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AUTOMATIC TELESCOPE INSTRUCTION SET 1993

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I. INTRODUCTION

The Automatic Telescope Instruction Set is an interface language which provides a means for controlling unattended astronomical telescopes and the recovery of data generated by those telescopes. ATIS is intended to allow the capabilities of various automated astronomical instruments to be utilized by the community of astronomers. ATIS allows expansion to include new capabilities as they are developed by the designers and users of automatic telescopes.

II. TERMS AND ACRONYMS

To understand ATIS it is necessary to define some terms and acronyms used in this document.

The term *Automatic Photoelectric Telescope* (APT) has been in use for some time to refer to telescopes which are capable of taking photometric observations under computer control. This definition has become too restrictive as ATIS is growing to include other forms of instruments.

The term *Automatic Telescope* (AT) will be used in this document will refer to any telescope which can be pointed under computer control, the telescope control computer, and the associated instruments which are also under computer control. The term *telescope* is not restricted to optical telescopes, although instructions for non-optical telescopes have not been included in this version of the standard. It is the AT's responsibility to execute the instructions which it receives which are within the capabilities of the telescope and instrument. The AT software is expected to reject any instructions which could damage the telescope or instrument or are outside of its capabilities and to continue with acceptable operation.

The term *Principal Astronomer* (PA) is commonly used to refer to the person responsible for an astronomical project. In ATIS, the PA is the human responsible for the proper operation of an automatic telescope. The PA is responsible for scheduling the telescopes time, arbitrating users requests for observations when there are conflicts, and to try to insure that the AT is meeting whatever objectives have been set forth for its operation. The PA may have the additional requirement of assuring the performance of the telescope by scheduling measurement of standard objects and other specialized test measurements.

The term *User* is used to refer to the persons who originate requests for observations on an AT. The user is usually the ultimate recipient of the data from an AT, either in raw or reduced form. It is assumed that a user also has computers and the term "user" includes the user's computer. The user has the responsibility to determine the science to be accomplished, to decide on appropriate observations required to accomplish the scientific objectives, to analyze the data, and to archive the data received from the AT's.

The term *Principal Astronomer's Computer* (PAC) is used in ATIS to refer to the computer, under the supervision of the PA, which generates ATIS files to be sent to an AT and receives the files generated by an AT. Additional tasks may include transmission

of the data, automatic reception of requests from users, scheduling optimization, data reduction, performance monitoring, and transmission of results to users.

The term *Network Principal Astronomer* (NPA) and the associated Network Principal Astronomer's Computer (NPAC) are used to refer to a human and the associated computers which coordinate observations between various PAs. This arrangement is used for networks of automatic telescopes such as the Global Network of Automatic Telescopes (GNAT). Network PAs are a lot like users in that they are not directly responsible for the operation of any particular telescope. The mission of a NPAC is to coordinate observing time between various PA/PAC's in order to achieve the goals of networks of users.

The terms above only refer to functions and not to specific people or computers. The same computer could, for example, be both a PAC and an AT controller. A PA may also be a user. A PAC or NPAC could consist of many computers.

ATIS files link users to PACs, PAC's to AT's, and PAC's to NPAC's. In other words, ATIS may be used for transmitting request for observations from users to the computer of the astronomer responsible for a given telescope, for sending reduced data back to the users, for the communications between the principal astronomer and the telescope, and for networking between telescopes through network control centers.

ATIS is not software, but software is required at all stages to handle ATIS files. Users are encouraged to share software for all areas of ATIS including user file generation, schedulers, telescope control, data reduction, FITS image manipulation and reduction, data analysis, and accounting. Appendix (A) contains a list of accessible sources of software related to ATIS and items of general interest for automated telescope operation.

III. USER TO PAC TO AT

III-A. The Principal Astronomer's Computer to Automatic Telescope Link

In the link between a PAC and an AT, ATIS links one telescope (an AT) to the individual responsible for the operation of that particular telescope (the PA). In this link, ATIS does not carry information about the scientific relevance of the requests. ATIS states how an automated telescope reacts to a given instruction, but the details of how the telescope executes the instruction are not defined. It is assumed that the operation of the telescope will be totally automated. The level of automation used in the generation of ATIS input files and the reduction and storage of ATIS output files is determined by the PA. ATIS allows the PA to design observing programs with adjustable levels of control and priority; and can leave the telescope control system the freedom to adjust for variable execution time or interruptions of the observations caused by clouds or other conditions, or it can exercise complete and exact control.

An attempt has been made to keep the statements in a form not unlike those which an astronomer might pass to a human telescope operator who knows how to operate the telescope but who has no knowledge of the scientific goals of the astronomer. This does not make compact files, but simplifies the debugging of problems. Standard compression programs can make ATIS files compact. It is not expected that

humans will directly generate ATIS files directly with an editor, although it could be done.

ATIS is designed to grow to allow added capabilities desired by users. If a capability is needed within ATIS which does not exist in the standard, users are encouraged to add these capabilities to their particular project. If these capabilities might be of use to others in the astronomical community users are encouraged to submit these modifications as proposed standards for future ATIS revisions. The users of ATIS should remain in control of what is placed in the standard. The ATIS standard should be revised no more frequently than once per year and is suggested that ATIS revisions carry the year as a reference to the revision. The original version of ATIS was published in 1989 and will be referred to as ATIS89. This version will be referred to as ATIS93.

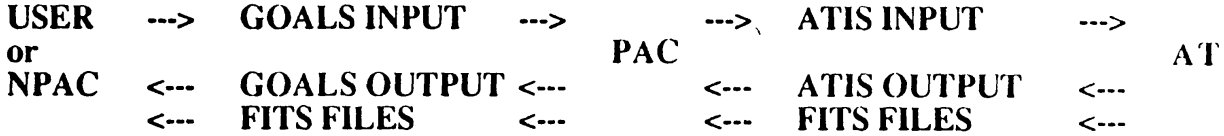
Capabilities added in ATIS93 which were not in ATIS89 include improved time scheduling, the provision for real time interaction between the PAC and the AT, statements for communications between users and PAs, and statements for operating instruments containing CCD detectors.

III-B. The User to Principal Astronomer's Computer Link

This portion of ATIS is completely new in ATIS93 and should be considered experimental. It is referred to as the Goal Oriented Astronomical Language (GOALS). It is designed to provide a means for users to express their requests for scientific observations to a PA (or to the surrogate PAC). It also provides a means to return the results of the observations in a meaningful way to the users. At the time of this standard, there are no users currently using this portion of the standard. The primary reason for providing this section was to remove some of the burden of detailed interaction between the PA and the users and to allow the design of an effective scheduler by providing a language for stating astronomical goals in a semi-formal manner.

IV. GENERAL CHARACTERISTICS OF ATIS

It is assumed that ATIS will exist as files in computers associated with the PA and with the telescope. These could be in the same computer, but usually are not. ATIS does not define how the information in these files is transferred between the computers. ATIS could be implemented with the transfers taking place manually by moving files on disks or tape through the mail. More typically, the transfer of data will be through data communication links by dial modem or wide area networks such as the Internet. There are generally four kinds of ATIS files as shown in this diagram:



ATIS is the general term for all four file types described below:

ATIS INPUT files carry instructions on objects to be observed, the detector and filter combinations to be used, the sequence of observations. It also has a set of statements to determine the time windows and priorities for selecting specific objects to be observed.

ATIS OUTPUT files carry a detailed record of the sequence of observations and carry either the raw data or pointers to files carrying the raw data. For an AT to be considered an ATIS compatible system it is mandatory that it can receive ATIS files, execute them, and generate ATIS output files, but it does not have to be fully automated.

GOALS INPUT files carry information from users to PAs concerning their requests for observations. These requests differ from ATIS INPUT files in that they provide more general statements about the frequency, distribution, and total quantity of observations to be made. They also provide information on the desired precision of the returned results.

GOALS OUTPUT files typically carry reduced data or pointers to data files. They also can carry accounting and auditing information.

ATIS input files have the following structure:

Header	Statements about the date, site and telescope and instrument.	
Advice	A linked list of statements of group selection criteria based on time dependent or certain testable conditions. Advice statements are optional and are normally generated by automatic schedulers.	
Group	Sequences of logically related statements consisting of:	
	Headers	Group selection criteria and sorting information.
	Controls	Statements which cause actions in the telescope or instrument.
	Comments	Generated by the P.A.
	End of group	An end of group marker Group
End of File		

ATIS output files have the following structure:

Header	Statements about the date, site and telescope,and instrument	
Group	Sequences of logically related statements consisting of:	
	Headers	Group identification and sorting information.
	Controls	Statements about the actions performed by the telescope or instrument.
	Comments	Generated by the PA or the telescope controller
	Results	Data and pointers to data files.
	End of group	An end of group marker Group

End Of File

Two optional temporary files are defined which are to be used only to monitor or modify an ATIS file on a particular night. These temporary files are called partial input and partial output files. These files are simply portions of an ATIS Input and Output file which are transmitted separately from the main files.

IV-A. FITS Files

The data for simple detectors is contained in the ATIS output file itself. Additional auxiliary files are used to carry output data from multi-element detectors such

as CCD's. These files use the "Flexible Image Transport System" (FITS) format for the storage. ATIS input statements request the generation of these files and the ATIS output statements carry information on the sequence of events related to the generation of these files.

IV-B. File Name Conventions

The following file naming conventions are recommended but not required by ATIS. These names are acceptable to a wide variety of computers and allow the telescopes and the reduction programs to recognize and sort files. All information used in the file name is also carried in the file data itself, so the file names are for convenience only. Defined file names are:

	PAC to TELESCOPE	TELESCOPE to PAC
ATIS file	INNJJJJJ	ANNJJJJJ
Partial files	RJJJJJXX	GJJJJJXX
Where :	NN	is the telescope number
	JJJJJ	is the last 5 digits of the JD.
	XX	is a two letter sequence AA AB ... ZY ZZ

Additional rules for FITS file naming conventions are found at the beginning of the 500 series statements. The following rules are assumed for the use of these files.

IV-C. ATIS Input Files (Required)

A telescope controller is expected to check for the presence of a file named INNJJJJJ at periodic intervals. The period is not specified in ATIS but would typically be at the beginning of the observing period for simple systems and after each group for networked telescopes. If a file exists with JJJJJ as defined in the 101 statement below, it will replace the current file in the telescope controller. If no file exists at the beginning of the observing period with a matching JJJJJ and an input file with the name INN00000 exists it will be executed. Input files with JJJJJ not equal to 00000 are will not be accessed again after they are loaded for execution allowing new files with a current JJJJJ to be transmitted during the night to replace an existing file. Archives of ATIS input files will typically be kept only by the P.A. if at all. New files with the name INN00000 transmitted during an observing night will not be executed until the next observing period.

IV-D. ATIS Output Files (Required)

The ATIS output file is generated during the actual observing period. One telescope will generate only one ATIS output file per 24 hour period and it will carry the JJJJJ number of the date on which the file was created. How frequently ATIS output files are updated or partial ATIS files are transmitted to the PA is not defined. The ATIS output file could be communicated to the PA character by character in real time or many nights of ATIS files could accumulate before transmission takes place. The mechanism for the transmission is not defined by ATIS. These files are expected to be a permanent record of the raw scientific data and should only carry information which may be of scientific interest in the understanding of the results. Diagnostic information, if provided, should be carried in auxiliary files which are not presently defined by ATIS. Archiving by the P.A. and at least temporarily by the telescope controller is recommended. The user is ultimately responsible for the proper archiving of the results.

IV-E. Partial Input Files (Optional)

Partial input files are temporary files which allow modification of an ATIS input file during its execution. They consist of either complete groups or advice statements. The JJJJJ must match the file being currently executed and they must be "installed" in the telescope controller in sequential order. The frequency of transmission of these files is not defined by ATIS.

IV-F. Partial Output Files (optional)

Partial output files help provide mechanism for implementing quasi real time interaction between the PA and the telescope when continuous communication channels are not available. When implemented, the telescope generates partial files in addition to the normal ATIS output file. The data in each file would typically be one group but this is not an ATIS requirement. It is required that when all of partial groups are concatenated in sequence, the complete ATIS output file is reproduced. When continuous communications channels are available, partial output files are unnecessary as the ATIS output file may be transmitted character by character or line by line to the PA.

IV-G. FITS Files

When the data generated by automatic telescopes would be unwieldy to include in the ATIS output, or where ASCII text is unsuitable to carry the information, the standard is to utilize a FITS file to store the data. FITS format is defined elsewhere. ATIS does not define when or how these files will be transmitted to the P.A. but, carries pointers in the form of filenames to the existence of the FITS files.

IV-H. Structure of an ATIS file

ATIS files consist of statements consisting of lines of ASCII characters. Lines consist of space delimited parameters. Each line is terminated in an end of line character or characters which is not defined by ATIS except to state that the end of line character should be native to the computer in which the file resides. Translation of files to this native state should always be the responsibility of the receiving computer. Many file communication protocols do this translation automatically. File compression may also be used, but this is not defined by ATIS. ATIS defines four parameter types. They are integer, real, string, and text.

