Sloan Digital Sky Survey

Quarterly Progress Report

First Quarter 2003

June 20, 2003

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1. SURVEY PROGESS

1.1 Summary

In Q1, observing focused on the Northern Galactic Cap and the Southern Equatorial Stripe. We obtained 634 square degrees of new "unique" imaging data, or 87% of the baseline goal of 727 square degrees. We also obtained ~79,300 spectra by completing 93 plates on the Northern Galactic Cap and 31 plates on the Southern Equatorial Stripe. The combined total of 124 plates is 79% of our baseline goal of 156 plates.

Overall, we still remain behind the baseline for the Northern Survey and the Southern Equatorial Stripe Survey. Although we lost some time to hardware problems in late January, weather continues to be the biggest impediment to survey progress. March proved to be especially bad, as weather kept us closed for the first eleven days of the March dark run. We opened on the twelfth day long enough to complete one 20-minute spectroscopic exposure, only to be shut out again on the following night. Thus, out of the first thirteen scheduled nights, we obtained one 20-minute science exposure. Frustrating to say the least.

1.2 Q1 Imaging

Table 1.1 compares the imaging data obtained in Q1 against the baseline projection.

Table 1.1. Imaging Survey Progress in Q1-2003

	Imaging Area Obtained (in Square Degrees)			
	Q1-2003		Cumulative through Q1	
	Baseline	Actual	Baseline	Actual
Northern Survey[1]	727	634	5700	4314
Southern Survey[1]	0	0	745	738
Southern Equatorial Stripe[2]	0	0	2053	1823

1. "Unique" area
2. "Good minus Unique" area

Imaging in Q1 focused on the Northern Galactic Cap, where we obtained 634 square degrees of new "unique" science data. In addition, we allocated three hours to oblique scans and one hour to a UCAC scan; oblique scans are required for photometric calibrations and UCAC scans are required to check astrometric calibrations. We also devoted 6.5 hours to testing and debugging procedures for acquiring Apache Wheel scans; and 3 hours to actually acquiring Apache Wheel data. Apache Wheel scans are taken when conditions are photometric, but seeing is marginal. Hence, they usurp spectroscopic observations but not imaging. The area imaged for the calibration and Apache Wheel scans is not included in Table 1, since the former data are not part of the survey footprint and the latter are taken in binned scan mode.

The following graphs show progress against the imaging baseline goals for each Survey region.

