Sloan Digital Sky Survey

Quarterly Progress Report

First Quarter 2001

June 10, 2001

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1. OBSERVATION STATISTICS

1.1 Summary

The first quarter of 2001 (Q1) saw routine operations. All of the observations were in the North Galactic Cap. The weather was poor in the first two dark runs, but nonetheless we set a record for number of new plates observed, and the amount of imaging data was significantly higher than in Q4 of 2000. The seeing improvements are paying off for both imaging and spectroscopy. While there is still a problem in having enough new imaging data to enable efficient tiling, the situation is much better now than it was at the beginning of last quarter. Also better is the status of the high-priority secondary calibration patches yet to be observed - this gap was narrowed in Q1. Finally, the observers are becoming more expert at minimizing the instrument and cartridge exchange time. We should also point out that our job offers to the two new observers have been accepted and we expect to be fully staffed by the end of the summer 2001 shutdown.

Problems with the u3 CCD reappeared during Q1 and affected the data in one 4-hour imaging scan. Despite the intermittent problem with the u3 CCD, it was decided to conduct imaging with the same (high) priority throughout the quarter with the notion that imaging scans would still support target selection. The PHOTO pipeline was modified in order to support processing with a defective u3 chip, and target selection was successfully completed in April with data obtained in March. Details on the u3 CCD problem are described in section 3.2. Details on the pipeline modification to compensate for the problematic CCD are described in section 2.1.1.

1.2 Time Use and Efficiency

Table 1.1 reports telescope usage in the same format as in the Q4 2000 report. Beginning with the current report we are adopting the following procedure: all spectroscopic exposures with $(S/N)^2 < 2.0$ are not counted in the "observing" category, but rather in the "weather" category, since these exposures are almost all attempts through thick clouds. This new procedure gives a fairer accounting for conditions at the mountain. In the future, we may implement a similar procedure for imaging scans, and we comment on this below.

Table 1.1 Observing Time – Q1 2001 (units are in hours)

Dark Run	13 Jan – 2 Feb	11 Feb – 3 Mar	13 Mar – 31 Mar
Scheduled dark hours	174	163	142
Hours lost to weather	100	101	39
Engineering time	-	-	-
Equipment down time	6	7	-
Setup & calibration	23	12	44
Imaging	21	25	19
Spectroscopy	24	18	40

The fraction of time exposing on the sky when possible compares favorably with previous quarters: subtracting the (modest) downtime and weather from the available time, we observed 65% of the possible time.

About 50% of the scheduled time was lost to weather, which compares to the nominal 40% expected loss rate assumed by the baseline. This understates the time lost to weather since a relatively large amount of imaging data was rejected because it did not meet seeing or photometric requirements. The reason for that circumstance is that in Q1 a high priority was placed on obtaining new imaging data; hence, the Observers were especially aggressive in making such attempts.

1.3 Status of Photometric Telescope Secondary Patches

We are approaching the halfway point concerning the secondary patches - more than 600 patches completed, out of a total of 1520. In Q1, we completed 214 patches, and the number of "not done, but high priority" patches was reduced from 51 to 13. At this rate of collecting data, we will have finished the whole sky by March 31, 2002.

1.4 Summary of Imaging Observations to Date

Table 1.2 provides the status of imaging observations at the beginning and end of Q1 - see the Q4 2000 report for a discussion of the format. We include also Q4 for comparison. Note that detailed processing has not been done (because of manpower allocations to support the Early Data Release) - the numbers here reflect projections based on only a preliminary evaluation of the imaging data collected in Q1. The 2001-Q2 report will included the revised figures since it is anticipated that data processing will be current at the end of Q2.

Table 1.3. Summary of Imaging Data to Date

	Gross	Net	Good	Unique	Footprint	Repetition Factor
North Galactic Cap						
through 2000 Oct 01	1545	1351	1138	1060	915	
through 2001 Jan 10	1826	1518	1277	1184	1014	
through 2001 Apr 1	2735	2169	1797	1618	1366	
Southern Outrigger Stripes						
through 2000 Oct 01	573	524	456	362	362	
through 2001 Jan 10	723	644	551	412	412	
through 2001 Apr 01	723	644	551	412	412	
Southern Equatorial Stripes						
through 2000 Oct 01	406	378	304	211	186	0.94
through 2001 Jan 10	569	523	435	255	222	1.13
through 2001 Apr 01	569	523	435	255	222	1.13

This table shows that we obtained 434 square degrees of new imaging data in Q1 in the "Unique" category, to be compared with 218 square degrees in Q4 of 2000. As may be expected, this gain in area reflects the telescope time in imaging mode in each of the two quarters.