INTEGERS are whole decimal numbers whose range is appropriate for the parameter being measured. They may be negative where appropriate. Zero is recommended for dummy integer parameters. In handling negative declinations in a form commonly used by the astronomical community, the integer "-0" carries information and is different from the integer "0". For example, a declination or latitude of "-0 0 29" should be considered a valid input in ATIS93 and should be correctly interpreted. Software will probably handle the "integer" parameters as string characters, but that is up to the person writing the software.

REAL numbers are decimal numbers with a decimal fraction. They are required to have a numeric character before and after a decimal point. They may be negative. The precision should always be reasonable for the particular parameter. Exponential notation is not allowed. Recommended dummy values are 0.0 and 99.9 selected to minimize confusion

STRINGS are defined as a series of up to 20 printable ASCII characters. A space is NOT acceptable within an ATIS STRING parameter as it is the parameter delimiter. It is general practice to use an underscore character "_" to represent a space within an ATIS STRING. A single underscore is recommended as the dummy or null parameter.

TEXT is also a series of ASCII characters. It differs from type STRING in that it may have any number of characters (while not violating the total line length requirements). There can be only one TEXT parameter on a line and it must be the last parameter of the line. The TEXT parameter is considered to contain all remaining characters on the line up to the end of line character(s). Zero characters is used as a dummy or null parameter. A TEXT parameter can be thought of as an undefined number of STRING parameters.

All ATIS parameters should follow these two simple guidelines:

All devices which generate ATIS parameters should restrict the range and precision of each parameter to meaningful values and should adhere closely to the format specifications.

All devices which receive ATIS parameters should be made robust such that errors in the file will not result in system failure and should be generous in the acceptable ranges for parameters.

IV-I. ATIS Statements

Every ATIS statement is made up of one identifier line and zero or one information lines.

Identifier lines always consist of a single integer in the range of 100 to 999 followed by an end of line delimiter. The integer will indicate whether there will be an information line following.

Information lines have a variable number of parameters and variable length. The parameter format is determined by the preceding identifier line. Information lines always have 80 or less characters not including the end of line delimiter. The existence of a particular parameter may be optional, but where an optional parameter exists, all preceding parameters must be present. The meaning of a parameter may also be variable, but the meaning can always be determined from previous parameters within the same line.

V. THE ATIS STATEMENT SET

The Following identifier lines are defined in ATIS93.

100 SERIES - GENERAL - telescope movement and aperture photometry

101 FILE HEADER	Information common to all groups
102 FILTER DETECTOR DATA	Information about a photometer
103 GROUP HEADER	Group identification and selection criteria
104 STAR	Identification of a particular object
105 MOVE	Point the telescope at specified coordinates
106 ACQUIRE	Find and center a point source
107 PHOTOMETER INSTRUCTION	Take an integration through a filter
108 SITE JULIAN DATE	Julian date of the file
109 PHOTOMETER RESULTS	Records the result of a single integration
110 COMMENT	Error statements or pass-through comments
111 SKY	Identifies a sky position reading
112 DARK	Identifies a dark position reading
113 - 114	NOT ASSIGNED
115 END OF GROUP	Defines the end of a group list.
116 ADVICE ON GROUP SELECTION	Alternate group header selection criteria

200 SERIES - ENVIRONMENT - control, measurement, and information

201 SET ENVIRONMENT	Pass an instruction to the site controller
202 GET ENVIRONMENT	Gather most recent data from sensors
203 REFERENCE	Link ATIS to published references

300 SERIES - GOALS INPUT - statements for setting astronomical goals used primarily in user to PA communication.

301 USER NUMBER	A unique user identifier
302 USER TO PA SEQUENCE NUMBER	Used to verify reception of all files
303 JD OF REQUEST	JD + Fraction when file was generated
304 USER MAILING ADDRESS	For PA to User mail contact
305 USER BILLING ADDRESS	For use on contract operated instruments
306 USER TELEPHONE NUMBER	For PA to User voice contact
307 USER EMAIL ADDRESS	For PA to User Email contact
308 USER MODEM NUMBER	For PA to User dial-up modem contact
309 USER INTERNET ADDRESS & PATH	For direct PA to user File transfer
310 OBSERVE GROUP BY PHASE	Set period, start & end phase, density
311 OBSERVE GROUP PERIODIC	Set frequency, density, and scatter
312 OBSERVE GROUP LOG RANDOM	Set minimum time, distribution
313 OBSERVE GROUP TIME WINDOW	Set JD,LST,UT
314 OBSERVE IF S.E.M.	Check Standard Error of Mean of observation.
315 OBSERVE IF DELTA MAGNITUDE	Check differential magnitude of observation.
316 OBSERVE IF SEEING	Check seeing conditions in guide camera.
317 MAX NUMBER OF OBSERVATIONS	Quit Observing if sufficient data
318-319	NOT ASSIGNED
320 FORM A GROUP	Generate a group from previous statements
321 RETURN DATA FORMAT	Request reduced or raw data
322-329	NOT ASSIGNED
330 OBSERVING SEQUENCE	Set sequences of objects and F.D.I.s
331 FDI SEQUENCE	Filters, detectors, & Integration Time
332-339	RESERVED
340 DEFINE GOALS OBJECT	Define group using the 100 series statements
341 END GOALS OBJECT	Set the end of a 340 statement

400 SERIES - GOALS OUTPUT - reduced photometric data. Used primarily for PA to user communication.

401 USER NUMBER	The unique user number
402 PA TO USER SEQUENCE NUMBER	Used to verify reception of files
403 JD OF RESPONSE	JD and fraction when file was generated
404 REQUEST REJECTION	Acceptance or rejection of each group
405-409	NOT ASSIGNED
410 REDUCED DATA	Return data in reduced form
411-419	NOT ASSIGNED
420-429	NEVER DEFINED - For custom output format
430 EXTINCTION DATA	Information on nightly extinction
431-434	NOT ASSIGNED
435 TRANSFORMATION DATA	Information on measured transformation values
434-439	NOT ASSIGNED
440 FILTER DETECTOR STATISTICS	Nightly statistics on each filter-detector
441 TELESCOPE STATISTICS	Nightly statistics on each telescope
442 HOURLY STATISTICS	Hourly statistics on general performance
443-449	NOT ASSIGNED
450 ACCOUNTING INFORMATION	Observing time statistics and totals

500 SERIES - CCD IMAGING - control and data handling

501 CCD DETECTOR	Define the camera characteristics
502 TAKE BIAS FIELD	A macro to take a bias field
503 BIAS FIELD DATA HEADER	Set up a FITS file for bias data
504 CLEAN CCD	A macro to clear the CCD
505 PREFLASH CCD	A macro to control preflashing
506 OPEN SHUTTER	A low level command to force the shutter
507 CLOSE SHUTTER	A low level command to force the shutter
508 TAKE FLAT FIELD	A macro for flat field with lamp control
509 FLAT FIELD DATA	Set up a FITS file for flat field data
510 TAKE IMAGE	A macro to take an image field
511 IMAGE DATA	Set up a FITS file for image data
512 ACQUIRE OBJECT	A macro for acquiring and offset guiding
513 TAKE DARK FIELD	A macro to take a dark field
514 DARK FIELD DATA	Set up a FITS file for dark field data
515 CAMERA TECHNICAL DATA	Info about voltages, hot pixels etc
516 FILTER DATA	Filter selection and information

VI. ATIS PARAMETER FIELDS

In the following descriptions of the ATIS parameter fields, separate statements are made for ATIS input and output files which indicate where the source of the data comes from. The following words are used.

required	The parameter must always be provided.
echoed	The parameter is repeated exactly as in the input file
set/reset	The parameter may be modified by the control system
optional	If an optional parameter is used it must be of the specified type and all preceding parameters must exist at least as dummy parameters.
never	The parameter never exists in this file.
tested	The parameter is tested against stored data. Aborts the group on mismatch.

VII. 100 SERIES - GENERAL

101 FILE HEADER

The FILE HEADER contains information which identifies the equipment and program and information about the site which is passed through to the reduction program. This statement must only occur once in an ATIS file.

IDENTIFIER: 101
INFORMATION:

	name	type	input	output
1	Observing Program Number	integer	required	echo
2	Site Number	integer	required	tested
3	Telescope Number	integer	required	tested
4	Reduction program	integer	required	echoed
5	Night Start Hour	integer	optional	set/reset
6	Site Latitude Degrees	integer	optional	set/reset
7	Site Latitude Minutes	integer	optional	set/reset
8	Site Latitude Seconds	integer	optional	set/reset
9	Site Longitude Degrees	integer	optional	set/reset
10	Site Longitude Minutes	integer	optional	set/reset
11	Site Longitude Seconds	integer	optional	set/reset
12	Observing Program Name	text	optional	echoed

Example:

```
101
3 1 3 1 0 31 41 2 -110 52 38 RS CVN Vanderbilt University Cool Star Study
```

Where:

Observing Program Number is the number, for a given site, that uniquely identifies an observing program.

Site Number is the number assigned to the site. Appendix (A) contains information on how to access the current list of sites.

Telescope Number is the number assigned to a telescope at a particular site. A telescope consists of all instruments which must point together to a single position simultaneously. Where this is not the case, separate telescope numbers should be assigned.

Reduction Program Number is the number assigned to various types of reduction programs to be used. The defined types are:

1	Differential photometry (including quasi-all-sky photometry for quality control) without special extinction and standard stars.
2	Differential photometry with specially selected extinction and standard stars for quality control.
3	Full all-sky photometry.
4-89	Reserved for future ATIS assignment
90-99	Never defined by ATIS. Defined by individual PA's.

Night Start Hour is the integer hour of Universal Time which, in conjunction with the 108 statement, defines the time of the beginning of an AIS file. This number should not change from night to night.

Site Latitude and Longitude. By IAU convention, longitudes west of Greenwich are negative.

Observing Program Name is set by the Principal Astronomer as a reminder.

102 FILTER DETECTOR DATA

The FILTER DETECTOR DATA for each neutral density filter + color band filter + detector combination. These are mean (default) values based on recently gathered data. It is included to assist in determining telescope performance, assisting in reduction programs, and in setting acquisition thresholds.

IDENTIFIER : 102
INFORMATION:

	name	type	input	output
1	Neutral Density Filter	integer	required	echoed
2	Color Band Filter	integer	required	echoed
3	K Prime	real	required	echoed
4	K Double Prime	real	required	echoed
5	Zero Point	real	required	echoed
6	Epsilon	real	required	echoed
7	Coincidence Coefficient (t)	integer	required	echoed
8	Bright Limit	real	required	echoed
9	Detector number	integer	optional	echoed

Example:

```
102
1 3 0.143 -0.008 -14.273 -0.013 35 5.52 3
```

Where:

Neutral Density Filter is a reference number of a filter or combination of filters which primarily attenuate the light.

1	No neutral density filter (clear)
2	The least dense neutral density filter
3-N	Other neutral filters in order of increasing density

Color Band Filter is a reference number to a filter or set of filters which at least partially defines the spectral response of the system. Assigned filter numbers are:

U=1 B=2 V=3 R=4 I=5	(Johnson/Bessell)
u=6 v=7 b=8 y=9	(Strömgren)
H-beta wide=10 H-beta narrow=11	(hydrogen beta)
H-alpha wide=12 H-alpha narrow=13	(hydrogen alpha)
clear=14 opaque=15	
short pass (1mm BG18) =16	(used in acquire)
long pass (1mm GG495)=17	(used for red leak)
reserved 18 - 19	
low alias broadband filters 20 - 29	(Young)
infrared filters 30 - 39	(Wing)
reserved for future ATIS standards 40 - 80	
never defined by ATIS 90 - 99	(user defined)

The telescope controller may use a lookup table to correlate filter number with a filter location, so the numbers assigned have no necessary relation to physical filter positions. Which combinations of NDFs and color filters are allowed on a particular telescope is not defined by ATIS but must be known by users and PAs.

k' is the previously calculated primary extinction coefficient for this filter + detector combination.

k" is the previously calculated secondary (color term) extinction coefficient for this filter + detector combination.

Zero Point is the previously calculated magnitude offset that transforms the instrumental magnitudes to the standard system (or each color band-NDF-detector combination).

Epsilon is the previously calculated first order color correction term used in transforming instrumental magnitudes to the standard system for this filter + detector combination. The reference color index is not stated in the ATIS file, but must be documented for the particular telescope and reduction program.

Coincidence Correction Coefficient (t) is the effective nonlinearity correction coefficient used to correct counts per second using the equation N=n/(1-10^-9*t*n) where t is the correction parameter in nanoseconds, n is the raw counts/second and N is the corrected counts per second. This equation is used to correct for pulse coincidence error (dead time) in photon counters. As other nonlinearities may exist this equation should not be used if it doesn't fit the detector characteristics. In those cases this parameter should be set to zero and the correct equation and coefficients documented using the 203 statement. Bright Limit is the magnitude in the specified bandpass of the brightest star that may be safely or accurately observed through a given NDF-filter-detector combination.

