at about 22Hz and 49Hz, Several different conditions for the telescope were used when making the measurements to try and identify the possible excitation of the mirror oscillations, they were;

1. telescope parked a zenith,with power off.

2. telescope parked at zenith with power off and all cooling fans off.

3. telescope parked at zenith and the active optics bellow servo ran at a very slow (0.5 second) up-date rate.

4. Telescope tracking.

For all the above conditions it was found that virtually identical spectra were produced suggesting that the modes of vibration are intrinsic to the mirror itself.

Graham Cox, 13 March 2001.

B Status report on fast serial link, 28 Feb 2001

B.1 Introduction

This document describes the current design and status of the communication interface card intended for use with a new CUO array controller. The proposal was to provide a replacement for the existing board which would improve the performance, throughput, with state of the art components. The board consists of a serial duplex fibre interface, a first-in- first-out (FIFO), control logic and a PCI-bus controller. It was originally considered making a board that would be a direct replacement of the exiting interface card, i.e. retain an identical serial protocol, and to have the ability to up-grade/convert to a faster transmission rate when a new controller arrives, though this was dropped, after discussions between myself and Preben, as a unnecessary waste of resources and time.

B.2 Design Description

It was decided at the beginning to retain the duplex fibre optic link using the same multi-mode fibre as used on the existing boards. Preben proposed the PCI bus and the Cypress HotLink CY7B9x3 transmitter/receiver chipset, which have been adopted. Suitable fibre optical transmitter and receiver modules from Hewlett Packard (HFBR-x119T) have been selected. The CY7B9x3 chips' internal encoding and decoding (8B/10B) will be used. Note, it is known that Cypress has since brought out a new combined transmitter/ receiver single chip, the CY7C924DX, and this can be used to replace the separate devices currently been used.

An important decision was to use the industrial standard PCI bus, now found in all personal computers. This bus is relatively complicated and so a proprietary interface device has been selected. The AMCC "Matchmaker" S5933 was chosen. This chip converts the PCI bus to a much simpler local bus with four definable 'Pass-Thru' data channels. Internal 32-bit wide, 8 deep FIFO channels have been selected for both directions, for communicating to the PCI bus. The S5933 can act as a bus master. A software Linux driver has been procured for the AMCC controller from Sheldon Instruments. This driver package comes with working examples and full source code.

Another important criteria is that the data flow from the array being read is continuous. This is arranged on the existing board with a full frame buffer. The buffer has been replaced in this new design by a first-in- first-out (FIFO) memory. This option can be used because the PCI bus can easily sustain the maximum possible pixel arrival rate from the array. Modern PCs will have no problems handling the data in real-time, especially since the AMCC controller chip can initiate bus transfers, and it was considered to duplicate PC memory on the board would only increase its complexity, so compromise its reliability. Cypress asynchronous CY7C46xA devices have been chosen for the FIFO and will make up a 32-bit wide memory. The system has been configured so that as soon as the first location in memory is full a transfer is initiated.

All the 'glue-logic' is implemented with an Altera MAX7000 PLD, the same family of devices already used in Copenhagen. This device will include a state-machine to ensure priority is given to data transfer from the array. The Cypress HOTLink devices work with bytes but to get the maximum throughput from the PCI bus all communication over the bus will be 32 bits. The conversion between long words and bytes is handled by the PLD.

To assist in the development a developer's kit was purchased from AMCC. This kit includes a board with the Matchmaker chip and prototyping area. The first prototype interface board will be built with this developer's kit.

B.3 Design Status

The status of the design is that all the hardware components have been acquired, we have the AMCC developer's kit and the PCI driver package. Preliminary code has been written for the PLD, and simulated up to a data transfer rate of 240 MHz, and work has started on the construction of the board. Also a home-made prototype board has been made to test out various ideas before putting them on to the actual AMCC board. The home-made board is only waiting for the PLD to be programmed and the chips to be plugged in. Later this board will be used to emulate the array controller. Once everything is found to be satisfactory on the home-made board the design will be finished off on the AMCC board.

At the end of March 2001 a student will be arriving at the NOT, for some industrial training, and he will work on the AMCC control interface. No work has yet been done with the PCI driver.

There is little additional information I need from CUO-IJAF for the technical development, though obviously we need to agree on the clock frequency. If we move to the new Cypress CY7C924DX device then the maximum frequency can only be 200 MHz, where I've verified my design at 240 MHz, (and 200 MHz). Most of the important definitions are handled by the software and the driver. The board only accepts data on the incoming channel and passes it on, and similarly transmits commands as they arrive on the PCI bus from the control program. The length of the commands needs to be clarified, though the board is designed to take byte, word or long word lengths.