Table 1.1 reports 65 hours of imaging in Q1. At the rate of 18.75 square degrees per hour, this is equivalent to 1220 square degrees. Yet, Table 1.2 shows only 909 new square degrees in the "Gross" category. The difference between these two numbers is the difference between data collected and data deemed to be processable. When the imager is mounted on the telescope, it often makes sense to attempt a scan if it is anticipated that there is a reasonable chance that cirrus will dissipate or the seeing may improve. This lost time totaled about 16 hours in Q1, and could arguably be assigned to "Weather" in Table 1.1. The ratio of unique to gross is a further measure of the fact that data was taken during marginal to unacceptable seeing. Certain strips had to be scanned more than once to obtain acceptable data for the entire stripe.

Figure 1.1 graphically shows the imaging progress in the Northern Survey Region in 2001-Q1. The main conclusion remains that despite the fact that we are officially ahead or close to par, the rate of obtaining new imaging data is not adequate (cf. the slope of the plot).

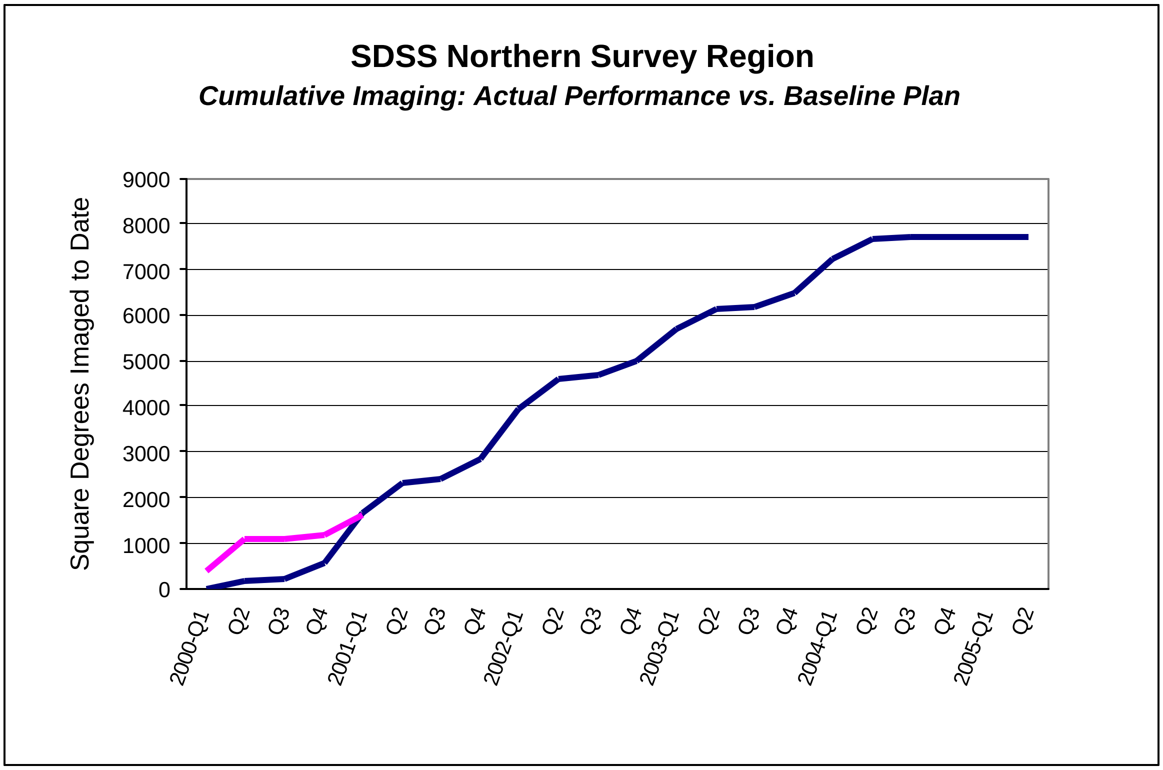

Figure 1.1. Cumulative Imaging Data vs. Baseline Plan

1.5 Spectroscopy in Q1

The total number of attempts to expose a plate in Q1 was about 110. The number of plates observed was 77. The difference in the number attempted versus the number observed is due to weather and plate availability. Sometimes a plate was repeated on different nights due to weather and sometimes a plate was repeated deliberately because new plates were not available for that particular time. We suffered this latter problem to a greater degree last quarter.