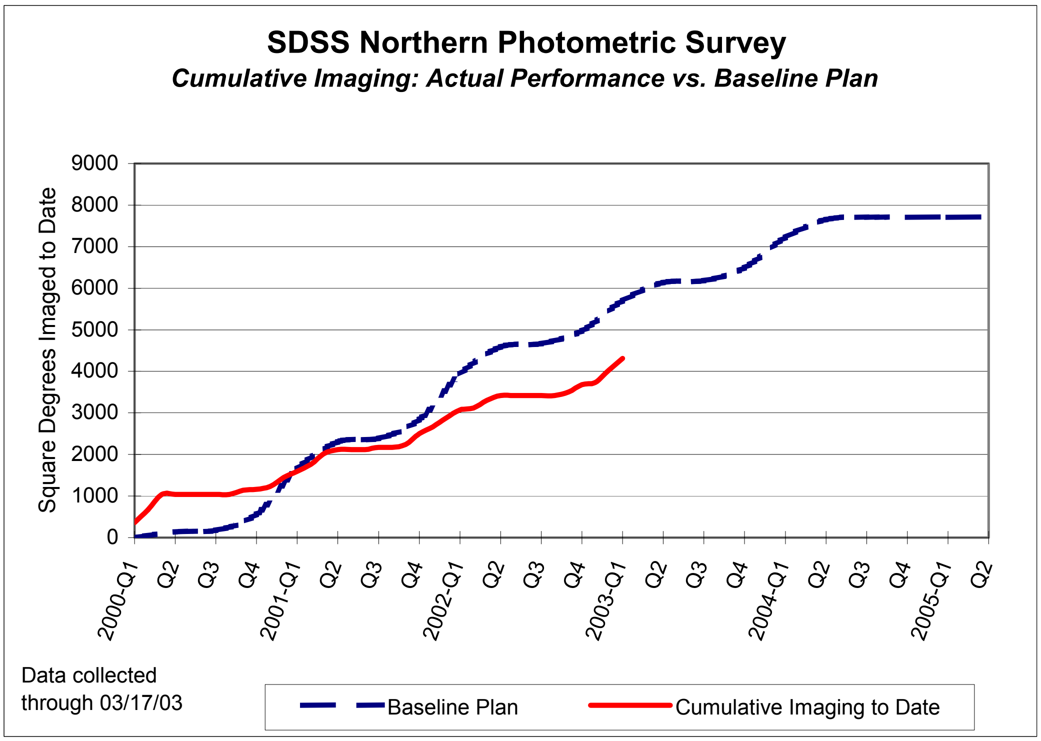


Figure 1.1. Imaging Progress against the Baseline Plan – Northern Survey

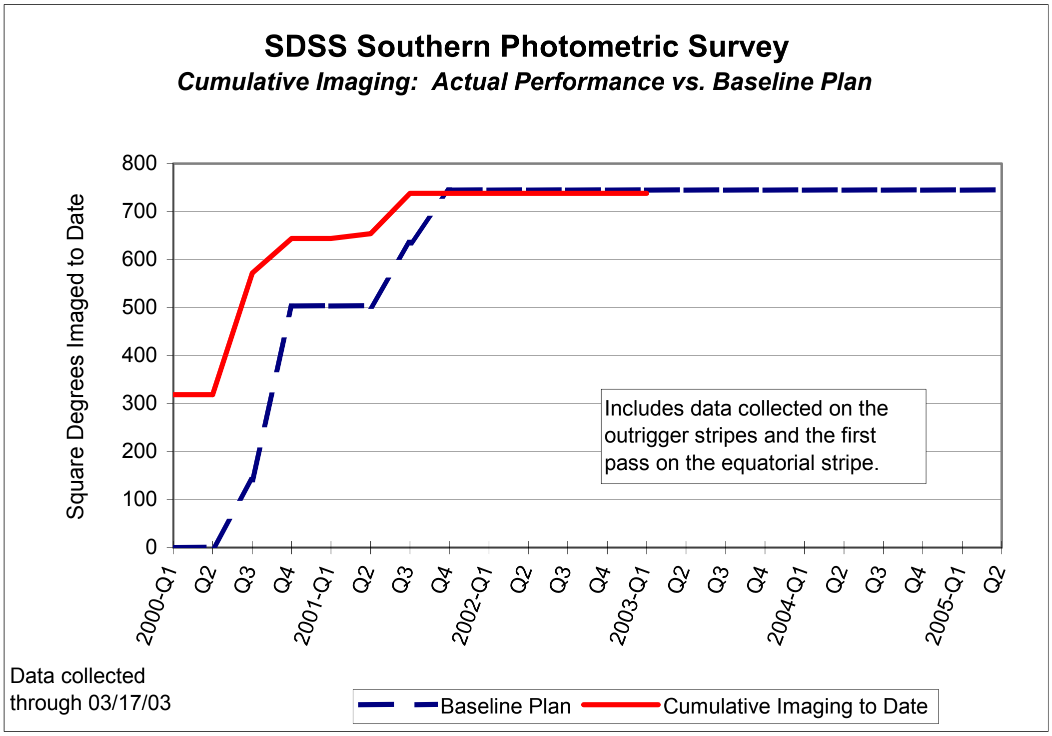


Figure 1.2. Imaging Progress against the Baseline Plan – Southern Survey

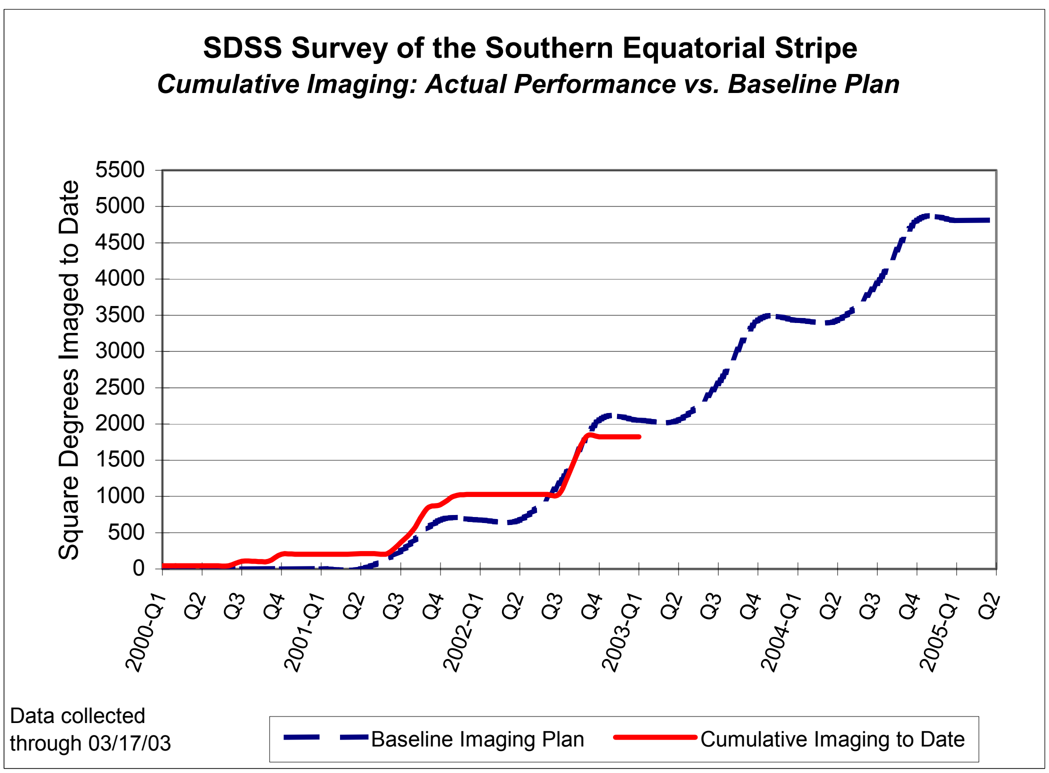


Figure 1.3. Imaging Progress against the Baseline Plan – Southern Equatorial Survey

1.3 Q1 Spectroscopy

We report progress on spectroscopy in terms of the number of plates observed and declared done during a quarter. The successful observation of a plate typically yields 640 unique spectra. In Q1, we observed a total of 124 plates. The baseline plan forecast that all plates observed in 2003-Q1 would be on the Northern Galactic Cap. In practice, 20% of the plates observed were Southern Equatorial Survey plates. Table 1.2 compares the data obtained against the baseline projection.

Table 1.2. Spectroscopic Survey Progress in Q1-2003

	Number of Plates Observed			
	Q1-2003		Cumulative through Q1	
	Baseline	Actual	Baseline	Actual
North	156	93	714	547
South	0	0	148	153
Southern Equatorial	0	31	165	139
Total plates	156	124	1,027	839

On January 29 we achieved a notable milestone. The observing team of Dan Long and Pete Newman completed nine spectroscopic plates in one night; they acquired 5,760 spectra in one observing shift! We had come close to this earlier in the quarter, when on January 1 the observing team of Jurek Krzesinski and Pete Newman completed eight and two-thirds plate in a single night. The ability to observe so many plates in a single night is the result of the efforts of many people across the project. It also confirms that the procedural and thermal improvements made over the past year are now paying dividends in terms of data yield.

The following graphs show spectroscopic progress against the baseline goal for each survey region.