Detector Number is an optional sequential order of each detector in a multiple detector system. If relevant, the ordering is by wavelength of peak response. New in ATIS93.

103 GROUP HEADER

The group header contains the information used to determine which group is selected for observation. The group header provides information which is used to select which group will be selected next. Additional group selection criteria are provided by the 116 statement.

IDENTIFIER: 103
INFORMATION:

	name	type	input	output
1	Group Number	integer	required	echoed
2	Group Type	integer	required	echoed
3	User Number	integer	required	echoed
4	Start JD	integer	required	echoed
5	End JD	integer	required	echoed
6	Start LST	real	required	echoed
7	End LST	real	required	echoed
8	Number of Observations	integer	required	set/reset

9	Priority	integer	required	echoed
10	Probability/Interval	integer	required	echoed
11	Moon	integer	required	echoed
12	Group Name	string	required	echoed
13	User Name & information	text	optional	echoed

Example:

```
103
227 1 3 2448120 2463000 23.121 2.033 1 5 100 2 V711_TAU Henry @ TSU
```

Where:

Group Number is a group identification number assigned by the user. The number, along with the user number forms a universally unique reference to a particular set of objects to be observed. These numbers are the same as the Group Number in the 116 statement.

Group type flags allow the reduction program to "unscramble" the sequence of the individual observations. Current assignments are:

1	Output from pre-ATIS APT's which has been converted to ATIS format.
2	Standard differential sequence of Check, Sky, Comparison, variable, Comparison, Variable, Comparison, Variable, Comparison, Sky, Check.
3	Red-Blue Pair format.
4	Single star plus sky format.
5	Single star (no sky).
6 - 89	Reserved for future ATIS standards
90 - 99	Never defined by ATIS - reserved for user assignment

User Number is a unique identification of the user who requested the data. See Appendix (A) for the list of user numbers.

Start JD is the earliest Julian date on which this group can be selected.

End JD is the last Julian date on which this group can be selected.

Start LST is the earliest local apparent sidereal time, in decimal hours, that this group can be selected.

End LST is the latest local apparent sidereal time, in decimal hours that this group can be selected.

Number of Observations is how many times the group is to be observed during a single night. A successful group observation a failure of the probability test, or an unsuccessful group abort will decrement the number of remaining observations by one. The output file will reflect the number of remaining observations at the time the group was selected. Initializing this value to 0 or 1 has special meaning. If this number is zero, the group can only be accessed by a 116 statement.
If this number is 1 the probability/interval parameter will refer to probability. If this number is greater than 1, the probability/interval parameter will refer to interval.

Priority determines which observable group is selected first. Equal priority groups are selected based on additional criteria. The highest priority is 1 with lower priorities having larger numbers. The priority value contains no weighting information (i.e 5 has the same priority over 6 as 2 has over 20).

Probability/Interval has dual meaning depending on the initial value assigned to Number of Observations. If the Number of Observations parameter is set to 1 at the start of the night, this parameter must be a number between 1 and 100 which indicates the percentage chance (on the average) that the group will be actually executed if it is otherwise selected. If the number of requested observations is greater than one, this number is the minimum time in seconds which must elapse between selections of this group and its subsequent selection. 116 statements can obey or ignore this requirement.

Moon has three possible values:

1	observe only when the moon is below the horizon
2	observe only when the moon is above the horizon
3	observe if the moon is either below or above the horizon.

The telescope controller calculates the moon's position.

Group Name is the name of the group.

User Information usually contains the name of the user and miscellaneous information about the group.

104 STAR

The STAR statement only causes information on the star (or other object) to be passed to the output without any action being taken by the control computer.

IDENTIFIER: 104
INFORMATION:

	name	type	input	output
1	Catalog Code	integer	required	echoed
2	Star Identifier	integer	required	echoed
3	Star Type Number	integer	required	echoed
4	Standard Identifier	integer	required	echoed
5	Spectral Classification	string	optional	echoed
6	Star names and aliases	text	optional	echoed

Example:

```
104
1 175325 2 0 G5_III HD88799 HR559
```

Where:

Catalog Code and *Star Identifier* are, respectively, the catalog and identification of the star using the system of Mermilliod(1978). This system encompasses DM, HDWE, NGC and other catalogs. Defined numbers are:

0	DM
1	HDWE
2	Star in NGC cluster
3	Star in IC cluster
4	Star in cluster without NGC or IC designation (less than 100)
5	Same as 4, more than 100

6	Stars on various lists
7	Stars in selected areas
8	Stars on lists divided into declination zones
9	Not listed
10 - 89	reserved for future ATIS standards
90 - 99	never defined by ATIS available for user catalogs

Star Type is a number indicating the function of the star in this group. Defined numbers are:

1	Variable Star
2	Comparison Star
3	Check Star
4	Program Star (all sky)
5	Standard Star (all sky)
6	Extinction Star (all sky)
7	Navigation Star (for precise offsets)
8 - 89	reserved for future ATIS standards
90 - 99	never defined by ATIS

Standard Identifier flags standard stars. This is required because some stars might be, for instance, an extinction star and a standard star.. Defined numbers are:

0	Not a standard
1	Is a standard.

Spectral Classification is an optional string field.

Star Names and Aliases are provided to allow reduction software to perform lookup searches in various catalogs. The use of this parameter is encouraged.

105 MOVE

The MOVE statement instructs the telescope to move to a position specified by celestial coordinates. Corrections for refraction, mount corrections, precession and non-object related corrections are the responsibility of the telescope control computer. Corrections for proper or orbital motion, if required, are the responsibility of the user. It is a joint responsibility of the user, the PA, and the telescope controller to prevent attempts to move outside of the window, and to avoid attempts to point near the moon if that would endanger the detector. These limits are telescope dependent and not defined by ATIS except as error messages when it occurs.

IDENTIFIER: 105
INFORMATION:

	name	type	input	output
1	R.A. Hours	integer	required	reset
2	R.A. Minutes	integer	required	reset
3	R.A. Seconds	real	required	reset
4	Dec. Degrees	integer	required	reset
5	Dec. Minutes	integer	required	reset
6	Dec. Seconds	integer	required	reset
7	Epoch	integer	optional	never

Example:

```
105
14 34 13.4 -0 4 20 2000
```

Where:

Hours (0 to 23), *Minutes* (0 to 59), and *Seconds* (0.0 to 59.9) are for Right Ascension.

Degrees (-89 to 89), *minutes*, and *seconds* (0 to 59) are for Declination. Note: Any software which handles these parameters must correctly handle small negative declinations (i.e., -0 0 23).

An optional integer epoch may be specified in the input file, otherwise current epoch will be assumed. The output file always contains the current epoch coordinates as calculated from the input coordinates and no epoch value is given.

106 ACQUIRE

The ACQUIRE statement is used to find and center a star (or other point source) within the diaphragm. The mechanism is for doing the centering is not defined, but the objective of the centering is to leave the object which was nearest to the optical center of the instrument after the last move statement which is no fainter than approximately 1 magnitude of the value specified (parameter 4 Magnitude) accurately on the optical center. It is the users responsibility (and in some cases the PA's) to select non confusing fields, and of the telescope controller to point well enough initially and find the correct object.

IDENTIFIER: 106
INFORMATION:

	name	type	input	output
1	Neutral Density Filter	integer	optional	set/reset
2	Color Band Filter	integer	optional	set/reset
3	Diaphragm	integer	optional	set/reset
4	Magnitude (V)	real	required	echoed
5	Color Index (B-V)	real	required	echoed
6	Integration Time	real	optional	set/reset
7	R.A. Error (arcsec)	integer	never	optional
8	DEC. Error (arcsec)	integer	never	optional
9	object intensity	integer	never	optional
10	image FWHM (arcsec)	real	never	optional

Example:

```
106
0 0 0 7.2 0.06 0                    Input file
```

Example:

```
106
2 16 550 7.2 0.06 0.6 24 -12 120 2.2    Output file from CCD camera
```

Where:

Neutral Density Filter is the number of the NDF used to acquire the star (see record type 102 for assignments). A filter may be requested in the input file. The output file will always indicate the filter used.

Color Band Filter is the number of the color filter used to acquire the star (see record type 102 for assignments). A filter may be requested in the input file. The output file will always indicate the filter used.

Diaphragm is the nominal diaphragm size in arc seconds to be used in acquisition. For ccd acquisition systems this should be the clear field diameter.

Magnitude is the expected V magnitude of the object to be acquired.

Color Index is the (B-V) color index of the object to be acquired.

Integration Time in an input file is a requested integration time in seconds for the initial search for the object. The value in the output file is the integration time in seconds used for the final measurement used in acquiring the object.

R.A. Error is the distance in arcseconds the telescope had to move in right Ascension to find the object. East is positive. (Note: not seconds of right Ascension).

Dec. Error is the distance in arcseconds the telescope had to move in declination to find the object. North is positive.

Intensity is the relative intensity of the final measurement of the object in the acquisition process in the uncorrected natural units of the detector. This might be a photon count for a pmt or a "centroid mass" as the sum of A/D converter readings for a CCD camera.

Image Size is the full width half maximum of the image size in arcseconds as determined by the acquisition detector.

107 PHOTOMETER INSTRUCTION

Take an integration through a single detector channel. If the instrument has a multi-channel detector, a separate instruction is required for each detector. In such instruments, the telescope is expected to "look ahead" and execute appropriate instructions simultaneously if the 107 statements occur consecutively. The 107 statement will be followed by one or more 109 PHOTOMETER RESULTS in the ATIS output file.

IDENTIFIER: 107
INFORMATION:

	name	type	input	output
1	Neutral Density Filter	integer	required	echoed
2	Color Band Filter	integer	required	echoed
3	Diaphragm	integer	required	reset
4	Magnitude	real	required	echoed
5	Color Index	real	required	echoed
6	Source	integer	required	echoed
7	Quality	integer	required	echoed
8	Remark	integer	required	echoed
9	Total Integration Time	real	required	echoed
10	Detector	integer	optional	echoed
11	Number of samples	integer	optional	echoed

Example:

```
107
1 3 60 7.21 1.2 5 4 1 0.1 10
```

Where:

Neutral Density Filter is the number of the NDF to be used to measure the object (see record type 102 for assignments).

Color Band Filter is the number of the filter to be used to measure the object (see record type 102 for assignments).

Diaphragm is the diaphragm size in arc seconds to be used in the observations. The input file contains the requested diaphragm size. The output file contains the diaphragm size used.

Magnitude is the expected magnitude of the star to be measured, in the requested bandpass. In the case of comparison and check stars in differential photometry, these values should be high-quality catalog values, if possible.

Color Index is the color index of the star to be measured. This value is used for reduction.

Source is the code of the source of the photometric magnitude. Defined Source codes are:

1	UBV	Nicolet (1978)
2	UBV	Mermilliod (1986)
3	UBV	Landolt (1973)
4	UBVRI	USNO Almanac (Johnson RI)
5	UBVRI	Iriarte et al (1965), Johnson RI
6	UBVRI	Lanz (1986), Johnson RI
7	RI	Jasniewicz (1982), Kron-Cousins RI
8	RI	Landolt (1983), Kron-Cousins RI
9		Other catalog
10-89		Reserved for future ATIS assignment.
90-99		Never defined by ATIS. (reserved for user)

Quality is a code indicating the quality (likely accuracy) of the photometric estimate. Codes are:

1	poor	error ~ 0.1 mag
2	fair	error ~ 0.03 mag
3	good	error ~ 0.01 mag
4	excellent	error ~ 0.003 mag

Remark is a code giving further information about the photometric value of the star being measured. Assigned and used by originating astronomer.

Integration time is the requested integration time in seconds. This is always defined by the user to insure consistent data.

Detector is optional if only one detector can access a particular filter combination on the specified telescope, otherwise it is required. New in ATIS93.

Number of Samples is optional and indicates the number of 109 statements which will be generated. If not specified one 109 statement will be generated.. New in ATIS93.

108 SITE JULIAN DATE

The Julian date is placed as a record at the beginning of the output file. This allows output files on various nights to be quickly located. The output file Site JD is the JD at the fixed UT as specified by the Night Start Hour in the 101 FILE HEADER.

IDENTIFIER: 108
INFORMATION:

	name	type	input	output
1	Julian Date	integer	optional	required

Example: (output file)

```
108
2451234
```

Where:

Site Julian Date is the JD at the Night Start Hour. It may appear in an input file and must appear in output files to indicate the date on which the file was created. (see the 101 statement.)

109 PHOTOMETER RESULTS

The PHOTOMETER RESULT is the standard output format for a successful PHOTOMETER INSTRUCTION (107 identifier) and follows it immediately in the output file.