Of the 77 plates observed, 10 were already counted in previous quarters and others of them may not meet survey requirements. For subsequent discussion, we will assume that 60 new plates were obtained in Q1. We make this assumption because detailed processing has not been done (because of manpower allocations to support the Early Data Release) - the numbers here reflect projections based on only a preliminary evaluation of the number of plates observed in Q1.

Figure 1.2 graphically shows spectroscopic progress in the Northern Survey Region. Again, while we are ahead of the baseline projection, the rate at which we are observing plates is not adequate.

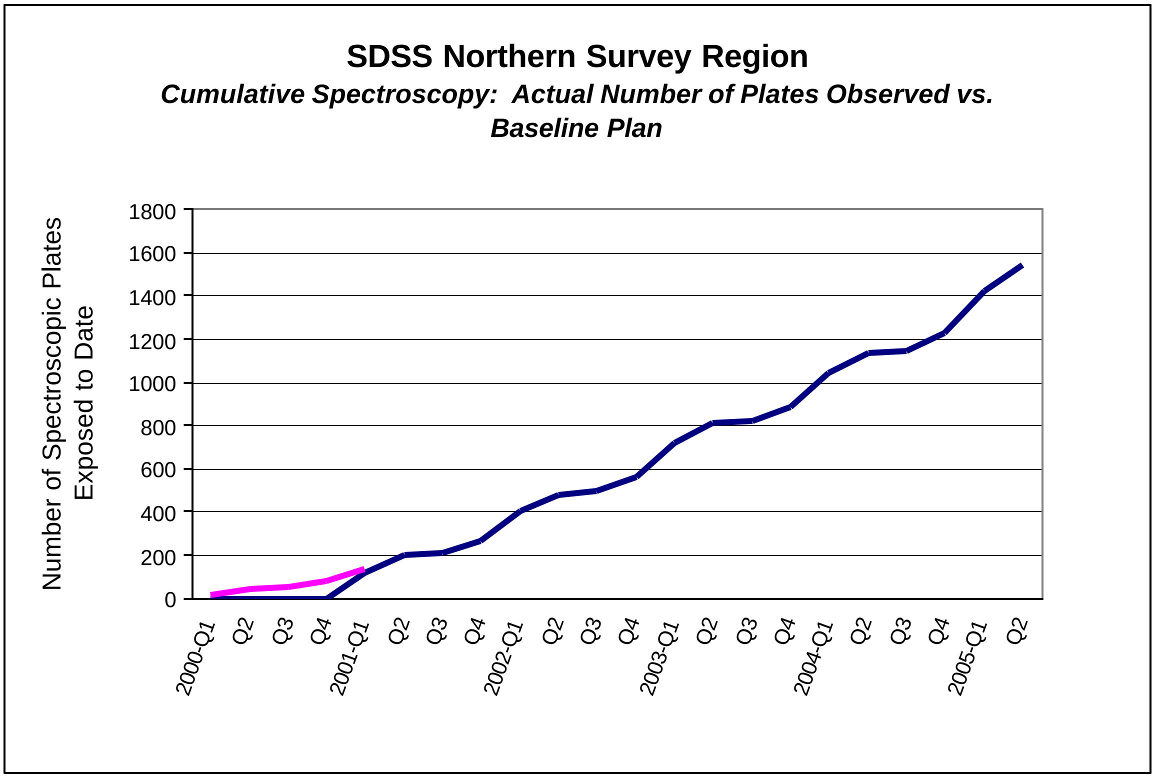

Figure 1.2. Cumulative Spectroscopy vs. Baseline Plan

1.6 Comparison to the Baseline Projection

From the preceding information, we can construct the following table.