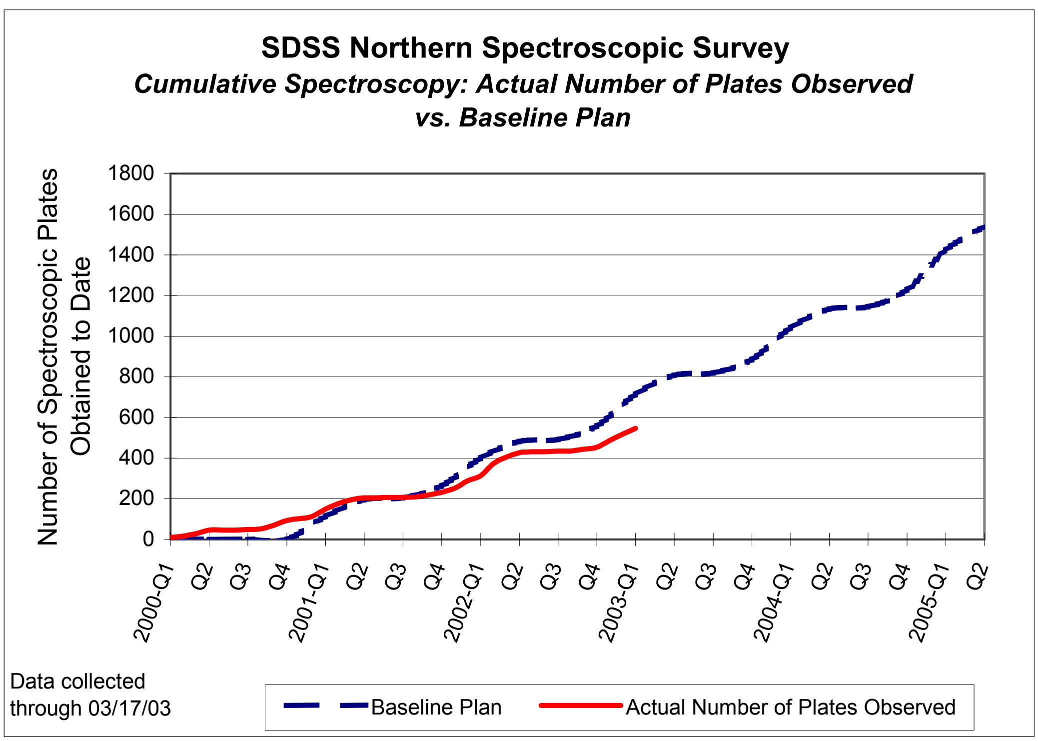


Figure 1.4. Spectroscopic Progress against the Baseline Plan – Northern Survey

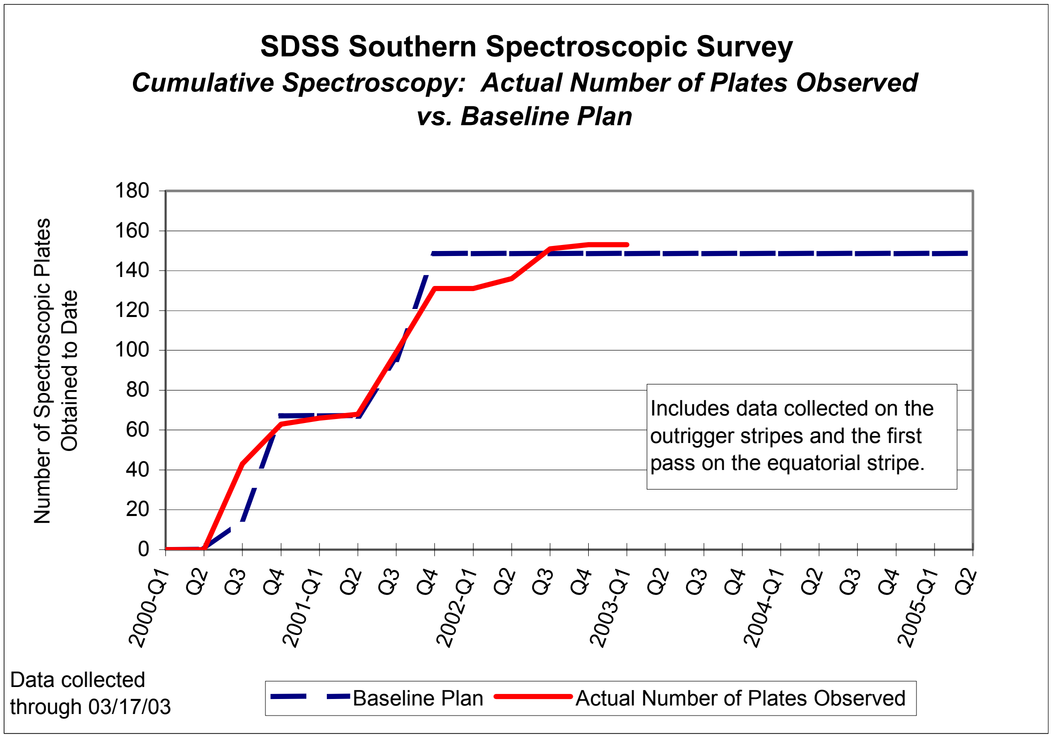


Figure 1.5. Spectroscopic Progress against the Baseline Plan – Southern Survey

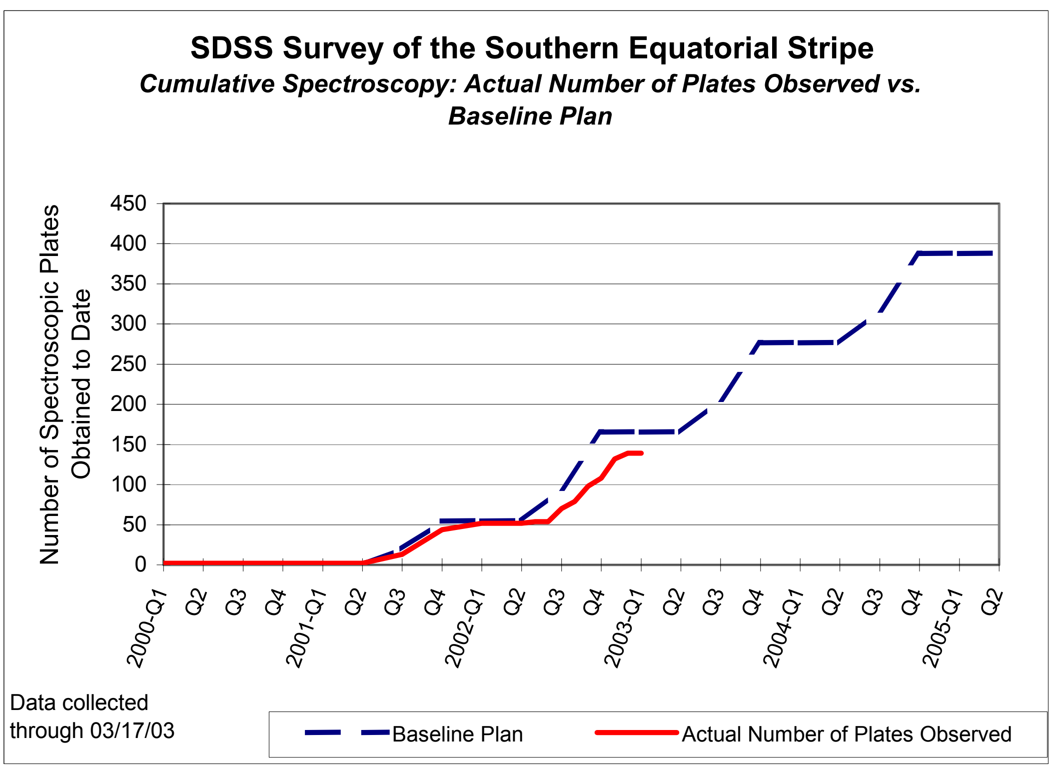


Figure 1.6. Spectroscopic Progress against the Baseline Plan – Southern Equatorial Survey

2.0 OBSERVING EFFICIENCY

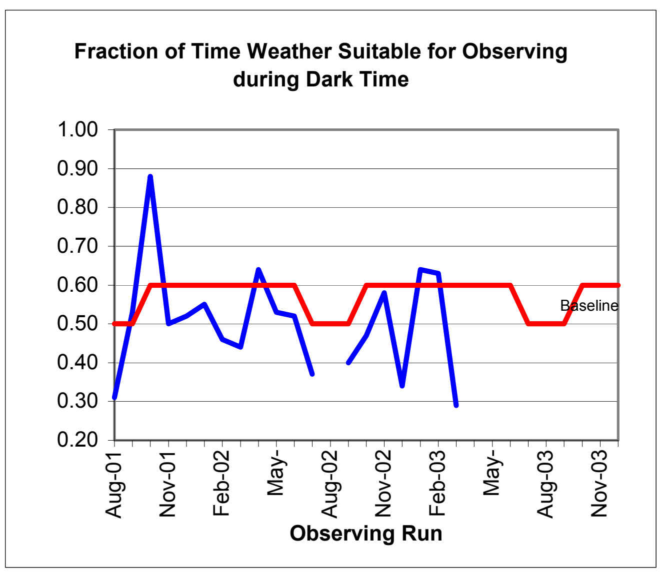
Table 2.1 summarizes the breakdown of observing time in 2003-Q1 according to the categories used to prepare the baseline projection.

Table 2.1. Comparison of Efficiency Measures to the Baseline

Category	Baseline	January Dark	January Dark + Gray	February Dark	February Dark + gray	March Dark	March Dark + gray
Total time (hrs)	Jan: 137:48 Feb: 140:14 Mar: 140:15	137:48	176:19	140:14	179:39	140:15	185:43
Imaging fraction	0.27	0.07	0.08	0.32	0.37	0.44	0.33
Spectro fraction	0.63	0.77	0.79	0.60	0.61	0.52	0.64
Weather	0.60	0.64	0.58	0.63	0.57	0.29	0.32
Uptime	0.90	0.98	0.98	0.91	0.87	0.99	0.96
Imaging efficiency	0.86	0.84	0.84	0.80	0.80	0.84	0.84
Spectro efficiency	0.65	0.63	0.63	0.61	0.64	0.57	0.58
Operations	0.90	0.96	0.95	0.96	0.96	0.96	0.95
Hours lost to problems		2:59	2:59	13:10	23:58	2:06	3:53
Hours lost to weather		49:49	73:59	51:14	72:46	98:54	125:45

