

Red-eye Progress Report

A number of milestones were passed since the last Bulletin in the Redeye infrared camera project, including delivery of the dewars, a NICMOS3 science array, and the completion of a pair of successful engineering runs. The first Redeye summit test occurred in June, when we used the engineering array with the 0.7:1.0 (narrow-field) optics at f/8 to characterize the system's image quality and prove its basic viability. Nonlinear performance in the engineering array prohibited photometric measurements during this single night of observations. In August we followed up with a two night run, this time using the science array, 1.7:1.0 (wide field) optics, fully baffled optical tube assemblies, and AR coated lenses. The goal of this run was to characterize the imaging performance of the wide field optics, as well as make critical measurements of the sky background and system throughput. After extensive lab tests and these two engineering runs, we now feel confident that we will be able to meet the January 1993 commissioning date for the cameras, as well as reach all of the projected performance goals. A final engineering run is planned for December, during which we will perform science verification observations and push the system to its limits.

At the time of this report we still have not received our second science array from Rockwell, but expect delivery before the end of 1992. In the event that we cannot secure a second science array before the beginning of next semester, we will use the existing detector in a single dewar and swap optics to support both narrow and wide field modes. This will demand block scheduling so adequate time (~24 hours) is available for performing the optics swap. Hence, in any event, we anticipate being able to support both wide and narrow field modes before the second science array arrives.

Filter	Sky Background (mag/arcsec ²)	Throughput (%)	FWHM (wide field)	FWHM (narrow field)
J	15.9	15	1.04"	0.64"
H	14.3	22	1.04"	0.60"
K	12.2	17	0.95"	0.57"

In Table 1 the performance levels measured in the summer engineering runs are listed. Note that we did not install before these tests a special occulting cold stop, designed to block thermal flux from the f/8 mirror assembly. We will use such a cold stop during the upcoming December 1992 engineering run and expect a ~1 mag reduction in the background at K. The throughput measurements are for the entire system, including telescope, camera optics, filter, and detector. Seeing measurements were derived from images of globular clusters and represent typical spatial resolutions for the cameras. On exceptional nights, reductions in the FWHM for stars may be reduced by ~0.2". Note that because of digitization of the focal plane with the 0.5" pixels used in the wide field mode, 1" PSFs will be typical. No significant aberrations were found with the optics, and the plate scale was found to change by <1 pixel across the entire field of view from J to K, meaning multicolor photometry should be straightforward. Tests of the AR coatings on Redeye's optics indicated a >10 mag rejection of secondary images created by internal reflections in the cold optics. The largest remaining bug at the time of this report is excess read noise

(~250 e-) due to our not employing a double correlated read-out scheme for the detector. We will implement this change in the DSP controller before our next engineering run and expect to reach the projected ~50 e-read noise. Also note that we have recently received all of the Redeye stock filters, which are listed in Table 2. A manual for Redeye should be ready in early 1993. The manual will ultimately be placed in the CFHT anonymous ftp disk so that users can remotely extract and printout the Redeye manual at their leisure.

Filter	λ_c (μm)	$\Delta\lambda$ (μm)	Peak Trans. (%)
J	1.24	0.29	83
H	1.65	0.28	84
K	2.21	0.39	78
K'	2.12	0.34	90
H ₂ 1-0 S(1)	2.125	0.024	63
Fell]	1.647	0.018	87
Pa β	1.282	0.015	74
Bry	2.165	0.022	80
CO (2-0)	2.297	0.027	79
K continuum	2.260	0.053	86

Finally I would like to compliment and congratulate the numerous people "behind the scenes" on the Redeye project. I am very proud of the entire Redeye team, which managed to go from funding to first light in only 14 months! These people often made rather heroic efforts to fabricate the myriad of components that go into the cameras. First I would like to thank The Tech Group and Bear Machining for providing outstanding assistance in all phases of the design and fabrication of the cryostats. Having the cryostats built locally by an organization that let CFHT oversee virtually all aspects of their production turned out to be a huge benefit to the project and the Corporation. I particularly thank Lou Robertson for working nights and weekends at Bear Machining to make parts for the cameras in the (usual) chaos that immediately preceded the June engineering run. I would also like to thank Don Wilson and the staff at Optics for Research, Greg Enzor at Thin Film Lab, as well as Kadri Vural and Bob Bailey at Rockwell International for providing first rate infrared lenses, coatings, and detectors for the Redeye project, respectively. On the local front, the electronics and Gen-III array control system are the work of Chris Clark. I remain amazed that Chris, with no infrared array experience, was able to get IR images in the lab last spring after only 2 weeks of work with his controller, which to my knowledge was the first application of a DSP controller with an infrared array at an observatory. On the user interface software, John Kerr and Steve Smith are responsible for what I think is the best infrared camera data acquisition software on Mauna Kea - no small feat when one considers the competition. Finally I would like to thank Steve Massey for his expertise in dewar design and maintenance. Early in the project, Steve and I made countless trips between Waimea and Hilo as we converged on a cryostat design in collaboration with The Tech Group. I often made those long drives sweating over some detail of the cameras, only to have Steve's enthusiasm, creativity, and cryogenic know-how find a solution for me. To all of these people I would like to express a deep mahalo as we close the fabrication phase of the Redeye project and begin to watch the cameras in action.....

D. Simons