Table 1.3. Comparison of Baseline Projection with Actual Performance - Q1 of 2001

	Imaging Hours	Spectroscopic Hours	Squares Degrees	Number of Plates
Baseline	58.2	85.5	1090.9	114
Actual	65.0	82.0	434.0	60

We conclude the following. 1) The accounting for hours matches the baseline. 2) However, the end products fell short of the expectations by a factor of 2.5 and 1.7 for imaging and spectroscopy, respectively. 3) Some of the reasons for the shortfall in the amount of imaging data collected were mentioned in Section 1.4; see also the progression from left to right in Table 1.2 in terms of acceptability of the data. In effect, the imaging hours in the baseline is the expectation for 100% good data, not the total hours spent exposing on the sky. 4) For spectroscopy, it will be possible to improve upon the factor of 1.7 with a combination of 1) better seeing; 2) exposing only to meet the minimum requirements for the S/N criterion (this will be enabled once we have an adequate inventory of plates); 3) continued progress in streamlining the procedures and strategy; and 4) allocating more time to spectroscopy once there is sufficient imaging data.

2. DATA PROCESSING AND DISTRIBUTION

2.1. Data Processing

Data processing operations at Fermilab during Q1 focused largely on processing newly acquired imaging data, running target selection and generating drill files for plug plate production, and re-processing imaging and spectroscopic data in preparation for the Early Data Release (EDR), which is discussed in Section 2.2. Some of the data included in the EDR was acquired during the commissioning phase of the survey and are affected by scattered light problems. Additionally, some of the data included in the EDR are affected by problems we have had with one of the u-band chips in the imaging camera. A significant amount of development and testing effort went into the Photometric Pipeline in Q1 to correct for these problems. Specifically, Photo development included two additional pieces of functionality to deal with instrumental problems.

2.1.1. Compensating for the Faulty u3 Chip

The u band CCD in column 3, referred to as u3, has shown intermittent behavior in which one half of the CCD does not properly record data. The Photometric Pipeline was modified to deal with this by adding code and data to the opBC file that describes the locations of bad columns in all the CCDs. The code already exists to propagate this information through the pipelines. The code is incorporated into Photo v5_3, but also has been added to Photo v5_2, which is currently running the data at Fermilab.

2.2.2. Compensating for Scattered Light

Early SDSS data were taken without the telescope being properly baffled, and scattered light is seen in the images. Since some of these data (94/125) are in the EDR, special-case code has been written using flats and biases from other runs to calculate the scattered light contribution and subtract it. This is now in Photo v5_3 and v5_2 and tested, and the EDR data have been reduced in a satisfactory manner, as shown by the QA tests.

2.2.3. Photometric Calibration

A prototype pipeline has been put together to match objects in fast and slow scan data and to measure the calibration. This works extremely well, and has been used to test the overlaps and some "Apache Wheel" data.

2.2.4. Photo v5_3

Photo v5_2 is the current production version of the Photometric Pipeline. The next version, Photo v5_3, is checked in and tested but will not be put into the production system until after the EDR. Although v5_3 is ready to go, functionality continues to be added to ensure that all fixes and enhancements are included into the new version when it is placed into production.

2.2. Data Distribution

During Q1, a partnership was established with the Space Telescope Science Institute to carry out the public release of data. The first data that will be released, the Early Data Release, consists of about 550 square degrees of imaging data and about 50,000 spectra. The imaging data consist mainly of commissioning data obtained prior to April 1, 2000. It also includes about 50 square degrees of data taken for SIRTF. The spectra were obtained from targets selected from the imaging data. The spectra were obtained in the first three quarters of 2000. The plan to distribute the Early Data Release to the US astronomy community through three web-based interfaces, each of which serves a different purpose. Details may be found in Revision 2 of the SDSS Archive Distribution Plan, which is included as Appendix 1 and can be found on the www.sdss.org website at http://tdserver1.fnal.gov/project/sdss/SurveyDocs/data-dist-plan-22.pdf.