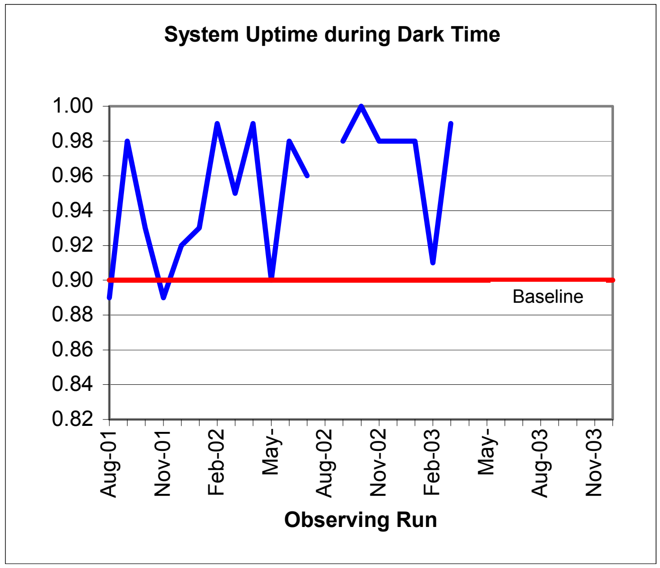
2.1. Weather

The weather category represents the fraction of scheduled observing time when the weather is suitable for observing. The baseline plan assumed that when the weather was good enough to have the telescope on the sky, it was also good enough to complete a spectroscopic plate in 45 minutes of exposure time. In reality, we are able to take useful spectroscopic data when the weather is much worse, by taking longer exposures to achieve the required signal-to-noise ratio.



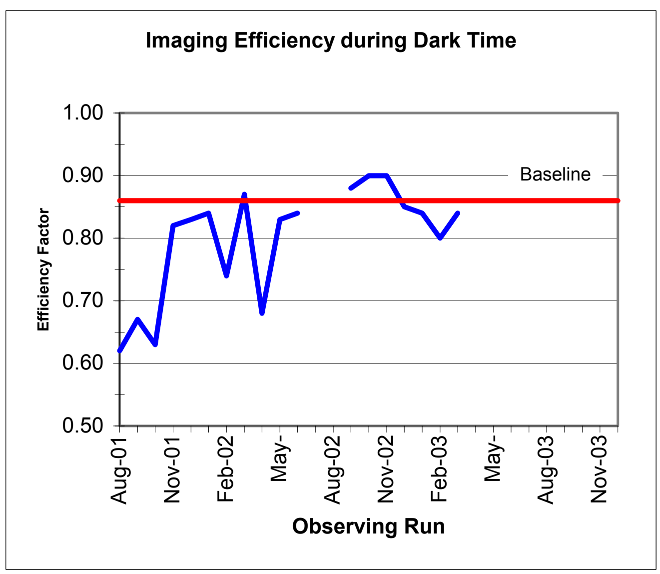
In Q1, weather in January and February was actually a little better than predicted in the baseline. Unfortunately, March was substantially worse. As in the past, we were able to offset some of the lost time by conducting spectroscopic observations during gray time.

2.1 System Uptime



System uptime measures the availability of equipment when conditions are suitable for observing. Although we exceeded the baseline goal throughout the quarter, we had problems with a spectrograph modification project in late January that resulted in excessive system downtime. Recall that in March 2002 we experienced a number of cold weather problems that resulted in lost observing time. One such problem was associated with the operation of the spectrograph shutter doors. Under extremely cold conditions, we learned that the shutter guides contract and pinch the shutter door, thereby impeding shutter door movement. Seeking to prevent this, we fabricated new shutter guides with wider slots to accommodate differential thermal contraction. During the January bright time, we installed the new shutter guides. Unfortunately, there were a number of problems during installation, which resulted in a loss of observing time in February. First, a clevis was re-installed incorrectly, which subsequently knocked a shutter position sensor out of alignment. Second, tape that blocked light from an LED on the position sensor came loose, which caused a light leak within the spectrograph. Third, several pins on a connector bent and shorted together during re-assembly, which caused a loss of communication with one of the spectrograph cameras. These events happened in series and took several days to troubleshoot and resolve, which resulted in lost time on the sky.

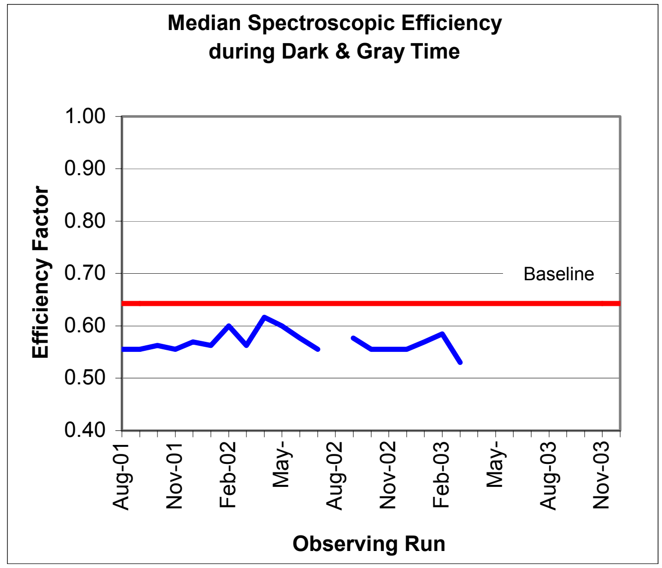
2.2 Imaging Efficiency



Imaging efficiency was slightly below the baseline throughout the quarter, due primarily to the completion of a number of short scans. Since overhead is the same regardless of scan length, shorter scans decrease imaging efficiency.

In addition to trending efficiency, we use two simple statistics from our time tracking data to measure imaging efficiency: the imaging efficiency ratio and the imaging effectiveness ratio. The first, a measure of observing efficiency, is the ratio of science imaging time to the sum of science imaging time plus imaging setup time. The second, a measure of how effectively we use available imaging time to acquire new survey quality data, is the ratio of imaging area obtained to the science imaging time.

2.3 Spectroscopic Efficiency



Spectroscopic observations occur during both dark and gray time. As measured by the time tracker, spectroscopic efficiency during Q1 ranged from 58% to 64%; the baseline is 65%. However, since the direct measurement of spectroscopic efficiency from the time tracking data is strongly affected by poor weather, we derive a more accurate measure of efficiency by assessing the time spent performing various activities associated with spectroscopic operations. The figure to the right shows spectroscopic efficiency over time. Table 2.2 provides the median time, by month, for various overhead activities associated with spectroscopic operations. Units for all categories are minutes except for efficiency, which is given as the ratio of baseline science exposure time (45 minutes) to total time required per plate. Using these measures, the derived spectroscopic efficiency for Q1 was 56%. Over the past twelve months, spectroscopic efficiency has averaged 57%.

Table 2.2. Median Time for Spectroscopic Observing Activities

Category	Baseline	January	February	March
Instrument change	10	5	5	4
Setup	10	13	11	15
Calibration	5	13	13	18
CCD readout	0	3	3	3
Total overhead	25	32	34	30
Science exposure (assumed)	45	45	45	45
Total time per plate	70	79	77	85
Efficiency	0.64	0.57	0.58	0.53

Instrument change time remained at or below 5 minutes per cartridge, which is well below the baseline. Setup time, which includes field acquisition and focus, was significantly above the baseline in March due to weather conditions. When weather conditions are poor, the observers generally take a little more time to finish setup and calibration than they otherwise would under good observing conditions. While there is nothing wrong with their approach, it does have an adverse effect when we look at efficiency numbers. We do anticipate improving efficiency by improving telescope guiding and by implementing the Hartmann focusing scheme that we've discussed in past reports. As of this writing, the code is essentially done and is undergoing extensive testing on the mountain. We had expected the new system to be fully implemented in Q1; it now appears that this will more likely happen late in Q2, if not over the summer shutdown.

