NAOMI WFS - status report July 1997 **wht-naomi-85**

Project: **NAOMI Wavefront Sensor**
Project No: IADA4
Date: 29 July 1997
Project Manager: Bruce Gentles

Summary
The 2-CCD scheme has been reviewed and approved and the previous baseline architecture abandoned.
We have adopted a single tape encoder running along the Common WFS rail which has separate reading heads for the Pick-off, the Fore-optics and the CCD focus/focal plane selector carriage.
We have decided to implement peltier cooling for the CCD and use a non MPP CCD.
The modelling for the assembly and alignment error budgets is nearly complete.

WaveFront Sensor project progress in detail
The 2-CCD scheme was proposed in detail, with a detailed scheme being packaged and designed and the CCD readout process modelled to give comparative results. This was recently approved and we will design the hardware for use with a permanent 2-CCD arrangement. Manual interchange of the beamsplitter with a compensating plate will be possible and the first-light system will have a single CCD camera, to save on cost.

We have adopted a single tape encoder running along the Common WFS rail which has separate reading heads for the Pick-off, the Fore-optics and the CCD-focus/focal-plane-selector carriage. This has several advantages:

?? The second outrigger rail can now run the full length of the WFS which allows the Pick-off to be mounted on both rails, thus significantly increasing the baseline of its mount.
?? The encoding of these related axes is in the same units, thus reducing the likelihood of software error causing collision.
?? The dynamics of the slides can easily be made very similar, thus matching the speed and timing of responses to focus shifts. This should improve the performance when dithering, and especially with non-sidereal objects.
?? The system is simpler and easier to maintain.

The reading heads use a 800 nm LED to sense the optical tape. We have shrouded the complete encoder in a box with a brush seal for the reading head mounting arm, to keep any stray light away from optical beams, and to keep the heads and tape clean. We consider the risk from stray light to be small and this baffle to make the problem negligible.

We have modelled the various noise sources in the CCD system for both acquisition and AO operation and found that we were only dark current dominated if we used a non MPP CCD at Ghril room temperature. Due to the mask problem and availability of the MPP CCD, we choose to implement peltier cooling for the CCD and use an ordinary thinned non MPP CCD. We are now in a position to order the CCD detectors.

The modelling of CCD noise has been extended slightly, and VBA functions available for excel written to calculate the readout time, expected photon and read noise for a particular readout scheme with the CCD39. This will give us predicted numbers in ADU's which can be directly compared with images read out from a real CCD. We have generated operating curves for the various 2-CCD architectures. These could easily be extended to use Parenti's model to calculate Strehl loss due to latency and read noise in order to calculate an optimum CCD read time for a given guide star magnitude.

The modelling for the assembly and alignment error budgets is nearly complete with only a few of the sub-assemblies yet to be analysed for sensitivity to misalignment. The current combined alignment and stability budgets will be separated into three separate ones.

?? Assembly tolerances for gross initial assembly which will prove that the design will be able to pass beams which will allow measurements to align with.
?? Alignment sensitivities which will be part of an error budget to define and justify the specified mechanical adjustments provided.
?? Stability tolerances which will provide an estimate of operational stability of the WFS.

Experiments to prototype the SDSU to VME to C40 link have discovered that this architecture does not meet the bandwidth requirements for NAOMI. An alternative which does not pass the data across the VME bus but via a parallel cable to ELECTRA has been proposed instead.

We have proposed a data format protocol for the data from the WFS camera which will form the basis of the ICD between RGO WFS and Durham ELECTRA reconstructor. A similar protocol is used in the Gemini PWFS. We may choose to adopt this one which would save a lot of specification and implementation work, as we could use the PWFS camera software directly.

We suggested several areas of savings, with corresponding losses in functionality for the WFS at a project meeting. We are relieved that only a few of these were adopted as this retained the essential functionality of the WFS. The current status of our areas is as follows:

Item	**status**	**comments**
Cooling of CCD.	No Saving.	This has been shown to be required.
single WFS filter wheel. -	Adopted.	
Reduce allocation of time for EPS -	Adopted.	
Omit sidereal tracking capability -	Adopted.	
Do not implement brakes on carriages. -	Adopted.	
Remove encoders from some axes.		We have decided to encode only the following axes. 1. P-off X and Y 2. Fore optics focus 3. CCD focus/focal plane select 4. Lenslet array selector The savings will be only of the order of 1-2 k

The efficiency of work on this project will inevitably be affected by the recent PPARC announcement on the ATC. The continuing uncertainty over the scope and scale of the changes makes it difficult to predict progress and publish any accurate milestones.

MILESTONES

Local milestone	Date Due	Changed to	Achieved	Reason for change
Optical System Design frozen	13-6-97		7-8-96	
Optical system design and space envelopes revisited	20-12-96		17-1-97	
WFS PDR	19-02-97		19-2-97	Revised system and WFS pick-off design
system review (1)	16/05/97	TBC		No ING progress on Ghril issues.
2-CCD scheme approval		2 June 97	16 July 97	
CCD delivery		13 Oct 97		a
controller delivery		1 Jan 98		a
NAOMI WFS CDR	22/09/97	14 Nov 97		a
system review (2)	18/09/97	TBC		a

NAOMI WFS build complete	16/04/98	15-Sept-98		a
WFS performance / acceptance tests start		17 Nov 98		a
WFS shipped to Durham		24 Feb 99		a

Note : a) schedule revised June 97 to include latest allocation profiles & estimates.

BUDGET

Provisional Allocation in 1997/8 TBC	£	93,700
Spend to 23/7/97	£	223
Minimum possible spend in 1997/8	£	223
Most likely spend (outturn)	£	93,700
Maximum possible spend in 1997/8	£	112,000

Reasons for variation in projected spend from allocation for 1996/97:

Section 18

Project: **NAOMI software**
Project No: IACA4
Date: 1997-06-17
Project Manager: Guy Rixon

The software for NAOMI will be evolved through a series of three prototypes, NAOMI-A, -B and -C respectively. The NAOMI-A experiment, which is in progress, will test the architecture (a mixture of DRAMA and EPICS programs) and will examine the feasibility of coupling the central intelligence of the observing system to EPICS databases without intervening D-tasks. Currently, a transaction protocol based on EPICS' channel-access facility is being designed and that design will be reviewed at the end of June. After that, a set of test programs will be written to test the efficiency and robustness of the communications. By the end of August, NAOMI-A should have validated the communications and it will be possible to specify the interfaces for NAOMI work-packages at ROE and the University of Durham.

MILESTONES

Milestone **Completion of**:	Planned date at :			Date Achieved	Reason for change
	1-3-96	1-4-97	1-6-97		
Protocol review			30-6-97		
NAOMI-A experiment		30-6-97	31-8-97		Staff not available.

Bruce Gentles
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