IDENTIFIER: 109
INFORMATION:

	name	type	input	output
1	JD.FJD	real	never	required
2	Total count	integer	never	required
3	Geneva Q statistic	real	never	optional
4	Geneva R statistic	real	never	optional
5	Geneva G statistic	real	never	optional

Example:

```
109
2451234.765432 123456 1.105 0.99 0.216
```

Where:

JD.FJD is the Julian day and fractional Julian day at the center of the integration without heliocentric correction.

Count is the total events detected and counted during the integration time. This value should be the raw intensity measurement without linearity corrections. If there is a prescaler, the number of counts should be multiplied by the prescaling factor to yield this number.

Geneva Statistics Q, R, and G, as defined by Rufener et. al are for monitoring the quality of individual observations. They are indicators, respectively, of scintillation, slow drift, and spikes or dropouts. These values should be included if the detector is capable of generating this data. This requires that the detector can be read with many subintegrations. If the integration time is less than one second these parameters are not generated. Refer to the bibliography for details on the calculation and use of these values.

110 COMMENT

A COMMENT is a remark which may be generated by the telescope control program and included in the ATIS output file or passed through from the ATIS input file. Any input file comments place outside of groups will appear in the output ATIS file before the first group is executed. Input file comments placed within groups will appear in the output file as the group reaches that point of execution. Comments may be used for time stamping events.

IDENTIFIER: 110
INFORMATION:

	name	type	input	output
1	Comment number	integer	optional	required
2	JD.FJD	real	optional	required
3	Comment text	text	optional	optional

Example:

```
110
10 2444679.6789 Roof closed - humidity 91
```

Where:

Comment Numbers presently defined are:

1	Could not execute the line in the ATIS input file
2	No qualified group was available for observation
3	Attempt to move outside observing window
4	Attempt to observe to the moon
5	Acquire failed
6	An invalid filter combination requested
7	Object too bright for detector
8	The probability test failed
9	Normal shutdown
10	Roof closed
11	Requested instrument not available
12	Maximum aborts count reached
13	Group aborted
14	Telescope parked
13 - 79	Reserved for future ATIS standards (both input and output)

80 - 89 Telescope controller generate messages not defined by ATIS
90 - 99 Comment from the ATIS input file. Number selected by the P.A.

JD.FJD is the Julian Date and fractional JD.

Comment Text is a parameter generated by the user, PA, or the telescope controller. If the statement is generated by errors detected by telescope controller, the messages should be such that they will assist the PA and engineers in resolving the problem. These messages should be verbose and infrequent. Messages generated by the user or PA may be for any purpose useful to the PA but they will not be acted upon by the telescope controller except to pass them through.

111 SKY

Indicates that the next photometer readings will be a sky measurement.

IDENTIFIER: 111
INFORMATION: (NONE)

Example:

```
111
```

112 DARK

Indicates that the next photometer readings will be dark measurements.

IDENTIFIER:112
INFORMATION: (NONE)

Example:

```
112
```

113 114 NOT ASSIGNED

115 END OF GROUP

Always the last identifier in an ATIS group.
IDENTIFIER: 115
INFORMATION: (NONE)

Example:

```
115
```

116 ADVICE ON GROUP SELECTION

This statement has been introduced in ATIS93 to allow several features not available in ATIS89. These features included scheduling as a function of Universal Time (UT), multiple means of accessing group headers for each ATIS group, and a "linked list" approach to the selection of groups. The 116 statements should be treated as groups and may be transmitted during the night on systems which allow group input and group output statements. 116 statements do not require matching 115 END OF GROUP statements. 116 statements are usually generated by PA's and PA'Cs rather than directly

by users. Like other groups, the relative sequence within the ATIS input file is of no importance.

IDENTIFIER: 116
INFORMATION:

	name	type	input	output
1	Advice Number	integer	required	echoed
2	Start LST	real	required	echoed
3	End LST	real	required	echoed
4	Start UT	real	required	echoed
5	End UT	real	required	echoed
6	Previous Group	integer	required	echoed
7	Set Execution Count	integer	required	echoed
8	Group Number	integer	required	echoed
9	User Number	integer	required	echoed
10	Group Test	integer	required	echoed
11	Next If True	integer	required	echoed
12	Next If False	integer	required	echoed

Example:

```
116
74 0.0 0.0 5.23214 5.43214 25344 3 25666 327 1 75 122
```

Advice Number is a unique (within a given telescope) number from 1 to a maximum number assigned to each 116 statement. The maximum number is not defined by ATIS, but is typically 1000 or more. Zero is never assigned as an advice number, but referencing advice number 0 exits the 116 pattern and executes one pass through the 'normal' 103 selection rules as if no 116 statements existed. The 116 statements are resumed at advice number 1 if it exists. Otherwise the 103 selection rules apply. Appending a 116 statement with the same advice number as an existing 116 statement overwrites the existing statement. Others are added to the list. Link changes are accomplished by adding and replacing 116 statements.

Start LST is the earliest LST in decimal hours which yields true. Use 0.0 in both LST parameters for "don't care".

End LST is the latest LST in decimal hours which yields true.

Start UT is the earliest UT in decimal hours which yields true. Use 0.0 in both UT parameters for "don't care".

End UT is the latest UT in decimal hours which yields true.

Previous Group checks if the previous executed completely or aborted

0	don't care if last group executed successfully
1	last group must have executed successfully
2	last group must have aborted

Set Execution Count determines how to change the group execution count prior to executing the group if 0 to N = set the execution count to N (N=0..maxint) -1 = don't change the execution count

Group Number is the 103 group to execute if tests pass. Selecting a non existent group will cause the "Next_if_False" path to be taken, along with an error comment. If the group is executed, the execution count will be decremented whether it is successful or not.

User Number is the 103 user number to check for a match. Group Number and User Number together always form a universally unique group to execute.

Group Test is a flag which indicates whether the 103 JD and Moon information should also be tested prior to executing the group. A fail will be treated as though the 116 line failed to pass.

0	ignore 103 header tests
1	J.D and Moon group tests must also be true

Next If True is the *Advice Number* to execute if all tests pass and the group has been executed (successfully or not).

Next If False is the *Advice Number* to execute if the tests fail. Requesting Advice number zero to execute will result in exiting the 116 statement sequence and making one pass through the 103 headers to select the next group. The software will then reenter the 116 sequence starting at Advice number 1. 116 statements are echoed in the ATIS output file immediately before a 103 statement when they are responsible for the execution of a group.

VIII. 200 SERIES - ENVIRONMENT

201 SET ENVIRONMENT

The SET ENVIRONMENT statement is designed to be a "catch all" for controlling the site, telescope, or instrument environment where is is deemed appropriate by the PA. It is designed to be very general in nature. It is not intended to be used by users. What is defined in the Control Sequence will usually be site specific, may contain essentially any command or action, and is not defined by ATIS. It is important that this line NOT be used to contain commands or data which is significant to the scientific content of the output ATIS file, as the Control Sequence output is not intended to be passed to the user. Bypassing this command completely and providing a communications channel for this purpose outside of ATIS is supported (and encouraged) by ATIS.

IDENTIFIER: 201
INFORMATION:

	name	type	input	output
1	JD.FJD	real	required	set/reset
2	Control Sequence	text	required	set/reset

Example:

```
201
244567.8 DOME HEATER ON: WAIT 60: DOME HEATER OFF
```

Where:

JD.FJD is the Julian date and fractional Julian date at which the command is to take place. If this time is set to 0.0 it will be acted upon immediately when an appropriate computer at the observing site receives the information. If the time has already passed when the request arrives, it will not be acted on.

Control Sequence is a text string which is sent to one or more computers which control the environmental conditions at the site. The format is not specified. This is determined by the PA. When the information is executed, a line showing the results of this execution should be returned in the output ATIS file.

202 GET ENVIRONMENT

The GET ENVIRONMENT statement is used to read sensors of any type which are accessible at a particular site. As this statement has no time stamp, it must be used inside of a group if it is to be executed. A group can contain only a group header, a 202 statement, and an end of group statement.

IDENTIFIER: 202
INFORMATION:

	name	type	input	output
1	Location	integer	required	required
2	Quantity	integer	required	required
3	Sensor Number	integer	required	required
4	Output Value	real	never	required

Example:

```
202
1 14 1 10.7        Temperature outside is 10.7 Celsius
202
10 15 1 -20.2      The detector is at -20.2 Celsius
202
4 1 8.5            The roll off roof is open 8.5 meters
```

Where:

Location is the place where the physical sensor is located defined locations are:

0	All locations (input file only)
1	outside of the observatory
2	inside the observatory
3	inside the telescope control computer enclosure
4	The observatory roof/dome
5	The telescope primary mirror
6	The telescope secondary mirror
7	The instrument housing
8	The detector cooler hot side
9	The detector cooler cold side
10	The detector
11	Primary Power
12	Secondary (backup) power
13	Heat exchange medium
14 - 89	reserved for future ATIS definition
90 - 99	never defined by ATIS

Quantity is the physical unit to be measured.

0	all measurements (input file only)
1	distance in X in meters
2	distance in Y in meters
3	distance in Z in meters
4	horizontal or right ascension angle in degrees
5	vertical or declination angle in degrees
6	velocity in meters/second
7	percent relative humidity
9	pressure in Pascals
10	voltage in Volts
11	current in Amperes
12	power in Watts
14	resistance in Ohms
15	temperature in degrees Celsius
16	steps cw of a stepping motor
17 - 89	reserved for future ATIS definitions
90 - 99	never defined by ATIS

Sensor Number is used to define multiple sensors which output from the same location and quantity.

0	All sensors (input file only)
1 - 99	site specific

Output Value is a real number reflecting the most recently measured value of the parameter. Logs of readings may be provided by means not specified in ATIS.

203 REFERENCE

REFERENCE statements are used to link ATIS files or portions of ATIS files to published documents giving further explanation of the environment which is being used. These references may be injected into the ATIS path by users, PA's, or telescope controllers and should remain unchanged as passed through the system.

IDENTIFIER: 203
INFORMATION:

	name	type	input	output
1	Originator	integer	required	echoed
2	Subject	integer	required	echoed
3	Available Media	integer	required	echoed
4	Reference	text	required	echoed

Example:

```
203
-2 3 3 INTERNET FTP 192.33.141.151 anonymous /pub/telescope4/specs
```

Where:

Originator is who (or what) placed the reference in the ATIS file.

-2	by the telescope controller
-1	by the PA
0	unknown
1 - N	by the user (this is the user number)

Subject is the subject of the reference.

0	unknown/other
1	The objects
2	The scheduling process
3	The site and telescope
4	The detector and filters
5	The reduction process

Available Media

0	unknown
1	published in technical journal
2	awaiting publication in technical journal
3	available on electronic media
4	available by private communication with originator

Reference is a text string which gives a path to obtaining the reference. This may be a reference to a publication, an address and telephone number to call for a copy, or an email or Internet FTP address and pathname. It is the responsibility of the originator to make this complete and to make sure the documentation is available.

IX. GOAL ORIENTED ASTRONOMICAL LANGUAGE STANDARD (GOALS)

Goal Oriented Astronomical Language Standard (GOALS) is a portion of ATIS which provides an interface language for communication of requests for observations from users of automatic telescopes to principal astronomers (PA) in charge of the operation of automatic telescopes and for return of the data from the PA to the users. GOALS is new to ATIS93 and should be considered as experimental rather than a standard. The 300 series statements are for requesting observations. The 400 series is for confirmation of request and the return of data and other information from the PA to the user. The user is responsible for determining the scientific significance of the observations, what kind of observations are to be made, and what kind of scheduling is required to achieve the scientific goals.

The principal astronomer (PA) is responsible for combining the requests from the users and generating ATIS files to send to the AT's. The principal astronomer is also responsible for distributing the data from the AT's to the users. GOALS provides a mechanism for this distribution in either raw or reduced form.

Unlike the telescope control portion of ATIS the structure of a GOALS file is designed to carry compact information about the sequencing of observation, the sequencing of filters, the objects and sky positions which make up groups, and the desired time or distribution of time when the groups are to be observed. There is a special statement to form a group, based on the previous instructions. Groups are assigned Group Numbers by the user. The combined user number an group number must be universally unique to each distinct star / sky / filter / detector / sequence / site / telescope arrangement.

X. 300 SERIES - GOALS INPUT

Goals files provide information flow from the user to the PA and will generally have the format:

Header (300-309 instructions)..(gives the P.A information about the user)
Object definitions (104-112 & 340-349 instructions)..(define GOALS objects)
Assignment of filter sequences
Assignment of observing sequences
Assignment of scheduling sequences
Assignment of GOALS objects to observing sequences.
Formation of groups

301 - USER NUMBER

The USER NUMBER is assigned to be unique among all ATIS users, not just those associated with a particular PA. This is required to allow future networking. A master list of user numbers will be coordinated by the user standards committee. P.A.s should assign user numbers from this list. The user name must reflect the human responsible for requesting the observations.