Regarding calibrations, the baseline allows 5 minutes to do calibrations, which is roughly the time it takes to complete flat fields and arcs. There was no provision in the baseline for spectrophotometric calibration, thus we may not be able to reduce calibration time much below what we are currently achieving. The peak in calibration time in March is again due to weather. When conditions are less than ideal, exposures times are typically much longer and plates may actually be completed on different days, which results in the need for additional calibrations. Since the alternative is to not observe, we accept the efficiency hit in the spirit of observing whenever we can to obtain as much survey quality data as possible. The strategy is aggressive and appropriate, but has a negative impact on our efficiency statistics.

The full set of efficiency plots is now posted on the SDSS website and updated monthly. From www.sdss.org, click on Survey Ops => Survey Management => Observing Metrics.

3. OBSERVING SYSTEMS

In Q1, we had one serious instrument problem but very few significant hardware or software problems. In addition to addressing these, we completed a number of planned engineering tasks and preventive maintenance activities.

3.1. The Instruments

The imaging camera worked well throughout the quarter. We did, however, experience a number of problems with the spectrographs as the result of a shutter modification project, as described in Section 2.1 above. We also experienced CCD readout problems with the blue camera CCD on spectrograph #1. This was ultimately traced to a bent pin in a connector that had shorted to ground. Although it is not clear exactly when the pin was bent, there is a strong possibility that the pin bent when the camera was removed to resolve some of the shutter-related problems.

3.2. The 2.5m Telescope

There were no significant problems with the 2.5m telescope or associated hardware systems directly. We did complete a number of minor repairs and planned maintenance tasks in Q1. Examples of work performed include the following:

- Swapped out the main air system dryer shuttle valves. This is done every three months to avoid dryer failure due to contamination in the valves. We have worked hard in the past to find the source of contamination in the system and have involved the system vendor in the exercise, but have had no success. We have thus taken the preemptive step of swapping out valves regularly to avoid failures during observing operations.
- Performed monthly maintenance on the flat field screens, which should now preempt problems of the nature we reported last quarter.
- Repaired two leaks in the 2.5m primary mirror astigmatism actuator corrector.
- Pumped down the vacuum in the imager umbilical and spectrograph auto-fill system lines.
- Cleaned and inspected all spectroscopic cartridge optical fibers and alignment pins.

3.3. The Photometric Telescope

Occasional runaways of the Photometric Telescope (PT) filterwheel continued to plague us in Q1 as we urgently worked on building a new filterwheel controller, developing new control software, and modifying existing operations software to better interface with the controller. In Q1, we completed the assembly of the new filterwheel and the development of the new control code. As the quarter ended, we were in the process of testing and debugging the new controller on the bench. We anticipate installing the new controller during the first bright period in Q2.

In last quarter's report, we noted problems getting our Cryotiger closed-cycle refrigerator back from the vendor. Refurbishment was taking much longer than they had promised. As a reminder, the Cryotiger® closed-cycle refrigerator is used on the PT to cool the CCD. We finally received our unit from the vendor late in the quarter and during re-installation, we discovered a leak in the pressure lines from the refrigerator compressor to the cold head mounted to the telescope. As the quarter ended, spare lines had been installed and the original lines were being leak-tested off-line to find and fix the source of the leak.

3.4. Operations Software and the Data Acquisition System

There were no problems with the data acquisition system in Q1 that prevented us from acquiring data. We still suffer from the occasional PTVME link error that causes data transfer between disk and tape to stop. We have tried to understand and permanently solve the problem in the past with little success and we currently do not have the resources to pursue this further. Given that an effective work-around exists and that the fault does not cause a loss of data, we continue to live with the system as is.

All observing software remains under formal version control and all changes are reviewed, approved, and planned during the bi-weekly observing software meetings. Observing software work in Q1 included modifying MOP to accommodate the new PT filterwheel controller, incorporating improved guiding code for the spectrograph guider, and developing software tools to assist with the implementation of mountaintop QA on spectroscopic data.

- The PT filterwheel issue is discussed in Section 3.3 above.
- The new guider code has the potential to improve observing efficiency by reducing exposure time. Better centroiding on the guide fibers will likely result in better centering of objects on their respective spectroscopic optical fibers. Better centering means more light down the fiber, and more light per unit time means smaller integrated exposure times. At the end of the quarter, the new code was written, installed, and undergoing testing at APO.
- Software tools to make the spectroscopic data more readily available to the observers were developed in consultation with the observers, the spectroscopic pipeline developers, and data processing personnel. As the quarter ended, the observers were beginning to use these tools to become more familiar with normal and abnormal spectroscopic data outputs. The mountaintop QA process is described in more detail in the following section.

3.5 Mountaintop Quality Assurance

Work began in Q1 to implement a formal quality assurance (QA) program at APO to assess and monitor the quality of spectroscopic data immediately after data collection. A second aspect of the program is to coordinate on-the-mountain inspection results with those obtained in the data processing operation at Fermilab. Improving the quality assurance program not only puts in place tools to more quickly identify and correct problems in the data, it improves communication between data collection and data processing operations. This effort is being led by Jim Annis at Fermilab and Scot Kleinman at APO.

In Q1, the spectroscopic quality requirements document was revised and brought up to date with a set of measurable requirements. From these requirements a set of quality checks was developed. Software was written and implemented at APO to make it easier for the observers to inspect the data more easily. The observers now closely review the spectro data and either note in the observing log that spectro QA completed successfully or note any problems or concerns that should be looked at in final data processing. Monthly spectrograph procedures were also reviewed and processes put in place to ensure that the data from monthly checkouts is analyzed and the results posted. The goal is to develop a process wherein spectrograph performance can be trended over time.

3.6. Thermal Issues

Prior to the advent of our thermal improvement projects, we used an infrared imaging camera to map the thermal environment around the telescope. In Q1, we borrowed the same camera in an attempt to repeat the measurements. Our goal was to quantify the improvements we have made and to learn if there were any remaining “hot” spots near the telescope. Unfortunately, problems operating the camera prevented us from acquiring useful data. Since the measurements are most meaningful in the cold winter months, we missed our window of opportunity for this year. We will try again next winter.

No other thermal work was performed and no further improvements are scheduled. We do plan to perform a cost-benefit analysis to determine whether it would be appropriate to relocate the outlet of the heat exhaust vent from the 2.5m telescope enclosure, but no progress was made on this in Q1.

3.7. Status of Engineering Tasks Scheduled for Q1

Table 3.1 reports the status of the more significant engineering tasks that were scheduled for completion in Q1-2003 Asterisks mark carry-over tasks from Q4-2004

Table 3.1. Status of Engineering Tasks Scheduled for Q1-2003

Task	Responsible	Driver	Priority	Status
Install temporary Holloman AFB light baffles	Leger	Data Quality	High	100%
Complete sky data analysis on Holloman light	Rockosi	Data Quality	High	0%
Upgrade plugging station interlock system	Leger	Safety	High	100%
Finish testing instrument change interlocks*	Anderson	Equip prot.	High	0%
Finish instrument change system display code	Lupton	Equip Prot.	High	0%
Refurbish existing imager umbilical assembly	Brinkmann	Reliability	High	0%
Finish design of counterweight system upgrade	Leger	Reliability	High	100%
Install new imager electronics enclosure and re-cable calibration system	Gunn	Equip prot. / Efficiency	Medium	0%
Complete imaging camera system baseline tests	Rockosi	Data Quality	Medium	0%
Finish installation of new Cloud Camera*	Gunn	Reliability	Medium	100%
Finish installation of DIMM telescope*	Gunn	Efficiency	Medium	95%
Fabricate secondary mirror actuator spares	Carey	Reliability	Medium	100%
Design plug plate drilling fixture*	Carey	Efficiency	Medium	90%
Complete telescope optics and hardware lifting fixture assessment	Boroski	Equip prot.	Medium	0%
Fabricate/calibrate thermometer spares	Gunn	Reliability	Low	0%
Fabricate spare thermometer A/D boards	Brinkmann	Reliability	Low	0%
Develop PMSS bench test system	Brinkmann	Efficiency	Low	0%

