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NEWFIRM Software—System Integration Using OPC

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Abstract. The NOAO Extremely Wide-Field Infra-Red Mosaic (NEWFIRM) camera is being built to satisfy the survey science requirements on the KPNO Mayall and CTIO Blanco 4m telescopes in an era of 8m+ aperture telescopes. Rather than re-invent the wheel, the software system to control the instrument has taken existing software packages and re-used what is appropriate. The result is an end-to-end observation control system using technology components from DRAMA, ORAC, observing tools, GWC, existing in-house motor controllers and new developments like the MONSOON pixel server.

1. Introduction

The NEWFIRM[1] camera (Autry et al. 2003) will offer well-sampled coverage in J, H and K_s broadband filters of a $28' \times 28'$ field of view at Cassegrain focus of the NOAO 4-meter facilities. First commissioning will be on the Mayall telescope at KPNO in mid-2005, and on the CTIO Blanco soon thereafter. Present plans call for the instrument to carry out wide-field science in both hemispheres by alternating between sites. It is under development at NOAO-North in Tucson with significant involvement from the engineering and technical staff at NOAO-South in La Serena. A schematic of the dewar design in the surrounding yoke and the on-sky footprint are shown in figure 1.

2. Discussion

In *Survey Mode* large scale programs intended for general public use will be carried out. This may involve tens to hundreds of square degrees of sky observations, many nights of observing time distributed over a lengthy period and public access to processed data. In this mode the instrument will operate in a pre-planned, systematic way with a minimum of real-time decision making during any particular night's observations. Filter and integration time changes are likely to be infrequent and a given region of sky the only nightly target. The telescope and instrument will function semi-automatically for periods of hours with monitoring and occasional intervention by the observer—who may not be a PhD level expert astronomer.

[1]`http://www.noao.edu/ets/newfirm/`

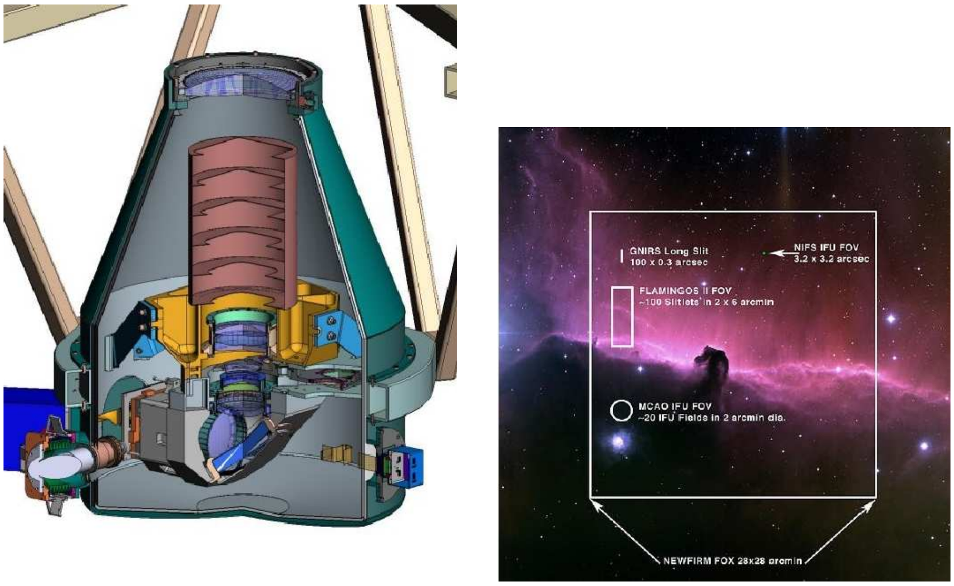

Figure 1. NEWFIRM Design and Sky Coverage

In *General Observer Mode* an astronomer using the NEWFIRM instrument will conduct a limited program over a few nights with a specific immediate science goal. Various filters may be used, as well as a variety of integration times, on targets in any accessible part of the sky. All three—filter, integration time and telescope pointing—may be changed frequently. There may be extensive real-time decision making and intervention by an expert astronomer as the observations proceed.

To meet these goals for NEWFIRM a software trade study[2] was conducted which clearly identified the direction in which the project should go: system integration using OPC[3]. The key technologies identified are listed in table 1.

Therefore, elements from several diverse software projects—such as DRAMA (Farrell et al. 1993), ORAC (Bridger et al. 2000) and GWC (Gillies 1995)—were adopted as well as new developments such as MONSOON (Starr et al. 2003). The integrated design—now known as the NEWFIRM Observation Control System (NOCS)—is shown in figure 2 and an explanation of the modules and current status is given in the table 2.