IDENTIFIER: 301
INFORMATION:

	name	type	status
1	User Number	integer	required
2	User Name	text	required

Example:

```
300
1027 John Q. Astronomer
```

Where:

The *User Number* as assigned by PA's from the master list

The user's name, typically *First, Middle Initial, Last* although any name writeable in ASCII is acceptable.

302 - USER TO PA SEQUENCE NUMBER

A sequence number is assigned by the USER. This number should be incremented by one for each request sent to a PA. It allows the PA to determine whether any requests have been missed. It should be initially set at 10000 for the first file sent to the P.A. using GOALS. When this number would exceed 99999 it should be reset to 10000.

IDENTIFIER: 302
INFORMATION:

	name	type	status
1	Sequence Number	integer	required

Example:
```
302
12345
```

303 - JD OF REQUEST

Julian day with fraction when the request file was generated by the user.

IDENTIFIER: 303
INFORMATION:

	name	type	status
1	JD of request	integer	required

Example:
```
303
2445678.2075
```

304 - USER MAILING ADDRESS

Use one 302 line for each line of address

IDENTIFIER: 304
INFORMATION:

	name	type	status
1	User Address	text	required

Example:
```
304
John Q. Astronomer, Phd
304
Western  Observatory
304
Department of Astronomy, Room 20
304
1234 Star Avenue
304
Phoenix, Arizona 85012
```

305 - USER BILLING ADDRESS

Use one 305 line for each line of address as in the 304 statement. Not applicable on all systems.

IDENTIFIER: 305
INFORMATION:

	name	type	status
1	Billing Address	text	required

306 - USER TELEPHONE NUMBER

As the PA would dial the number for a voice line, without PBX prefix.

IDENTIFIER:306
INFORMATION:

	name	type	status
1	Telephone number	text	required

Example:
```
303
602 234 9996
```

307 - USER EMAIL ADDRESS

The users email address for pa to user human communications. This is not for transfer of data.

IDENTIFIER: 307
INFORMATION:

	name	type	status
1	Email address	text	required

Example:
```
307
jastron@sunshine.watsau.edu
```

308 - USER MODEM NUMBER

(as in the 303 statement)

It is the users responsibility to be compatible with the PA's Modem. V.32 compatible modems are a suggested standard.

309 - USER INTERNET ADDRESS & PATH

This information would be for the return of data automatically by FTP to the user.

IDENTIFIER: 309
INFORMATION:

	name	type	status
1	user ftp address or name	string	required
2	login	string	required
3	password	string	required
4	Path to directory	string	required

Example:
```
309
190.99.99.99 jastron lbrite* /user/goals/jastron
```

Where:

The *user ftp address* should be provided in the decimal number rather than name as it does not rely on name servers.

Login is a login string required to access the data directory password should be given if required. The PA is expected to keep this confidential. The PA is expected to initiate data transfers as only the PA knows when data is available. If there are security concerns all information related to the 309 statement may be passed by any means outside of ATIS.

Path to directory determines where ATIS-GOALS and FITS files will be placed in the users computer.

310 - OBSERVE GROUP BY PHASE

Request that observations be made to uniformly fill in specified phases of a light curve. The user is responsible for pre-determining the epoch and period of the object. This information is not carried in ATIS output data, only the time and readings.

IDENTIFIER: 310
INFORMATION:

	name	type	status
1	JD of epoch	real	required
2	period of object	real	required
3	starting phase	real	required
4	ending phase	real	required
5	density	integer	required

Example:

```
310
2440072.34567 23.345432 0.65 0.75 20
```

Where:

The *Julian date* of epoch is an arbitrary time against which the phase is measured.

Period in mean solar days

Starting phase window has a range of 0.0 to 1.0.

Ending phase window has a range is 0.0 to 1.0.

Density is the desired number of points within the phase window

Multiple sections of the phase of an object may be specified by inserting multiple 310 statements sequentially in the file.

For the following calculations "rnd" is a quasi-random real number between 0.0 to 1.0 generated by the PA (PAC). The PA will attempt to schedule the observation to the times calculated during the times when all positions within the group fall within the observing window of the telescope. Scheduled groups which are missed are not counted in N.

311 - OBSERVE GROUP PERIODIC t=t0+(N*t1+(rnd-.5)*t2)

This statement requests repetitive measurements of an object with uniform spacing.

IDENTIFIER: 311
INFORMATION:

	name	type	status
1	t1 - The time between observations	real	required
2	t2 - The desired maximum scatter	real	required

Example:

```
311
1200.0 120.0 10              one reading every 20 minutes with +/-
                             2 minute scatter for about three hours
```

Where:

t0 is the Julian date of epoch in days with fractional days.

t1 is the time between observations in seconds.

t3 is the desired maximum scatter in seconds.

The PA (or PAC) will schedule events only during the period when the selected group is in the observing window of the telescope, but N increments for each period t1 whether the observation is made or not. This is used in conjunction with 313 and 317 statements to determining the start and end windows and total number of observations. N and t0 are set to zero at the beginning of each window defined by the 313 command.

312 - OBSERVE GROUP LOG RANDOM t=(tprev)+T1*10^(1+rnd*k)

Gives a (somewhat) random log distribution of the time between observations as scheduled by the PA. The PA may adjust the time (hopefully somewhat randomly) as long as it falls within the range allowed for rnd. The purpose of this statement is to allow better detection and measurement of objects with unknown periods and to reduce aliasing.

IDENTIFIER: 312
INFORMATION:

	name	type	status
1	t1 - time between observations	real	required
2	t2 - distribution factor	real	required

Example:

```
311
3600.0 1.0                    readings with separations from 1 to 11 hours.
```

This statement should be used in conjunction with the 313 and 317 statements to determine the starting (t0) and ending times.

313 - OBSERVE GROUP TIME WINDOW

Allows the start and end time of an observation to be specified.

IDENTIFIER: 313
INFORMATION:

	name	type	status
1	Start JD in days + fraction	real	required
2	End JD in days + fraction	real	required
3	Start LST in hours	real	required
4	End LST in hours	real	required
5	Start U.T. in hours (UT-1)	real	required
6	End U.T. in hours (UT-1)	real	required

Example:

```
312
244975.0 245100.0 0.0 0.0 6.333 9.333
```

Use 0.0 for both parameters to indicate "don't care" for that parameter. Objects may be observed if the current Julian day with fraction is greater then start JD AND the current julian day with fraction is greater than end JD AND all group objects are between the Start LST and End LST AND the current U.T is between the Start U.T. and End U.T. If the object isn't in the telescopes observing window, the observations won't be scheduled.

314 - OBSERVE IF S.E.M.

Observe the group if the previous hour's average Standard Error of the Mean of all observations meets the stated criteria. This statement will be available only on interactive systems.

IDENTIFIER: 314
INFORMATION:

	name	type	status
1	threshold SEM	real	required
2	object resource	integer	required
3	hi/lo flag	integer	required

Example:

```
314
0.005 0 0                          observe if S.E.M. of all stars <.005 mag
```

Where:

The actual *standard error of the mean* must be calculated by the PA (or APA) from actual measurements and compared to the threshold SEM.

The *object resource* selects which stars are to be compared against.

0	All previous stars
1	Standard/extinction stars only

The *hi/lo flag* allows switching observing programs based on the quality of the night.

0	execute if SEM of observation is less than threshold
1	execute if SEM of observation is greater than threshold

Note: the "hour" is not necessarily exactly one hour, but rather an attempt to make a sliding window incorporating all information obtained in the previous hour. It may be weighted toward the more recent measurements.

315 - OBSERVE IF DELTA MAGNITUDE

This statement is used for catching flares or eclipse events. The term reference and variable only determine the sense of the difference. The reference becoming fainter is equivalent to the variable becoming brighter.

IDENTIFIER: 315
INFORMATION:

	name	type	status
1	group number to monitor	integer	required
2	reference star identifier	integer	required
3	variable star identifier	integer	required
4	filter number	integer	required
5	threshold magnitude	real	required
6	hi/lo flag	integer	required

Example:

```
315
29395 29366 3 -2.3 0
```

Where:

Group number is the group number which is to be monitored for differential magnitude. It must be present on the telescope and must belong to the user requesting this group.

The *reference star numbers* are the Mermilliod "star identifier" for an object in the monitored group.

The *variable* must also be in the same group.

The *filter number* is the color filter only. It is assumed that both object will have been measure with the same detector/filter combination.

The *threshold magnitude* is the value of intensity trigger a response of this group. The mean magnitudes of all occurrences of the variable and reference object in the tested group will be used.

The *hi/lo flag* indicates the condition under which the group will be measured.

0 execute group if the variable magnitude is less (brighter) than the threshold in the sense of v-c

1 execute group if the variable magnitude is greater (fainter) than the threshold in the sense of v-c

316 - OBSERVE IF SEEING

The seeing is based on measurements made with a CCD camera or similar device. This camera may be a primary instrument or a acquisition or tracking instrument. The data may even be obtained from another telescope at the same site.

IDENTIFIER: 316
INFORMATION:

	name	type	status
1.	average FWHM seeing threshold	real	required
2.	hi/lo flag	integer	required

Example:

```
316
2.0 0
```

Where:

Average FWHM threshold of seeing in arcseconds
The hi/lo flag determines the sense of the test.

0. execute if seeing FWHM is less than threshold
1. execute if seeing FWHM is greater than threshold

As in the 314 statement, the averaging will be performed over the available data from the previous hour.

317 - MAX NUMBER OF OBSERVATIONS

The maximum number of times the GOALS group will successfully execute as the result of this GOALS file. Aborted groups are not counted in this number, but there is no other test for data quality. This number accumulates from night to night.

IDENTIFIER: 317
INFORMATION:

	name	type	status
1	Group Number	integer	required
2	Max number of observations	integer	required

Example:

```
317
31543 100
```

318 - 319 UNASSIGNED

When any 310 - 319 headers appear sequentially in a GOALS file they all apply until more 310 to 319 headers appear in the file following statements other than 310 to 319 statements Headers of DIFFERENT type are combined by "AND'ing" but headers of the SAME type will be "OR'ed": (315 or 315) and (312 or 312) and 314 and 316

320 - FORM A GROUP

Instructs the PA (APA) to schedule an ATIS group based on the previous information in the file.

IDENTIFIER: 320
INFORMATION:

	Name	type	status
1	Group Number	integer	required
2	Weighting Factor	real	required

Example:

```
320
23232 2.5
```

Where:

The *Group Number* is a unique number assigned by user which in combination with the user number will form a universally unique reference to the objects and sequence within the group. The

The *Weighting Factor* is provided by the user to indicated the relative usefulness to the data. It is a real number between 0.0 and 10.0. These values are totally subjective for both the PA and the user. They are simply to assist the PA in the scheduling of available time. The numbers are used as linear multipliers.

A rating of 3.0 means the data is three times as valuable as a rating of 1.0 to the scientific goals of the user. The PA will attempt to normalize these weighting factors among the

various users such that conflicts will resolve to the users higher priority requests, while retaining the long term objective of meeting each users total observing time requests. Being "fair" to each user is one possible objective. Maximizing scientific value to the entire community is another. This method gives both the user and the PA some control on balancing the desired results.

321 - REQUEST RETURNED DATA FORMAT

This statement requests the format for the return of data. Like other series 300 statements, it controls all groups formed after the statement. Multiple 321 statements may appear in a GOALS input file such that certain groups are treated differently.

IDENTIFIER: 321
INFORMATION:

	name	type	status
1	Raw data	integer	required
2	reduced data	integer	required
3	weather data	integer	required
4	environmental data	integer	required

Example:

```
321
0 1 1 1
```

Where:

Raw Data is a flag indicating how raw data should be returned

0.	no raw data
1.	supply raw data (ATIS or FITS as generated by the telescope controller)

Reduced data is a flag stating whether reduced data should be returned an which reduction format should be used.

0	no reduced data
1	reduction in ATIS 400 series format
2 - N	reduction in other format as defined by the PA (documented by the 203 statement)

Weather data is a flag indicating how weather data should be returned.

0	No data
1	minimal data (temperature, humidity)
2	full data

Environmental data is a flag indicating how environmental data should be returned.

0	No data
1	minimal data (temperature of detector)
2	full data

323- 329 UNASSIGNED

330 - OBSERVING SEQUENCE

These may be any mix of the following:

Gn - GOALS object numbers
Fn - Filter Sequence numbers

Then number of parameters on a line is not specified, but the line must be less than 81 characters in length. Consecutive 330 lines are concatenated. The entire line should be considered type TEXT. These statements form logical groups which, when combined with scheduling request allow the PA to schedule observations. These statements are followed immediately by a 320 "form group" statement.

Example:

```
330
F1 G7532 G50 G7533 G7544 G7533 G7544 F2 G7544 G7533
330
G7544 G7533 G50 G7532
```

Where:

The *prefix G* refers to a GOALS object number as specified by n which is the parameter of the 340 statement.