Regarding the tasks in Table 3.1 that were not completed as planned, their current status is as follows:

- The interlock instrument change PLC code still requires a few minor changes that were determined through preliminary system testing. However, conflicting priorities at Fermilab continue to limit the amount of time that the developer is able to work on revising the PLC code. Moreover, the spectrograph problems we experienced pulled site engineering resources away from tasks like testing and commissioning interlock system changes. We anticipate that final code changes will be made and we will install and test new code during the 2003 summer shutdown.
- No progress was made on refurbishing the existing spare umbilical assembly for the imaging camera. Although the umbilical in service is showing no signs of wear and the existing umbilical could be pressed into service in an emergency, we nonetheless intend to refurbish the unit to reduce vulnerability to downtime. To this end, work has also begun on a new spare umbilical. We anticipate that the new umbilical will be assembled by the end of the summer shutdown, and the existing spare may be refurbished by then as well.
- Cloud camera commissioning is essentially complete and the instrument is regularly used as an observing tool. Heaters were installed on the mirror base plate in Q1 to keep the lid from freezing to the base due to condensate collecting in this area. Remaining work includes determining whether a correlation exists between the values reported by the cloud camera and PT calculated extinctions, and determining whether a short circular-buffer running movie would be useful and practical to code. Since these are low priority tasks and ancillary to the core function of the cloud camera, we consider the fundamental project complete. The remaining tasks will be completed by one the ARC 3.5m telescope observers on a best effort basis.
- DIMM telescope installation is essentially complete and commissioning is well underway. All hardware, electronics and control software have been installed. Data has been acquired with the telescope pointing at Polaris and tests have shown that the telescope is capable of pointing to other areas of the sky on command. While the 2.5m telescope is observing in one area, the observers can now look at seeing conditions in other areas. This has the potential to improve observing efficiency and productivity by improving our ability to more accurately determine seeing conditions before changing observing modes. Remaining work includes programming the DIMM to automatically move around on the sky to monitor seeing conditions, but since this mode of operation isn't core to using the DIMM for 2.5m telescope operations, this feature is considered an enhanced goal and will be completed on a best effort basis.
- Significant progress was made on the design of the new plug plate fixture late in the quarter. Although the design work is behind schedule, the delay has no operational impact since we have a working, albeit less efficient fixture currently in use. When complete, the new fixture will meet two needs: it will increase the efficiency of the plug plate production operation and will provide a spare drilling fixture that we will use to certify a back-up vendor. We anticipate finishing the new fixture during the summer quarter.
- A number of tasks are shown with 0% progress. The majority of these are low priority tasks that were superceded by more important work that was necessary in order to maintain the operational readiness of the telescope and subsystems. Low priority tasks remain on our task list and will be finished on a best effort basis.

3.8. Engineering Tasks Scheduled for Q2-2003

Table 3.2 lists the more significant engineering tasks scheduled for completion in the second quarter of 2003. Tasks marked with asterisks are carry-over tasks from Q1-2003.

Table 3.2. Engineering Tasks Scheduled for Q2-2003

Task	Responsible	Driver	Priority
Complete sky data analysis on Holloman light*	Rockosi	Data Quality	High
Refurbish existing imager umbilical assembly*	Loomis	Reliability	High
Finish the counterweight system upgrade	Leger	Reliability	High
Refurbish data acquisition system power supplies	Brinkmann	Reliability	High
Install new imager electronics enclosure and re-cable calibration system*	Gunn	Equip prot. / Efficiency	Medium
Install imaging camera dog house back door	Leger	Equipment protection	Medium
Develop imager electronics QA*	Rockosi	Data Quality	Medium
Finish commissioning the DIMM telescope*	Gunn	Efficiency	Medium
Design plug plate drilling fixture*	Carey	Efficiency	Medium
Complete telescope optics lifting fixture assessment*	Boroski	Equip prot.	Medium
Fabricate spare spectrograph power supplies	Brinkmann	Reliability	Medium
Install pressure transducers on the LN2 supply dewars for imaging camera and spectrographs	Leger	Reliability	Medium
Fabricate/calibrate thermometer spares*	Gunn	Reliability	Low
Fabricate spare thermometer A/D boards*	Brinkmann	Reliability	Low
Develop PMSS bench test system*	Brinkmann	Efficiency	Low

3.9 APO Facility Improvements

The fire fuel-reduction project discussed in last quarter's report was completed in Q1, prior to the onset of the spring forest fire season. The project involved removing ground slash and some trees in the down-slope, up-wind direction near the observatory.

In past years we have rented a truck to move the 2.5m primary mirror to Kitt Peak for aluminizing. Last year, we had several problems renting a suitable truck. Most notably, when we arrived to pick up the truck in Albuquerque (the closest location we could find), we learned that the transmission was being repaired. Unwilling to transport our mirror up and down mountain roads with a freshly rebuilt, untested transmission, we scrambled to find another suitable truck. Although Mark Klaene managed to pull this off, the experience convinced us that it is getting ever more difficult to rent a suitable truck. Given the risk to the mirror, we are now considering whether we should purchase a truck for this purpose. A set of requirements has been prepared and budgetary quotes are being solicited. Once realistic costs are known, we will finish a cost-benefit analysis and based on the result, may submit a request to proceed with this capital purchase.

4. DATA PROCESSING AND DISTRIBUTION

Data processing operations ran smoothly throughout Q1, with all newly acquired data promptly processed and loaded into the operations database for access by the collaboration. The processing of newly acquired data was carried out with the authorized production versions of the photometric and spectroscopic pipelines and the processed data was made available to the collaboration.

Recall that in 2002-Q4, we discovered a problem in the calculation of the model magnitudes in Photo v5_3, which had been used to reprocess all of the imaging data taken prior to July 1, 2001. A new version of the pipeline, Photo v5_4, was delivered and testing and debugging continued throughout Q1. In parallel, development continued on the software code and tools that will be used to access the DR1 data through the Data Archive Server (DAS) and the Catalog Archive Server (CAS). This effort culminated in the release of the DR1-DAS to the public at the end of the quarter.

4.1. Data Processing

4.1.1. Pipeline Development and Testing

No changes were made to the spectroscopic pipelines in Q1.

A systematic offset between model and Petrosian magnitudes of galaxies was found in the output of Photo v5_3 at the beginning of 2002-Q4. This was traced to a deep-down bug in the model-fitting code and a major effort was dedicated to finding and fixing the bug during the quarter; further details were provided in last quarter's report. A new version of Photo, v5_4, was cut and code testing and debugging continued throughout Q1. Near the end of the quarter, Photo v5_4 was declared production-ready. In addition to processing all new data with Photo v5_4, all existing imaging data collected to date will be re-processed through the new pipeline and calibrated with new flat fields. We anticipate that reprocessing will be finished by the end of August 2003.

4.1.2. Data Processing in Q1

All imaging and spectroscopic data collected through the end of Q1 were processed with Photo v5_3, idlSpec2D v4_9, and spectro1D v5_7. The DP group routinely processed new imaging data within 2-3 days and spectroscopic data within 24 hours. They also delivered a total of 106 plate designs on schedule to the UW machine shop for the monthly plate drilling runs and reprocessed existing imaging data several times to support the development and testing of Photo v5_4.