The design has two novel features. First, the NOCS *never* handles pixel data. Such data is served by the MONSOON image acquisition system directly to the data reduction pipeline with the NOHS task providing such meta-data as may be necessary to calibrate the data and/or provide FITS headers. Second, the observer interface is *always* the observing tool and, in so-called classic observing mode, the query tool will pick up the next observation sequence automatically from a queue.

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[2]`http://www.noao.edu/ets/newfirm/PDFs/SoftwareTradeStudy.pdf`

[3]Other People's Code.

Table 1. NEWFIRM Software Key Technologies

Technology	Source
GCC	http://gcc.gnu.org/
DRAMA	http://www.aao.gov.au/drama
GWC	http://www.noao.edu/wiyn/gwc_interface_documents.htm
Tcl/tk	http://www.tcl.tk/
Java	http://java.sun.com/
Perl	http://www.perl.com/
XML	http://www.w3.org/XML/
PostGreSQL	http://www.postgresql.org/

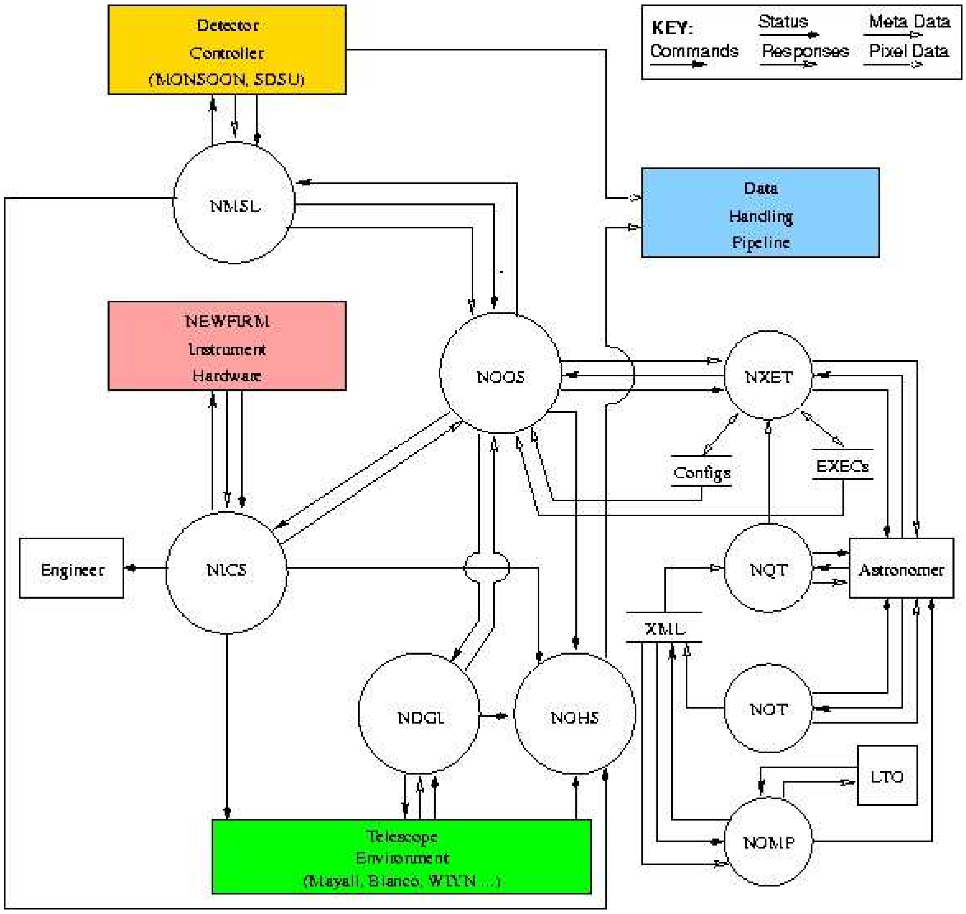

Figure 2. NEWFIRM Software Design

Integrating these diverse software systems into a maintainable and configurable whole is the underlying challenge.

Table 2. NEWFIRM Software Modules and Status

Module	Description	Support	Status
NOOS	Observation sequencer	UKATC	Done
NDGI	Telescope interface	NOAO	In design
NOHS	Meta-data repository	NOAO	Prototyped
NICS	Instrument controller	NOAO	In design
NMSL	MONSOON interface	NOAO	In design
NOT	Observing tool	Gemini/JAC/NOAO	Done
NQT	Query tool	JAC	Done
NXET	Dictionary translator	JAC/NOAO	Done
NOMP	Observation management	JAC	Done

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Bridger, A., et al., 2000, Proc. SPIE, 4841, 227

Farrell, T. J., et al., 1993, BAAS, 25, 954

Gillies, K., 1995, NOAO Internal Report

Starr, B. M., et al., 2003, Proc. SPIE, 4841, 600.