The *prefix Fn* refers to a GOALS FDI sequence which is the first parameter of the 331 statement.

The actions specified in the FDI sequence are applied to each subsequent GOALS object until another FDI sequence appears in the file or

331 - FDI SEQUENCE

This statement establishes Filter/Detector/integration time (FDI) sequences for taking integrations through specific neutral filter, color filter, detector, and integration time combinations. These should be defined in the GOALS file prior to referencing them with the 330 statements. A particular filter sequence number should be unique within a GOALS input file. The entire line should be considered type TEXT. Sequential 331 statements with the same starting Fn will be concatenated. The user should be aware that the object is not re-acquire on telescopes which don't have active star tracking, so sequences should be limited in length. Each sub-parameter remains in effect within a filter sequence until replaced with a sub-parameter of the same kind. Filter and detector numbers set up the conditions. Integration time statements infer "take an integration" at that point in the sequence.

IDENTIFIER: 331
INFORMATION:

	name	type	status
1	FDI sequence	text	required

FDI text is made up of an unspecified number of sub-parameters as follows:

Fn = The Filter Sequence Number as in the 330 statement

The same number appearing as successive statements indicates a continuation of the previous line. The same number appearing in non successive statements indicates a replacement of previous definition.

Nn = neutral density filter number (optional, default is 1 (no filter).

Bn = Bandpass filter number (at least one required in a sequence.

Dn = Detector number (not required for single detector instruments).

Irr.r = Take integration. The rr.r is the time in seconds and may take either real or integer form.

Example:

```
331
F1 N1 B1 I20 N2 B2 I10 B3 I10
331
F2 N2 B3 I10 B2 I10 N1 B1 I20
331
F127 N1 B3 D3 I2.5 I2.5 I2.5 I2.5 I2.5
```

In the above examples filter sequence F1 uses UBV filters with 20 second integration with no N.D. filter in U and 10 second integration through the first N.D. Filter in B ----and V. Filter sequence F2 reverses the filter order. Filter sequence F127 takes five consecutive 2.5 second integrations in V with no N.D filter using the third detector in the instrument.

340 - DEFINE GOALS OBJECT

This statement has only one integer parameter, but is always followed by some combination of ATIS 104, 105, 106, 111, or 112 instructions as appropriate for the object or location. When used with the 330 and 331 statements, entire groups are formed. If the particular PA is equipped to do automated look-ups on star information from catalogs, only minimal information is required. (example 2)

IDENTIFIER: 340
INFORMATION:

	name	type	status
1	GOALS object number	integer	required

Example:

```
340
34567                          Assign GOALS object number
104
1 10783 1 0 A2pSrCr            Define what star
105
1 45 10.3 8 30 4 2000          Define its coordinates
106
0 0 0 6.58 -0.05 0             Acquire info
341                            End of definition
```

Alternate example:

```
340
24567                          Assign GOALS object number
104
1 10883 0 1 _                  provide minimal object info
341                            End of definition
```

In the later case, the PA is expected to perform a lookup on all missing information. If the P.A. cannot locate the information a "group unacceptable" report is returned to the user.

341 - END GOALS OBJECT

This parameter is always used in conjunction with the 340 statement to indicate the end of an object definition.

IDENTIFIER: 341
INFORMATION: (NONE)

Example: See the 340 statement

XI. 400 SERIES - GOALS OUTPUT USED FOR PA TO USER COMMUNICATIONS

401 - USER NUMBER

The same format as the 301 statement

402 PA TO USER SEQUENCE NUMBER

Generated by the PA following the same rules as the 302 statement

403 - JD OF RESPONSE

Uses the same format as the 303 statement.

404 - REQUEST REJECTION

This statement is used to inform the user that requests for observations (using the 300 series statements) have been accepted or rejected.

	Name	type	status
1	User Sequence number	integer	required
2	User Group number	integer	required
3	Accept/reject code	integer	required
4	comment	text	optional

Example:

```
404
24 3357 2 Telescope 1 does not have Stromgren u filter
```

Where:

User sequence number is the 302 sequence number from which the observation was requested.

User group number is the group request which is being discussed.

Accept/Reject code is defined as:

0	GOALS Group Accepted
1	can't read request - format problem
2	unavailable filter/detector
3	request outside of hour angle/dec window
4	object outside of magnitude limits

5	can't provide missing object information.
6	requested observing time unavailable
7	user time allocation exceeded
8 - 89	reserved
90 - 99	never defined in ATIS - for PA to assign desired meaning

Comment: detailed reason for rejection (optional).

A GOALS group may be initially accepted by the P.A. and later rejected. Problems with the group (such as incorrect coordinates) may not be detected until initial observations are completed. P.A.s should be reluctant to reject groups after the first few observations have been completed. The most recent acceptance or rejection is the valid state. A group will not be accepted after a rejection without resubmission by the user.

405 - 409 UNASSIGNED

410 - REDUCED DATA

This version of ATIS only defines the output format for the reduction of differential photometry. Groups will be reduced with the assumption that corrections will be made for first and second order extinction and for first order transformation. The following output format will be check and variable stars will be compared to comparison stars only. If more than one comparison star is used, all combinations of variable - comparison and check - comparison will be included. The mean values of all readings of a particular object in each group will be used, and the SEM of the differential values will be displayed.

IDENTIFIER: 410
INFORMATION:

	name	type	status
1	Group Number	integer	required
2	Catalog code for v or k	integer	required
3	Star identifier for v or k	integer	required
4	Object type	integer	required
5	Catalog code for c	integer	required
6	Star identifier for c	integer	required
7	Julian date & fraction	real	required
8	Heliocentric correction	real	required
9	Airmass for v or k	real	required
10	Delta airmass for v or k or c	real	required
11	Mean Differential mag	real	required
12	S.E.M for object	real	required
13	S.E.M for reference	real	required

Example:

```
410
2345 1 123412 0 1 133453 2448765.43783 -220.2 1.304 -0.031 -2.0345 5.5 7.3
```

Where:

Group number is the ATIS group number

Julian Date and Fractional JD (JD.FJD) is the centroid of the time of the individual integrations within the group with respect to the variable or check star without heliocentric correction.

Heliocentric correction seconds is the value calculated for the variable or check object which when added to the JD.FJD corrects gives the date/time which would have given the same measurement had it been taken from the position of the earth/sun barycenter. Note: most current heliocentric correction programs don't take into account the effects of the larger planets. The corrections used should be documented with 203 statements.

Catalog Code for variable or check as in 104 statement.

Star Identifier for variable or check as in 104 statement.

Object type as in the 104 statement.

1	variable
3	check

Catalog Code for the comparison object as in 104 statement.

Star Identifier for the comparison object as in the 104 statement.

Airmass of the variable or check object with corrections. This should be corrected for refraction and barometric effects if the required information is available. Document corrections used with 203 statements.

Differential Airmass is derived by subtracting the airmass of the check star from that of the variable or comparison. Adding this number to the airmass of the variable or check object should yield the airmass of the comparison object.

Mean Differential Magnitude in the sense of variable minus comparison or check minus comparison corrected for extinction and transformation. Document the extinction and transformation with 430 and 431 statements, and the equations used with 203 statements.

Standard error of the mean of the individual variable or comparison integrations in millimagnitudes.

Standard error of the mean of the individual check integrations in millimagnitudes.

411-419 RESERVED (for other ATIS reduced output formats)

420-429 NEVER ASSIGNED (For PA specific reduced output formats)

430 - EXTINCTION DATA

When this data is provided it should be calculated at regular intervals typically a few times per night and should always be provided if reduced data is provided. The same format may be used to determine nightly extinctions or any other observational period chosen by the PA.

IDENTIFIER: 430
INFORMATION:

	name	type	status
1	Start JD.FJD	real	required
2	End JD.FJD	real	required
3	Bandpass filter number	integer	required
4	Detector number	integer	required
5	Calculated K'	real	required

6	Calculated K' standard error	real	required
7	Calculated K"	real	required
8	Calculated K" standard error	real	required
9	seconds accepted	integer	required
10	seconds rejected	integer	required

Example:

```
2449208.5 2449208.7 3 1 0.1755 0.0015 -0.003 0.002 870 40
```

Where:

Start JD.FJD is the JD with fractional JD of the first integration used in determining the value.

End JD.FJS is the JD with fractional JD of the last integration used to determine the value).

Color Filter number used for the measurements.

Detector number used for the measurements (zero if not known).

The calculated K' using a method which should be documented with 203 statements.

Standard error of calculated K' from the data available.

Calculated K"

Standard error of the calculated K"

Number of integrating seconds for all objects used for these extinction calculation.

Number of integrating seconds for all objects which were measured but were rejected from the extinction calculation to improve the fit.

431 -433 Reserved

434 - TRANSFORMATION DATA

This data is calculated from measurements of standard stars with data fit to those stars. It is recommended that how well various standard stars fit the derived values be documented.

IDENTIFIER: 434
INFORMATION:

	name	type	status
1	start JD.FJD	real	required
2	end JD.FJD	real	required
3	n.d. filter number	integer	required
4	color filter number	integer	required
5	reference filter number	integer	required
6	detector number	integer	required
7	epsilon	real	required
8	epsilon standard error	real	required
9	zero point	real	required
10	zero point standard error	real	required
11	seconds accepted	integer	required
12	seconds rejected	integer	required

Example:
```
2449208.5 2449208.7 2 3 2 1 -0.0055 0.0015 8.034 0.021 1520 210
```

Where:

Start JD.FJD is the JD with fractional JD of the first integration used in determining the value.

End JD.FJS is the JD with fractional JD of the last integration used to determine the value).

The neutral density filter as described in the 102 statement.

Color Filter number used for the measurements and the nominal band being corrected. Values are described in the 102 statement.

Detector number used for the measurements (zero for single detector).

The *reference filter number* is the actual or catalog filter used as the reference for obtaining the color index for the transformation. How this is used should be documented and referenced with a 203 statement.

The *calculated epsilon* (the correction to standard magnitude as a function of the color index of the object). The methods used should be documented with 203 statements.

Standard error of calculated epsilon from the data available.

Number of integrating seconds for all objects used for these transformation calculations.

Number of integrating seconds for all objects which were measured but were rejected from the transformation calculations to improve the fit.

435-439 - UNASSIGNED

440 - FILTER DETECTOR STATISTICS

These values are calculated for each filter/detector combination on each telescope at a given site. This information should be shared between telescopes.

IDENTIFIER:440
INFORMATION:

	name	type	status
1	JD	integer	required
2	Telescope number	integer	required
3	Color filter number	integer	required
4	Total time	integer	required
5	Percent past S.E.M	integer	required
6	K'	real	required
7	K"	real	required
8	Average SEM	real	required

Example:
```
2449200 2 3 3 480 93 0.134 0.005 5.3
```

Where:

JD is the Julian Day at the start of the observing period for which the data applies.

The *telescope number* is from a telescope at the same site as the users observations. The user should be able to receive all nightly averages from all of the telescopes running

ATIS at a particular site. This is a useful tool for determining if performance degradation is in the instrumentation or caused by the atmosphere.

Color filter number is described in the 102 statement.

Total time is the total integrating seconds for this filter and telescope.

Percent past SEM is the percentage of integrations in this color which pass a filter based on the standard error of the mean of the counts within each group. This filter is typically set at 1 percent.

K' is the average nightly extinction determined for the filter and telescope.

K" is the average second order extinction determined for the filter and telescope.

Average S.E.M. is the average standard error of the mean for all observations in the specified filter. The calculation may be performed on raw counts on unreduced data or extracted from the reduction process, but it should be done consistently for a given site.

441 - TELESCOPE STATISTICS

This data is useful for determining the overall performance of a the instrument and of the weather. Details of the methods should be documented with the 203 statement.

	name	type	status
1	JD	integer	required
2	telescope	integer	required
3	total operating time	integer	required
4	total integrating time	integer	required
5	percent operating efficiency	integer	required
6	percent past SEM	integer	required
7	average pointing error	integer	required
8	average dark count detector 1	integer	required
9	average dark count detector 2	integer	optional
10	average dark count detector 3	integer	optional

Example:

```
441
2449033 1 42030 28560 68 94 956
```

Where:

JD is the Julian date at the star of the observing period.

Telescope number for each telescope at the site.

Total operating time is time in seconds for the observing period when the enclosure was open and the telescope controller had available objects in the observing window.

Total integrating time is the actual time spent integrating in all filter detector combinations in seconds.

Percent operating efficiency is the ratio of integrating time to operating time. This value may be greater than 100% for multi-detector instruments.

Percent passing SEM is the percentage of group/filter combinations whose standard error of the mean of the raw counts passes a fixed filter, typically set at 1 percent.

Average pointing error is the mean of the pointing errors reported in the 106 statements multiplied by 10 and truncated to an integer. It is a diagnostic for detecting problems with the telescope drive system.