3. OBSERVING SYSTEMS

The main activity this quarter has been work on the long-standing thermal problems with the telescope. There was a problem with the vacuum system in the camera early in the quarter that was fortunately repaired with very little loss of time. In general, the systems have been working well, and there has been steady improvement on the thermal front. We expect to have all of the Phase I thermal work completed by the beginning of the May dark run. This summer we will begin the Phase II thermal work, which involves the extensive work for dealing with very cold winter weather.

3.1. Thermal Work

Studies this past summer and fall, including taking thermal images of the telescope under working conditions, checking the optical figures of the secondary and common corrector, doing a careful inventory of power sources in the enclosure, and measuring airflow in the mirror ventilation system, led us to the conclusion that our problems with image quality were certainly thermally induced. The primary culprit was very poor airflow in the primary mirror, more than a factor of 20 below the design flow rate, which resulted in a time constant much too long to allow the mirror to equilibrate with the outside air. This situation was exacerbated by the existence of strong temperature stratification in the upper enclosure and a total power dissipation in the lower enclosure much larger than the design budget, both of which contributed to very non-equilibrium initial conditions. Some of these problems were the result of poor initial engineering design, others the legacy of our general financial and management problems in the project during the 1996-97 period, when some critical integration tasks were being carried out. The mirror airflow problems are responsible for long-lasting thermal deformations of the mirror that result in poor image formation. The power problems, in addition to contributing to the former, also are responsible for the creation of bad local 'seeing' due to heat-generated convection currents.

Once we became aware of the severity of the thermal problem we completed a series of studies and began the installation of instrumentation to allow further studies. We began working to alleviate the parts of the problem we were sure we understood. This work is nearing completion.

We have thus far:

a. Installed an extensive system of accurate solid-state thermometers on the telescope and surroundings with which we can monitor the thermal environment and the temperatures of the optical elements.

b. Reduced the air leaks in the lower enclosure by about a factor of 2. In the original design, the mirror airflow was induced by pulling a slight vacuum in the lower enclosure with a large (5000cfm) blower, but most of the flow was in the form of leaks to the outside.

c. Reduced the dependence on the lower enclosure airflow system with the installation of fast, high-pressure fans in the telescope cone. This has improved the mirror flow by a factor of 10. We still have leaks in the system and expect another factor of 2 by the time we are done, but the improvement has been dramatic. The mirror time constant is now about 2 hours. It is evident that the original flow calculations were seriously in error because constrictions in the flow in the telescope structure were not taken properly into account. The measured pressure/flow-rate characteristics are now in good agreement with calculations, but we need to improve the pressure (find and fix the leaks).

d. Removed the single largest heat load in the lower enclosure, the mirror support system pumps. The mirror supports for both the SDSS telescope and the 3.5-meter are now supplied by large-capacity screw compressors installed in the operations building supplying large holding reservoirs at the telescopes. This was augmented by the installation of a venturi pump to generate the vacuum needed by the support system, which by virtue of being an expansion device adds a significant amount of refrigeration. The result of these changes reduced the load from 9kW to about 3kW. However, since the cone fans added about 1.5kW, the net heat load in the lower level is now at approximately 4.5 kW.

e. Installed plumbing to carry away the heat from various motors in the lower enclosure using the extant ground-loop liquid system. The ground-loop pump itself was so equipped a couple of months ago and we are in the process of equipping the three remaining fractional-horsepower motors and the cone fan motors. This involves installing a heat exchanger system with the ground loop, since we do not want to bring the corrosive potassium acetate loop fluid onto the telescope. When this system is made operational, it will carry away an additional 1.5 kW.

f. Eliminated inefficient linear AC/DC power supplies in the lower enclosure and on the telescope in favor of a modern DC distribution system. When finished this work is finished during Q3, we expect to eliminate another 1 kW.

g. Contracted to change the ductwork for the existing air handling/conditioning system to eliminate the stratification problems, and to install ductwork to bring air for the thermoelectric instrument cooling system directly from the outside, which will make the instruments themselves run about 3C cooler, bringing them to the ambient temperature. This work will be done this May.

h. Contracted to install additional air conditioning to handle the very low temperatures in the winter months. The present system does not function properly below about 7C, fully 17 degrees above low winter temperatures and 10 degrees above mean winter temperatures. This will be done using commercial stand-alone freezer units; the work will be done during the summer shutdown as part of the Phase II thermal work.

i. Began investigating the replacement of the very inefficient Glentec power servo amplifiers that run the telescope with much more modern and efficient PWM units. An amplifier has been selected, but we must complete performance and noise tests this summer before proceeding.