Below is an estimate of the time required to complete the first prototype board. In addition to this time there is the software control development. This area is not my speciality and help would be advantageous. A simple driver needs to be written to test the board and hopefully this can be done in a few weeks. Designing a printed circuit board (PCB) will take some time since it includes the learning of the design package. It is thought that some of this work could be done by Carlos Perez. It must be noted that the times given are assuming full time work which can not be the case since obviously the telescope takes precedence, and there are other projects to work on as well involving the telescope directly.

Description of Work	Time
Build and test the 'home-made' prototype board.	2 weeks
Transfer design to AMCC developer's board	2 weeks
Test board	3 weeks
Write a simple PCI Linux driver	4 weeks
Design PCB layout	4 weeks
Assemble and test PCB design	3 weeks

Graham Cox 28 Feb 2001.

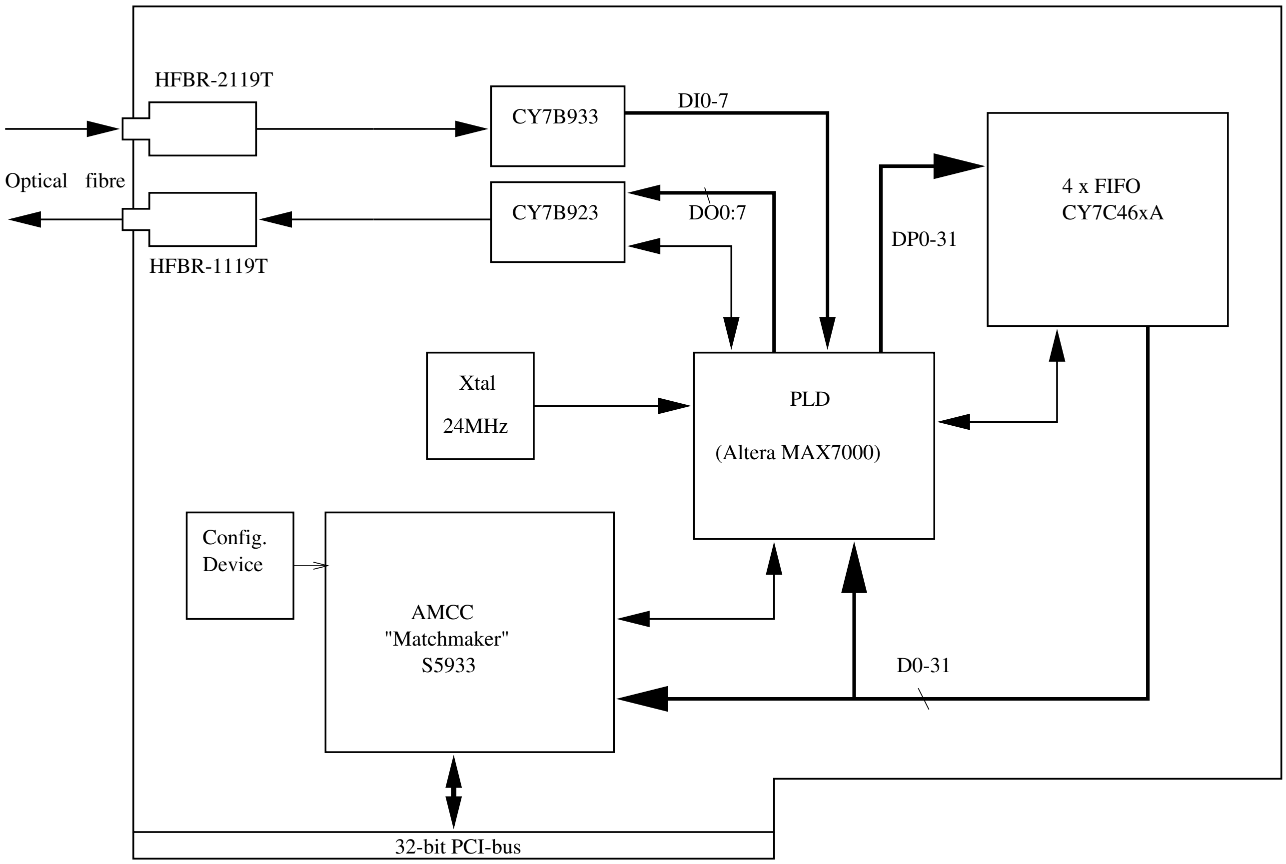

Figure 2: PCI card, block diagram