Average dark count is the mean of all dark counts normalized to counts per second. It is a diagnostic for detecting problems in the detector or cooling systems.

442 - HOURLY STATISTICS

Hours are counted starting with the beginning of the observing period defined in the 101 statement. Periods with no integrations taken are not reported.

	name	type	status
1	JD.FJD	real	required
2	Telescope number	integer	required
3	integration time i	integer	required
4	percent past SEM filter	integer	required
5	average SEM	real	required
6	average Q	real	required
7	average R	real	required
8	average absolute G	real	required
9	average SEM	real	optional

Example:

```
442
2449033.16667 1 1220 85 0.008 0.23 .72 .0002 1.87
```

Where:

JD.FJD is the Julian date and fraction at the start of the hour for which this data is displayed.

Telescope number is the number of the telescope on which the data was taken.

Integration time is the total number of seconds during the hour for all detectors.

Percent past SEM is the percent of group/object/filter combinations whose standard error of the mean for raw counts passed a filter typically set at 1 percent.

Average SEM is the average standard error of the mean of all group/object/filter combinations measured during the hour.

Average Q is the average Q Geneva statistic for the hour.

Average R is the average R Geneva statistic for the hour.

Average G is the average of the absolute values of the G Geneva statistic for this hour.

Average FWHM is the average of the values for the full width half maximum image size from the 106 statements for the hour. (optional).

443 - 449 UNASSIGNED

450 - ACCOUNTING INFORMATION

This information is provided to each user to show the relative observing time on the telescope.

IDENTIFIER: 450
INFORMATION:

	name	type	status
1	JD	integer	required
2	total groups	integer	required
3	user groups	integer	required
4	standard groups	integer	required
5	total integration	integer	required
6	user integration	integer	required
7	standard integration.	integer	required
8	Percent user past SEM	integer	required
9	User integration year to date	integer	required
10	User percentage year to date	integer	required

Example:

```
405
2449032 85 11 4 45030 5080 1620 91 250700 24
```

Where:

JD is the Julian Date for this observing period.

Total groups are the number of groups executed during the observing period.

Standard groups are the number of standard groups (accessible to the user but executed by the PA) during the observing period.

Total integration is the total time spent integrating during this observing period. User integration is the total time spent integrating user groups during this observing period.

Percent past SEM is the percentage of user data which passed internal standard error of the mean tests.

User integration year to date is the total integrating seconds for user groups / filter / detector combinations which passed the SEM filters.

User percent year to date is the percentage of user integrating time relative to other users (not including standards).

The PA determines the value for the SEM filter, but .01 magnitude (or 1% for raw counts) has become a common value for this filter.

XII. 500 SERIES - CCD IMAGING - STATEMENTS FOR CCD CAMERAS.

XII-A. Image File Naming Conventions

The data generated by taking a typical CCD image does not lend itself well to transmission in ASCII format and there is a well established format for this form of data. The "Flexible Image Transport System" (FITS) format is used by ATIS for the transfer of all CCD images. ATIS provides a logging function by maintaining the record of how the files were generated and provides pointers to the data in the form of file names. The following CCD file naming format is recommended for use with the ATIS 500 series statements:

TJJJJJYY.FIT

Where T has been assigned for the following file types:

P	Picture or image file
F	Flat field image file
D	Dark field image file
C	Calibration image file
B	Bias field image
JJJJJ	Last five digits of the Julian Date
YY	Alpha code for the sequence of images taken on a given night observing run, i.e., AA AB AC.... ZW ZY ZZ This allows up to 676 images of each type per night.
FIT	The FITS file format extension. Either FIT or FITS is acceptable. Generally FITS is used on systems which will accept longer extensions, such as UNIX, and FIT is used on DOS based systems which are restricted to three character file extensions.

The above file name format should be self explanatory except for the CJJJJJYY file type. This prefix is included as a means of identifying calibration images, so that future identification of these images can be simplified. It also identifies this important type of images as a separate class. ATIS CCD CAMERA COMMAND FORMAT

XII-B. ATIS CCD Statements

501 - CCD DETECTOR

The CCD specific file header contains information which identifies the CCD Detector being used. This is important in cases where multiple cameras or cameras with multiple CCD detectors are available at an observatory. There is no control information contained in the header. The information only needs to be included once for each nights observing run. If during the night, for some reason, the camera is changed then the CCD is pointed to by the CCD number included in image files. The 501 header information should follow sequentially after the 101 header in the ATIS file. One header for each detector number. At observatories where aperture photometry and CCD Photometry are done, care should be taken that separate 102 entries are available for each unique detector-filter combination.

IDENTIFIER: 501
INFORMATION:

	name	type	input	output
1	BITPIX	integer	required	echo
2	NAXIS1	integer	required	echo
3	NAXIS2	integer	required	echo
4	CCDNO	integer	optional	echo
5	PIXFOVH	real	optional	echo
6	PIXFOVV	real	optional	echo
7	CAMGAIN	real	optional	echo
8	CAMNOISE	real	optional	echo
9	DETECT	string	optional	echo
10	SPECAL	string	optional	echo

Where:

BITPIX: Is the number of bits in each digital number (D/N). This is equal to the number of bits in the analog to digital converter used to digitize the image. NAXIS1: Is the number of pixels per row of the CCD Detector.

NAXIS2: Is the number of pixels per column of the CCD Detector.

CCDNO: This is the CCD number assigned to a particular CCD. This is used where several different CCD's might be used with the same telescope electronics.

PIXFOVH: The field of view per pixel (in arcseconds) provides a handy way of providing historical information as to the telescope and CCD used during a specific time period, as well as providing valuable astrometric information for reduction.

This field represents the horizontal field of view.

PIXFOVV: This field represents the vertical field of view per pixel (in arcseconds).

CAMGAIN: Is the Camera gain expressed as electrons per ADN.Input CAMNOISE: Is the camera noise level expressed in electrons.

DETECT: Name of the camera. Used where multiple cameras are available.

SPECAL: Indicates any special processing done to the CCD, i.e., thinning etc.

Example:

```
501
16 512 512 1 1.2 1.4 3.2 25.0 CRAF_CAS NONE
```

502 - TAKE BIAS FIELD

This field is included for those people who take bias field images, to remove low level defects from the dark field and, flat field images before processing the actual image. The length of the exposure and number is hard coded into the camera software. This statement is used in conjunction with the dark field and flat field statements. The bias fields should be obtained at the same time as the dark and flat fields.

IDENTIFIER: 502
INFORMATION: NONE

Example:

```
502
```

503 BIAS FIELD DATA HEADER

This is the output header for the bias field.

IDENTIFIER: 503
INFORMATION:

	name	type	input	output
1	JD.FJD	real	never	required
2	CCDNO	integer	never	required
3	BIANAM	string	never	required

Where:

JD.FJD: The Julian data and fractional Julian date of the flat field exposure.
Input format: Real typical format xxxxxxx.xxxxxx

CCDNO: This is the CCD number assigned to a particular CCD. This is used where several different CCD's might be used with the same telescope electronics.

BIANAM: The Bias file name, following file naming format as defined above.

Example:
```
503
2448428.2222 1 B48428AA.FIT
```

504 - CLEAN CCD

In order to obtain optimum noise performance from a CCD it is mandatory to do several high speed reads of the chip prior to exposure. These high speed reads remove noise bias which builds up during the time the CCD is idle between exposures. This procedure also removes residual images left from very bright objects. Each horizontal and vertical pixel phase must be clocked. However the A/D converter should not be read, and there is no need to clock the double correlated sampler logic. The number of clean cycles should be hard coded into the telescope controller.

IDENTIFIER: 504
INFORMATION: NONE

Example:
```
504
```

505 PREFLASH CCD

At some institutions special processing is employed to enhance the spectral response of a ccd. One of these processes is flashing the CCD with either an IR or UV source, while the CCD is exposed to a special gas. This procedure is carried out prior to the CCD being cooled down. This procedure tends to improve the spectral response for an extended period of time on certain types of CCD. In other camera designs a light source is built in the camera to pre-charge the CCD, this is called a fat zero. This header only need be included if these procedures are used, and is maintained for historical purposes. However, if an internal light source is used to generate a fat zero this header is used to control the source.

IDENTIFIER: 505
INFORMATION:

	name	type	input	output
1	PRELEN	real	optional	echo/set
2	NUMPRE	integer	optional	echo/set
3	PRONUM	string	optional	echo/set
4	PRESOUR	string	optional	echo/set

Where:

PRELEN: Length of exposure to light source. Specified in seconds of time.

NUMPRE: Number of times preflash was done.

PRONUM: The number or name of any written procedure used to preflash the CCD. Useful when a complex preflash procedure is used, such as before cool down etc.

PRESOUR: Type of light source used for the preflash.

Example:
```
505
0.1 2 PREFLASH UV
```

506 - OPEN SHUTTER

This statement is used to open the CCD camera shutter for an exposure. It must be sent in order to start an exposure. Once opened the shutter remains open for the duration of the instructed exposure length, then automatically closes. It is therefore not required to issue a separate statement to close shutter. This statement is not required to be used with macro type statements such as the 509, 510 or 512. The output should be recorded via the 511 header.

IDENTIFIER: 506
INFORMATION:

	name	type	input	output
1	INTTIME	real	required	echo
2	BPFILTER	integer	required	echo
3	CCDNO	integer	optional	echo

Where:

INTTIME: The integration time for the flat field exposure expressed in seconds of time.

BPFILTER: The number of the bandpass filter to use for the flat field exposure. The assignments of the color filter number should follow the same convention as described in the 102 - FILTER statements in ATIS.

CCDNO: This is the CCD number assigned to a particular CCD. This is used where several different CCD's might be used with the same telescope electronics.

Example:

```
506
100 2 1
```

507 - CLOSE SHUTTER

This statement is used to manually close the CCD camera shutter after an exposure. No additional modifiers are used with this statements. The shutter close statement is normally not used, as the shutter is automatically closed after a specified exposure length. This statement is included for cases where manual shutter control is desired.

508 - TAKE FLAT FIELD

The need to flat field a CCD's response due to pixel nonuniformities in gain is well recognized. However the procedures for accomplishing this task vary. Flat fields may be taken at the beginning and end of a nights observing run or more frequently. Evening twilight and morning twilight sky or a light flooded portion of the inside of the observatory dome may be used for illumination. The procedures available are determined by the PA and made available to the user. However the need to do flat fielding in multiple colors is strongly recommended. At least one flat field sequence per filter should be taken each day. They should be sequential and of an exposure length such that the D/N are in mid range. Since dust or dirt is likely to build up during a nights run, two flat field sequences are recommended. Sticking with the ATIS convention of opening the dome at the start of each J.D. and before astronomical twilight, this might be a good time to take the first flat field. The second flat field can be taken just after the software senses astronomical twilight and before the dome is shut in the morning. Another alternative is to setup a white surface, which is in-line with the telescope while

it is in the home position, and take the flat fields during the day light, when the telescope is idle.

IDENTIFIER: 508
INFORMATION:

	name	type	input	output
1	NTTIME	integer	required	echo
2	BPFILTER	integer	required	echo
3	CCDNO	integer	optional	echo
4	NUMFPIX	integer	required	reset
5	FTYPE	integer	required	echo

Where:

INTTIME: The integration time for the flat field exposure expressed in seconds of time.

BPFILTER: The number of the bandpass filter to use for the flat field exposure. The assignments of the color filter number should follow the same convention as described in the 102 - FILTER statement in ATIS.

CCDNO: This is the CCD number assigned to a particular CCD. This is used where several different CCD's might be used with the same telescope electronics.

NUMFPIX: The number of Flat field images of each bandpass filter to take.

FTYPE: The type of background used to take flat field image. This function is telescope controller dependant and it is the astronomers responsibility to know the capabilities of the instruments when defining the method.

1	Observatory Dome
2	Twilight sky fixed position
3	Twilight sky drift scan
4	Twilight sky jog position
6	Dark Sky fixed position
6	Dark sky drift scan
7	Dark sky jog position
8-89	Reserved for Future ATIS Standards
90 -99	Never defined by ATIS

Example:

```
508
0.5 4 4 1 0 0
```

509 - FLAT FIELD DATA

The data in this field is all generated by the software at the time the flat field is taken. The coordinates of the center of the image are contained in the standard ATIS header.

IDENTIFIER: 509
INFORMATION:

	name	type	input	output
1	JD.FJD	real	never	required
2	NTTIME	real	never	required
3	CCDNO	integer	never	required
4	BPFILTER	integer	never	required
5	FLATFILE	string	never	required

Where:

JD.FJD: The Julian data and fractional Julian date of the center of the flat field exposure.

INTTIME: The integration time for the flat field exposure expressed in seconds.

CCDNO: This is the CCD number assigned to a particular CCD. This is used where several different CCD's might be used with the same telescope electronics.

BPFILTER: The number of the bandpass filter to use for the flat field exposure. The assignments of the color filter number should follow the same convention as described in the 102 - FILTER statement in ATIS.