We are not yet finished, but the situation is already dramatically improved; we can typically begin a night with the mirror in equilibrium and have done so several times in imaging mode during the last month. When we are done at the end of the summer we expect to be able to keep the mirror in equilibrium even with very sharp temperature drops and even during the dead of winter.

3.2. The Camera

At the end of last quarter, the camera developed a quite severe vacuum leak, and an emergency repair effort was mounted during the January bright time. The problem turned out to be an improperly installed O-ring coupled with a flexure problem that had been with us from the beginning. We fixed the O-ring and will address the flexure problem this summer. Since the repair the camera vacuum has been excellent.

We continue to have intermittent problems with the power supplies for the camera, and have designed a replacement for the most heavily loaded of these commercial units. A test unit has been built and works well; we are awaiting delivery of printed-circuit cards before building the rest of the power supplies.

One of the camera CCDs, the ultraviolet chip in dewar 3, has begun to show peculiar problems in which one half of the CCD intermittently fails to record data. We are very worried that it might fail altogether, and we have only one ultraviolet spare and it is of very poor quality. The engineers at SITe are helping us to try to understand what the problem is, and we must decide on a course of action before the summer shutdown, which is the earliest we can address this problem in any case. We have several possible courses of action, including trying to purchase some more detectors.

3.3. The Spectrographs

The spectrographs have been essentially trouble-free this quarter and have been very productive.

3.4. The Photometric Telescope

The JPG/JHU team has measured the filters in situ on the PT using a digital spectrometer brought from Japan. The edges of the filters are very close to where experiments with dry air flushing had indicated they should be, and new stable filters with these specifications have been ordered from Asahi Tokyo. The new filters will be installed this summer. Persistent problems with the PT filter wheel, which are currently only annoying, will also be addressed this summer; we do not wish to expose the filters in use to the environment until we absolutely are forced to do so.

3.5. Operations Software

There have been the usual set of evolutionary changes to the operations software, mostly involving bug fixes and improvements to efficiency. The system we have evolved to deal with changes and testing appears to be working well, and we have lost essentially no time to software problems.

3.6. Remaining Tasks for Next Quarter

The next quarter will take us up to the summer shutdown, during which we have a very ambitious engineering program. Before then, we expect to complete all aspects of the thermal program except for the winter air conditioning work. We also expect to complete the installation of the new automatic safety latches for the camera, the installation of a new automated lower shutter for the photometric telescope dome in anticipation of essentially hands-off operation of that instrument, and the installation the differential-image-motion-monitor seeing monitor on the 2.5-meter enclosure. We will begin work on the winter air-conditioning system but do not expect to have it finished. The first stage of the new instrument-change system, the control console should be installed, though the software is unlikely to be finished before the end of summer. We plan to aluminize the 2.5-meter secondary and PT primary during summer shutdown in July, and to that end, a new mirror-handling system is scheduled for installation on the PT in June.

4. SURVEY PLANNING

4.1. Observing Aids

One new observing aid was installed and several were updated.

1. hoggPT is a software program that processes the data from the Photometric Telescope and integrates the data from the 10-micron cloud camera to provide real-time feedback on the photometric quality of a night. At the end of a night, hoggPT reduces the data from the whole night and incorporates the end-night calibrations to inform the observers of the quality of the data from the night. The assessment of photometric quality applies equally, of course, to the 2.5-meter imaging data. The first version was delivered and installed at APO during 2001-q1. At present, only the primary stars are processed. Work next quarter will be done to process secondary patches.

2. Son of Spectro is a program that analyzes spectroscopic exposures in near-real time and determines if they have adequate signal/noise. This program has been made more robust so that it can deal with missing or bad exposures of various types that inevitably crop up in the normal course of observing.

3. The plate inventory database that tracks which plates have been observed has been enhanced so it now tracks multiple sets of exposures of plates. Several incremental improvements will be made next quarter.

4. The patch database that tracks the Photometric Telescope observing program has been enhanced so that it incorporates feedback from data processing more easily. A goal for next quarter is to add the capability to add new patches to help fill in gaps in the coverage for occasional short imager runs that don't cross existing patches.