4.2. Data Distribution

4.2.1. Development of Data Distribution Systems

In Q1, considerable effort went into preparing the data and developing the interfaces to support DR1. Development of the two main interfaces that will provide the collaboration and public with access to the SDSS data continued throughout Q1. These interfaces are the Data Archive Server (DAS) and the Catalog Archive Server (CAS). Through a web interface, the DAS provides access to pixel data (spectra, atlas images, raw frames, corrected frames, binned frames), as well as color images and plots in the form of flat files. The CAS is a Structured Query Language (SQL) database of objects, loaded from the DAS files, that enables the construction of catalogs of various classes of astronomical objects.

4.2.1.1. Data Archive Server

The DAS was finished in Q1 and made available to the general astronomy community on April 4, 2003. Work in Q1 included finishing the development of several interfaces for accessing data through the DAS. These include a web interface to provide access to the DR1 binary FITS files, a finding chart maker, and an interim DAS-SQL interface. The finding chart maker produces a JPEG image, optionally with spectro and imaging objects superimposed, and a corresponding FITS image file in a selected band. The interim DAS-SQL interface provides easy access to the "target" and "best" versions of the imaging data, and to the spectroscopic data for DR1. An extensive, coordinated testing effort was undertaken in Q1 which exercised the interfaces and identified problems requiring attention. Problems were noted, prioritized and tracked to resolution via the SDSS GNATS problem-reporting database.

In parallel with work on the DAS interfaces, we finished the Data Release 1 web site, completed extensive web-based documentation to support the DR1, implemented a help desk at Fermilab to support the public's use of the data, and ran extensive stress tests on the DAS system to verify performance under heavy loads. System response time under all conditions was satisfactorily.

4.2.1.2. Catalog Archive Server

A preliminary version of the CAS was release to the collaboration for evaluation in January 2003. While the collaboration evaluated this version, bug fixes and significant enhancements were made to many aspects of the CAS. A total of 17 PRs were addressed and closed in Q1, six of which were critical/high and eight which were serious/high. In addition, CAS schema and data model changes were made to coincide with the change from Photo 5_3 to Photo 5_4, and the CAS comma-separated value (CSV) generators were updated to reflect these data model changes. Several test loads were made using Photo 5_3 outputs formatted to reflect the Photo 5_4 data model, which allowed testing of the loading process prior to the availability of actual Photo 5_4 data. Enhancements were also made to the sdssQA tool, one of the interfaces to the data contained in the CAS. In addition to addressing bugs, enhancements included redesigning the object browser and output preview interfaces, overhauling the output format handling, and incorporating and testing new sample queries. The sdssQA plotting tool was also finished and tested. Significant effort also went into improving CAS performance and query response times and developing extensive documentation to support the CAS.

The emphasis in Q1 was to deliver a finished version of the DR1-CAS, loaded with Photo 5_3 reductions and served from JHU, to the collaboration by the end of the quarter. Although this was not accomplished by the end of the quarter, it was accomplished on April 18. The emphasis in 2003-Q2 will be to transfer the CAS loading process to Fermilab and integrate it into the production operation, where the CAS will be loaded with Photo 5_4. Along the way, bug fixes and enhancement will be made by the JHU team in response to evaluation and feedback from the collaboration.

4.2.2. Status of Data Release 1

To summarize, the beta version of the DR1-DAS was made available to the general astronomy community on April 4. The beta version of the DR1-CAS was released to the collaboration on April 18. We would like the collaboration to spend three months testing and evaluating the DR1-CAS before we release the DR1-CAS to the general astronomy community. At this time, we anticipate releasing the DR1-CAS to the public by the end of June 2003.

4.2.3. Data Processing and Distribution Goals for 2003-Q2

The following goals has been established for data processing and distribution through the second quarter of 2003:

1. Begin re-processing the entire imaging dataset with Photo v5_4;
2. Integrate a new version of the spectroscopic pipeline, idlspec2D, into production operations that contains code for applying spectrophotometric corrections;

3. Continue routine processing of imaging data in order to design plates for scheduled tiling runs;
4. Provide helpdesk support for the DR1-DAS;
5. Release the beta version of the DR1-CAS to the general astronomy community in mid-June;
6. Finish the development and documentation of the software needed to load the DR1 data into the CAS SQL Server database;
7. Integrate the SQL Server database tools into the production operation at Fermilab and train the production staff in their use;
8. Begin loading the SQL Server databases at Fermilab with the full set of DR1 imaging, spectro, and tiling data;

5. SURVEY PLANNING

5.1 Observing Aids

Several programs are used to aid in planning and carrying out observations.

HoggPT is a data processing robot that reduces data from the PT and the cloud camera in real time to provide information about photometricity during a night. The software is still being tuned to handle data from the new cloud camera. A new version was installed in March.

The plate database tracks the inventory of plugplates at the mountain and information about when a plate is observed. Some minor updates were made to the plate database to make it easier for the observers to track plates and to enter information more easily.

5.2 Target Selection

No changes were made to the primary survey target selection code or algorithms. However, algorithms are being revised to work with the upcoming new major version of Photo v5_4. These revisions are all in the parameters used to select targets, not the basic algorithms themselves.

For this quarter, 106 plates were designed and drilled in three drilling runs. Of these, 20 were for the special southern equatorial survey programs. We continue to accumulate a good inventory of plates for observing throughout the year, with the exception of late spring at the end of the northern survey area and for early winter at a gap between the southern and northern areas. We expect to solve the former as further imaging data is collected.

5.3 Survey Planning

The software that is used to track survey progress that is contained in this report is also used to prepared monthly survey plans. It has been upgraded to provide a basic dark run report that lists in detail the data that were obtained and the status of their processing. This report is posted to the collaboration. The software also creates a series of metrics for data processing that show how long it takes data to be processed.

6. COST REPORT

The operating budget that the Advisory Council approved in November 2002 for the year 2003 consists of $1,800K of in-kind contributions from Fermilab, US Naval Observatory (USNO), Los Alamos National Laboratory (LANL), and the Japan Participation Group (JPG); and $3,400K for ARC funded expenses.

Table 6.1 shows the actual cost performance by project area for ARC-funded cash expenses in Q1 2003. A more complete table comparing actual to baseline performance is included as an attachment to this report.

Table 6.1. ARC-Funded 1st Quarter and Forecast for 2003 ($K)

	2003 – 1st Quarter		2003 – Total	
Category	Baseline Budget	Actual Expenses	Baseline Budget (Nov 2002)	Current Forecast
1.1. Survey Management	59	56	245	277
1.2. Collaboration Affairs	4	0	16	16
1.3. Survey Operations				
1.3.1. Observing Systems	199	141	769	729
1.3.2. Data Processing & Dist.	137	141	533	542
1.3.3. Survey Coordination	0	0	0	0
1.3.4. Observatory Support	362	362	1,447	1,447
1.4. ARC Corporate Support	25	22	189	189
Sub-total	785	722	3,199	3,201
1.5. Management Reserve	50	0	201	201
Total	835	722	3,400	3,402

6.1 Final CY2002 Expenses

Final invoices have been received for all operating expenses incurred in 2002 and final expense totals adjusted accordingly. The final value of in-kind contributions was $1,858K, which was substantially less than the forecast of $2,291K. In 2002, we required less in-kind support than we had originally anticipated. Final ARC-funded expenses were $3,244K against an approved budget of $3,425K. Approximately $19K in management reserve was used in 2002 to cover expenses associated with items not included in the approved baseline budget. These items are described in the 2002-Q4 report. The remaining $181K in unspent funds has been moved forward into future years to complete the survey and pay down unpaid invoices.