Several programs are in various stages of development to aid in planning observations.

1. A program that tracks imaging progress has been augmented to provide more complete information for the quarterly reports and to automatically generate new observing plans. The new program generates a set of web pages that provide complete status on survey area covered with good and bad imaging data and run by run plots of seeing vs. time.

2. The plate layout program determines the exact parameters to be used for designing new plates. This program has been made easier to run. A goal for next quarter is to improve the ease of use considerably so it is more nearly automated.

3. The plate planning program helps decide which areas of sky should be imaged next in order to maximize plate availability at all times during the night. This program does not yet exist - a goal for next quarter is to create a first version.

4.2. Target Selection

The target selection code was changed to handle the set of imaging data in which one-half of the u3 CCD was bad. One such run was used for target selection.

61 new plates were designed and drilled, covering two "chunks" of the northern survey area.

5. COST REPORT

The approved SDSS project budget for 2001 consisted of two parts: $1,909K for Fermilab, US Naval Observatory (USNO), and Los Alamos National Laboratory (LANL) expenses, which are paid by these institutions and counted as in kind contributions; and $4,004K for ARC funded expenses. Actual ARC funded expenses in the first quarter were $744K against a baseline of $901K. The ARC funded budget is summarized in Table 3.1, which compares first quarter and annual expenses against the baseline. A more complete table comparing actual to baseline performance is included as an attachment to this report.

As noted in previous reports, final first quarter expenses were not available for all of the institutional budgets at the time this report was prepared, due to variations in the timeliness of the accounting systems for the various institutions performing work for the SDSS. In these instances, first quarter expenses have been estimated to the best of our ability. The reported expenses will be revised as final invoices are received from the supported institutions.

Table 3.1. ARC-Funded 1st Quarter Expenses and Forecast for 2001 ($K)

	2001 – 1st Quarter		2001 - Total	
Category	Baseline Budget	Actual Expenses	Baseline Budget	Current Forecast
1.1. Survey Management	56	36	274	251
1.2. Collaboration Affairs	0	0	0	0
1.3. Survey Operations				
1.3.1. Observing Systems	281	240	1,095	1,144
1.3.2. Data Processing and Distribution	195	155	696	684
1.3.3. Survey Coordination	0	0	0	0
1.3.4. Observatory Support	330	302	1,320	1,292
1.4. ARC Corporate Support	39	11	167	167
Sub-total	901	744	3,553	3,538
1.5. Management Reserve	97	0	447	447
Total	998	744	4,000	3,985

5.1 First Quarter Performance - In-kind Contributions

The sum of in-kind contributions for the first quarter was $555K and was provided by Fermilab, Los Alamos, and USNO. Fermilab provided support for the data acquisition system at APO, the software programs used by the observers to operate the telescopes and instruments (the "Observers' Programs"), and the data processing systems at Fermilab as agreed. In the budget table attached to this report, the forecast for the in-kind value associated with SSP61, FNAL Observers' Program and DA Support, is significantly higher than the baseline. This is because the value of the in-kind effort was not included when the 2001 baseline budget was prepared in November 2000. Fermilab provided the agreed upon level of support for survey management and for data processing operations, and a higher than agreed upon level of effort to support the Observing Systems. The additional effort associated with the Observing Systems included continued development work on the slip detection system; work to improve the thermal environment around the telescope; work on the new instrument latch controller and PLC-monitored instrument change system, and work to implement a project-wide drawing control system. As the latter three projects reflect an increase in the scope of work for Fermilab, the expected value of in-kind salary costs has increased, as shown for SSP42 in the attached budget table. Los Alamos provided programming support for the Telescope Performance Monitor and observing support for the Photometric Telescope as agreed. USNO provided support as required for the software systems they provided and now maintain. As these systems are mature and stable, the level of support required in the first quarter was 45% less than anticipated.

5.2. First Quarter Performance – ARC Funded Expenses

The sum of ARC-funded expenses for the first quarter was $744K, which is $157K below the first-quarter budget of $901K.

Survey management costs were less than the Q1 baseline mainly because software testing and validation in support of the Early Data Release did not start at JHU and UW as early as planned. In addition, the agreement between JHU and ARC for this work was still being negotiated at the time that the baseline was prepared. As a result, the baseline budget for this work at JHU is higher than what was allocated in the end. This cost reduction was slightly offset by higher than budgeted costs for Survey Management support at Fermilab in Q1. These costs were associated with increased travel by the Project Management office to help develop the plan and schedule for the work associated with the Early Data Release. For the year, the current forecast for Survey Management costs is $24K below the baseline.

No ARC funds were allocated to support Collaboration Affairs in the baseline budget and no costs were incurred in this area during the first quarter.

Observing Systems costs were below the first quarter budget by $41K. The budget to support the work associated with improving the thermal environment around the telescope is held in the ARC budget for Observing Systems Support. Costs incurred in the first quarter were associated with the purchase and installation of a new compressed air system to replace the primary mirror support system pumps that dumped excessive heat into the telescope enclosure. Engineering work was performed in Q1 to design an improved cooling system for the 2.5m telescope enclosure and to modify existing enclosure ductwork to reduce stratification, but the procurement and installation activities will occur in the second quarter. Accordingly, the funds for this work have been moved forward into the second quarter. The Fermilab budget for Observing Systems support was underspent partly because design and engineering resources were not available to work on the telescope drive amplifier replacement project. Since no design work was done, no procurements were made. This work is now planned for the second and third quarters and the budget moved forward accordingly. The UW budget for Observing Systems support was underspent in Q1 partly because of the postponement of work on a tooling fixture to improve the efficiency of plug plate drilling operations. The design and procurement work on the tooling fixture were postponed and the engineering resources deployed to work on tasks associated with improving the thermal environment around the telescope in order to improve image quality.

Data Processing and Distribution costs were $40K below the first quarter budget. The baseline plan for 2001 called for hiring an additional data analyst at Fermilab to support data distribution activities. Fermilab was not able to find a suitable candidate for this ARC-funded position in the first quarter and so funds allocated to fund this position went unspent. As of this date, no offer has been made and the search continues. A similar situation occurred at Johns Hopkins. Funds were allocated to hire a computer professional to replace the individual who left the project in mid-March. Our intent was to bring the replacement individual on-board before the existing person left, in order to more efficiently transfer knowledge, and the funding profile was set accordingly. Fortunately, a suitable candidate has been identified to fill the position and he will start around June 1. As a result of the later than anticipated start date, the funds allocated to support the JHU position went unspent in the first quarter.

Observatory Support costs were $28K below the first quarter budget. Two positions were created at APO to replace the two observers who left the project in the fall of 2000. Anticipating that these positions would be filled, the budget for 2001 contained the payroll for all seven of the observers stationed at APO. While both positions have been filled, the individuals were not on the payroll in the first quarter pending the processing of their work visas. The resulting payroll “savings” was partially used for travel and incidental expenses for the two new observers to visit the site while their immigration paperwork is in progress.

ARC Corporate Support costs were $28K below the first quarter budget. Funds are held in the ARC Corporate account and distributed evenly throughout the year to support personnel replacement costs. These funds were not needed in the first quarter and so they have been redistributed in quarters 2-4. In addition, funds are held in the ARC Corporate Support budget under the category “Additional Scientific Support” to provide for additional scientific support when needed to work on specific problems or areas of concern. This budget is also spread evenly throughout the year in the baseline plan. Since no support was required in the first quarter, the funds have been redistributed evenly in quarters 2-4.

No management reserve funds were distributed in the first quarter and so these funds have been moved forward by distributing them equally in quarters 2-4.

6. PUBLICATIONS

Photometric redshifts from reconstructed QSO templates
AJ submitted - Tamas Budavari, et al.

High-Redshift Quasars Found in Sloan Digital Sky Survey Commissioning Data VI.
AJ accepted - S. Anderson, et al.

Broad Absorption Line Quasars in the Sloan Digital Sky Survey with VLA-FIRST Radio Detections
AJ submitted - Kristen Menou, et al.

SDSS Color Separation of Galaxy Types
AJ submitted - Iskra Strateva, et al.

Composite Quasar Spectra From the Sloan Digital Sky Survey
AJ accepted - Daniel E. Vanden Berk, et al.