6.2 First Quarter Performance - In-kind Contributions

The sum of in-kind contributions for the fourth quarter was $473K against the baseline forecast of $466K, and was provided by Fermilab, Los Alamos, the U.S. Naval Observatory (USNO), and the Japan Participation Group (JPG).

Fermilab provided support for the data acquisition system at APO, the software programs used by the observers to operate the telescopes and instruments, and the data processing systems at Fermilab as agreed. Details of Q1 in-kind contributions are as follows:

- The level of support provided for survey management was less than anticipated in the baseline plan; administrative support for the project management office in Q1 was below the baseline forecast.
- The level of Fermilab Observing Systems Support was lower than the baseline forecast because of a data entry error. Although the actual level of effort provided for engineering support at APO was as planned, an error was made when the March efforts were reported. One individual was reported at 1% of time worked instead of 100%. This error will be corrected in the Q2 accounting report.
- In-kind support provided for Observers' Programs and DA Support consists mainly of support for the DA system at APO. The Q1 contribution was slightly below forecast and reflects the work done to improve the sky detection algorithm in the astroline software code.
- The level of in-kind support for Software and Data Processing is slightly higher than the baseline. This reflects the increase in the amount of effort that went into developing, testing, and documenting the DR1-DAS prior to public release.

Los Alamos provided programming support for the Telescope Performance Monitor and testing support in preparation of DR1. The level of in-kind support provided in Q1 was greater than anticipated in the baseline forecast because additional effort was made available to support the DR1 testing effort. This increase in effort will continue into Q2 and so the forecast has been revised upward accordingly.

USNO provided support as required for the astrometric pipeline and other software systems they maintain. Activities remain focused on quality assurance testing and support in preparation of DR1. The value of in-kind support reported for Q1 was slightly higher than the baseline due to cost of living and other salary adjustments. As salary costs will remain at this level through the remainder of the year, the forecast has been revised upward.

No in-kind support was provided by the JPG in Q1 because no support was required for the imaging camera filters or calibration system. We do not anticipate needing support in these areas through the remainder of the year. However, the forecast for Q2-Q4 still shows a forecasted in-kind contribution of $5K per quarter. The forecast is unchanged to indicate that the JPG remains committed to provide this level of support should it be required to support observing operations.

6.3. First Quarter Performance – ARC Funded Expenses

The sum of ARC-funded expenses for the first quarter was $722K, which is $63K or 8% below the fourth quarter budget of $785K.

Survey management costs were within $3K (5%) of the Q1 budget. Travel expenses related to the Office of the Project Scientist were lower than anticipated. Expenses related to ARC Support for Public Affairs were also lower than anticipated, as January AAS meeting costs were less than budgeted and there were no DR1 brochures during Q1 as anticipated. These under-runs were partially offset by the addition of a feasibility study looking into possible future uses of the SDSS infrastructure, which was not included when the baseline budget was prepared. A total of $40K was approved in Q1 for this effort, with $11K in actual expenses incurred in Q1 for computer hardware purchases, travel, and graduate student support. For the year, survey management costs are forecast to be $277K, or $32K (13%) above the baseline budget of $245K.

The budget for Collaboration Affairs provides for Working Group travel and technical page charges and is held in an ARC corporate account. No expenses were incurred in Q1. Since it is early in the year, unspent funds have been moved forward and distributed evenly across Q2-Q4. Thus, for the year, the forecast for Collaboration Affairs remains at $16K.

Observing Systems costs were $58K (29%) below the Q1 budget. Funds had been allocated to the ARC Observing Systems Support account to cover the cost of repairs or other unanticipated engineering needs that might arise over the course of the year. Since these funds were not required in Q1, the ARC budget appears underspent. Funds were also set aside in the FNAL-Observing Systems Support budget for the counterweight upgrade. A much less expensive solution has been found to mitigate the counterweight reliability concern and actual expenses were less than anticipated. The UW Observing Systems budget is underspent in part because salary costs were lower than forecast (due to personnel availability) and in part because material and supply costs were lower than anticipated. For example, funds had been allocated in Q1 for the new plug plate fixture. Since the design work is behind schedule, fabrication did not occur in Q1. These funds has therefore been moved forward into Q3 to reflect the current schedule. For the year, the revised forecast for Observing Systems is $729K, or $40K (5%) below the baseline budget of $769K.

Data Processing and Distribution costs were $4K (3%) above the Q1 budget. This is in reasonable agreement with the baseline budget. No exceptional or unusual expenses were incurred in Q1. For the year, the revised forecast for Data Processing and Distribution is $542K, or $9K (2%) above the baseline budget of $533K. The slight increase reflects increase in salary support costs at Princeton and the University of Chicago as a result of salary increases and cost of living adjustments.

Observatory Support costs were exactly in line with the baseline forecast. No unusual or exceptional expenses were incurred. For the year, the forecast for Observatory Support remains equal to the baseline budget of $1,447K.

Total ARC Corporate Support costs were $3K (10%) below the Q1 budget. Significant corporate office expenses included $10K for the Young SDSS Astronomers' Travel Fund, $2.4K for APO petty cash expenses and $7.4K for insurance. No personnel replacement costs or additional scientific support funds were used in Q1, so the balance has been shifted forward and distributed equally across Q2-Q4. The observers research support fund was also slightly underspent; the balance was shifted forward into Q2-Q4. For the year, the forecast for ARC Corporate expenses remains equal to the baseline budget of $189K.

6.4 Management Reserve

No management reserve funds were expended in Q1. As previously noted, $40K has been allocated to prepare an SDSS extension white paper. If this cost cannot be covered by funds made available by other accounts being underspent, then it will be necessary to draw down the management reserve to cover this allocation. Since it is early in the year and the current forecast for ARC-funded expenses is within $2K of the $3,200 approved budget, we are not forecasting a management reserve draw down at this time.

7. PUBLICATIONS IN 2003-Q1

Investigating the SDSS Cataclysmic Variable SDSS J132723.39+652854.29
PASP submitted - Michael Wolfe, et al

Cataclysmic Variables from SDSS II. The Second Year
AJ submitted - Paula Szkody, et al

An Initial Survey of White Dwarfs in the Sloan Digital Sky Survey
AJ submitted - Hugh Harris, et al

The Environment of Passive Spiral Galaxies in the SDSS
PSAJ submitted - Tomotsugu Goto et al

On Departures From a Power Law in the Galaxy Correlation Function
ApJ submitted - Idit Zehavi, et al

The near-IR properties and continuum shape of high redshift quasars from the Sloan Digital Sky Survey, A&A submitted - Laura Pentericci, et al

VLT+UVES Spectroscopy of the CaII LoBAL Quasar SDSS 0300+0048
ApJ submitted - Pat Hall et al.

The size distribution of galaxies in the Sloan Digital Sky Survey
MNRAS accepted - Shiyin Shen, et al

Observing the dark matter density profile around isolated galaxies
ApJ submitted - Francisco Prada et al

Angular Clustering with Photometric Redshifts in the Sloan Digital Sky Survey
ApJ submitted - Tamas Budavari, et al

The velocity function of early-type galaxies
ApJ submitted - Ravi K. Sheth, et al

The following publications are based on public data:

Low-Surface-Brightness Galaxies in the Sloan Digital Sky Survey. I. Method and Test Sample - AJ submitted - Alexei Y. Kniazev, et al

A Catalog of Compact Groups of Galaxies in the SDSS Commissioning Data
AJ submitted - Brian C. Lee, et al