FLATFILE: The flat field file name. This field is automatically appended to by the software, and should remain blank in the command file. Named per the format specified above.

Example:

```
509
2448428.6366 0.5 4 F48428AB.FIT
```

510 - TAKE IMAGE

This is the actual statement used to take an image. The object coordinates are maintained by the standard ATIS statement and therefore need not be duplicated here. In cases where reduced readout scan is specified, it is the telescope controllers responsibility to insert the correct values for NAXIS1 and NAXIS2 in the output FITS file. This is a macro statement and therefore the open and close shutter statements are not required for its operation.

IDENTIFIER: 510
INFORMATION:

	name	type	input	output
1	NDFILTER	integer	required	echoed
2	BPFILTER	integer	required	echoed
3	CCDNO	integer	required	echoed
4	HISTORY	integer	required	echoed
5	INTTIME	integer	required	echoed
6	IMNUM	integer	optional	echoed
7	TRACK	integer	optional	echoed
8	MAGNI	real	optional	echoed
9	CI	real	optional	echoed
10	SOURCE	integer	optional	echoed
11	STARTX	integer	optional	echoed
12	ENDX	integer	optional	echoed
13	STARTY	integer	optional	echoed
14	ENDY	integer	optional	echoed
15	BIN1	integer	optional	echoed
16	BLOOM	integer	optional	echoed
17	OBJNAME	string	optional	echoed

Where:

NDFILTER: The number of the neutral density filter used (if any) No NDFILT=1, the lowest density=2, the next most dense=3 etc.

BPFILTER: The number of the bandpass filter used to expose the image.

CCDNO: This is the CCD number assigned to a particular CCD. This is used where several different CCD's might be used with the same telescope electronics.

HISTORY: This is the history of the image file, i.e., signifies whether any processing such as dark field subtraction or flat fielding has been done to the file. Usually this field will contain the word raw. Indicating no processing has been done. This is a telescope controller built-in function, the astronomer is responsible to know the capabilities of the instrument, and the reduction algorithms available.

The following types of processing have been defined:

0	Raw Image
1	Dark Subtracted (image - dark - bias)
2	Flat Fielded
3-89	Reserved for Future ATIS Standard
90-99	Never Defined by ATIS

INTTIME: The integration time in seconds used to acquire the image

IMNUM: The number of images to take of this object (used for keeping track of multiple images of the same object) for summed images.

TRACK: This field is used to control the telescope's sidereal drive logic as to whether the sidereal clock is used for tracking an object or the clock is off. CCD drift scans are obtained by turning the sidereal clock off. A "1" in this field turns the clock on, and a "0" turns the clock off. The telescope controller is responsible to return the telescope to the same position it was in before the tracking was turned off.

MAGNI: The expected magnitude of the object. For extended objects the expected surface brightness of the object.

CI: The objects catalog b-v color index.

SOURCE: Is a code of the of source of photometric data included used for magnitude and color index. Source codes include:

1	UBV Nicolet(1978)
2	UBV Mermilliod (1986)
3	UBV Landolt (1973)
4	UBVRI USNO Almanac (Johnson RI)
5	UBVRI Iriarte et al (1965) Johnson RI
6	UBVRI Lanz (1986) Johnson RI
7	RI Jasniewicz (1982) Kron-Cousins RI
8	RI Landolt (1983) Kron-Cousins RI
9	RI Christian (1985) Kron-Cousins RI
10	RI Graham(1982) Kron-Cousins RI Southern Hemisphere
11	Schild (1983) Kron-Cousins RI M67
12 - 89	Reserved for Future ATIS Standards
90 - 99	Never Defined by ATIS

STRTX: Start X pixel for capture of reduced size images. If this field is 0 then full image is saved to disk.

ENDX: End X pixel for capture of reduced size image. If this field is 0 then full image is saved.

STRTY: Start Y pixel for capture of reduced size image. If this field is 0 then full image is saved.

ENDY: End Y pixel for reduced size image. If this field is 0 then full size image is captured.

BIN: This field specifies pixel binning. The binning number is indicated below:

1	No binning 1 pixel equals BITPIX in 501
2	2 x 2 binning 1 pixel equals sum of 4 pixels
3	3 x 3 binning 1 pixel equals sum of 9 pixels
4 - 89	Reserved for Future ATIS Standards combinations to
90 - 99	Never Defined by ATIS

BLOOM: This field is intended to turn clocking during integration on or off. This technique to decrease Blooming by bright objects in the field has been found to be quite effective with MMP type CCD's. A 1 in this field turns the clocking on.

0	No clocking during integration
1	Clock CCD lines during integration.

OBJNAM: Object name.

Example:

```
510
1 5 15.0 1 1 1 12.5 0.98 12 0 512 0 512 1 1 NGC4527
```

511 FILE HEADER - OUTPUT HEADER

The data in this field is all generated by the software at the time the image is taken. This is not an input header, but rather a data output header. The coordinates of the center of the image are contained in the standard ATIS header and the output FITS header. It is the telescope controllers responsibility to write all pertinent technical information need for reduction of the image to the FITS header.

IDENTIFIER: 511
INFORMATION:

	name	type	input	output
1	JD.FJD	real	never	required
2	CCDNO	integer	never	required
3	CAMTEMP	integer	never	optional
4	MNUM	integer	never	optional
5	NDFILT	integer	never	required
6	BPFILT	integer	never	required
7	OBJECT	string	never	optional
8	IMFILE	string	never	required

Where:

JD.FJD: The date and time the image was taken.

CCDNO: This is the CCD number assigned to a particular CCD. This is used where several different CCD's might be used with the same telescope electronics.

CAMTEMP: The camera temperature at the time the image was taken. IMNUM: The image number of a series of images of the same object.

BPFILT: The number of the bandpass filter used to acquire the image. See color in the 102 statement for details.

NDFILT: The number of the neutral density filter used (if any) No NDFILT=1, the lowest density=2, the next most dense=3 etc.

OBJECT: The object name.

IMFILE: The image file name, following file naming format as defined above.

Example:

```
511
2448428.6830 -50 1 5 1 NGC4527 I48428AF.FIT
```

512 - ACQUIRE OBJECT

This statement is intended to replace the standard ATIS 106 statement, as it is not adequate for CCD acquisition especially if offset guiding or particle read-out of the CCD is used. Due to the diverse designs of both hardware and software used in CCD cameras, the acquisition software routines should be hard coded into the Telescope and CCD software. If offset guiding (or finding) is used and more that one star is needed to define an extended object position, than the 512 statement maybe followed by a second 512 statement. The second statement shall contain the coordinates of the second offset star. It is the P.A's responsibility to assure that the offset object falls within the field of view of the CCD being used. This is a macro statement and therefore the use of the open and close shutter statements is not required.

IDENTIFIER: 512
INFORMATION:

	name	type	input	output
1	INTTIME	real	required	echo
2	ACQFIL	integer	required	echo
3	ACQMAG	real	required	echo
4	ACQCI	real	required	echo
5	OFFRAHR	integer	optional	echo
6	OFFRAMIN	integer	optional	echo
7	OFFRASEC	real	optional	echo
8	OFFDECDEG	integer	optional	echo
9	OFFDECMIN	integer	optional	echo
10	OFFDECSEC	real	optional	echo

Where:

INTTIME: Integration time in seconds used for acquiring object.

ACQFIL: Filter number to use for image acquisition. This is generally the visual filter. See color in the 507 statement for details.

ACQMAG: Expected navigation star or object magnitude.

ACQCI: Expected navigation star or object color index.

OFFRAHR: Offset guide star R.A. Hours.

OFFRAMIN: Offset guide star R.A. Minutes.

OFFRASEC: Offset guide star R.A. Seconds.

OFFDECDEG: Offset guide star Dec Degrees.

OFFDECMIN: Offset guide star Dec Minutes.

OFFDECSEC: Offset guide star Dec Seconds.

Example:

```
512
2.0 3 12.5 0.98 0 0 0 0 0 0
```

513 - TAKE DARK FIELD

This statement is used to take the dark field image. The original idea to use the standard ATIS 112 statement to accomplish this task was eliminated as it was felt that, in the case where a telescope had an instrument selector, and a photometer was used as an additional instrument, the additional statement provided more flexibility.

IDENTIFIER: 513
INFORMATION:

	name	type	input	output
1	INTTIME	integer	required	echo
2	CCDNO	integer	optional	echo
3	NUMFPIX	integer	required	reset

Where:

INTTIME: The integration time for the flat field exposure expressed in seconds of time.

CCDNO: This is the CCD number assigned to a particular CCD. This is used where several different CCD's might be used with the same telescope electronics.

NUMFPIX: The number of dark field images to take.

Example:

```
513
0.5 1 4
```

514 - DARK FIELD DATA

These fields contain data on the dark field image file. The data in this header represents output from the software. The Dark field exposure can follow the image exposure in sequence. However it is more efficient to do the dark and flat fields during the daylight, while the telescope is idle

IDENTIFIER: 514
INFORMATION:

	name	type	input	output
1	JD.FJD	real	never	required
2	NTTIME	real	never	required
3	CCDNO	integer	never	optional
4	DARKTEMP	integer	never	required
5	DARKFILE	string	never	required

Where:

514 is the record type (integer).

JD.FJD: The date and time the dark field image was taken. INTTIME: The integration time of the dark field image. This is automatically set equal to the image integration time.

CCDNO: This is the CCD number assigned to a particular CCD. This is used where several different CCD's might be used with the same telescope electronics.

DARKTEMP: The CCD temperature at the time the image was taken.

DARKFILE: The name of the dark field image file.

Example:

```
514
2448428.6840 15.0 1 -50 D48428AG.FIT
```

515 - CAMERA TECHNICAL DATA

The format of the fields is left open to the user. It can be straight ASCII text. This area is intended for maintaining historical data on the CCD camera. Such things as the defect table, bias voltage setting, software program used, clamp to sample time, etc., can be included here. A suggested format for encoding the defect table is included below.

IDENTIFIER: 515
INFORMATION:

	name	type	input	output
1	CCDNO	integer	required	echo
2	DEFECT	string	required	echo

Where:

CCDNO: This is the CCD number assigned to a particular CCD. This is used where several different CCD's might be used with the same telescope electronics.

DEFECT: CCD defect information. Defined in array format, i.e., [X..Y] or [X1,X2..Y1,Y2] where X indicates pixel row and Y indicates pixel column. There can be multiple entries in this field.

516 - FILTER DATA

This field is meant for maintaining technical data on experimental filters, i.e., make-up of combinations of combined filters, addition of blanks to reduce levels etc. This field is useful for keeping track of such data and need only be included if such data is desired. The format of this field is left open to the user.

IDENTIFIER: 516
INFORMATION:

	name	type	input	output
1	Filter Data	text	required	echo

Where:

Filter Data is a line of information as described above.

Example:

```
516
Note: V filter includes 2mm GG385
```

XIII. REFERENCES

Genet, R. M., and Hayes, D. S. 1989 *Robotic Observatories*, Mesa, Autoscope Corp.

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Seeds, M.A. and Genet, R. M. 1989, *Public Domain Software for Automatic Telescopes* (ATIS), ed D.S. Hayes and R. M. Genet, Mesa, Fairborn Press.

Young A. T., Genet R.M., Boyd L.J., Borucki W.J., Lockwood G.W., Henry G.W., Hall D.S., Pyper Smith D., Baliunas S.L., Donahue R., Epand D.H. 1991, *PASP* 103, 221.

APPENDIX (A). ATIS RESOURCES

This document on ATIS93 was written out of the desire to keep direction and continuity in the operation of automatic telescopes and to give potential users of ATIS93 input on its development. A directory in a Unix computer at the APT service at Mount Hopkins has been established as an official repository for ATIS93 information. This directory can be accessed by dial modem or through the Internet.

The host name is APT3.SAO.ARIZONA.EDU but this name is probably not in most name servers. The numeric Internet address is 192.33.141.153.

The directory can also be accessed by modem on 602-670-6756. The modem is a telebit 2500 which can operate in 2400 bps Hayes, 9600 bps V.32, and 18000 bps PEP modes. It auto - negotiates the format with many standard modems. Dial transfers are available using kermit (Ckermit).
For either modem, telnet, or FTP use the following:
Login: ATIS Password: ATIS93

The intent is to have the current version of ATIS93 available in several formats to include straight ASCII, Microsoft Word for Windows, and Postscript. This will be kept updated as changes are made. Check the file date to determine if your version is current. There should be no major changes. There may be some errors or inconsistancies which haven't been discovered in this printed version. Other files in this directory include:

USERS93.TXT	The list of assigned user numbers
SITES93.TXT	The list of ATIS sites and site numbers
NEWUSER.TXT	This file has write permission and allows new users to add themselves to the list or to make additions or corrections to the list. It will be reviewed periodically and new entries and changes moved to the USERS93.TXT file.

Other ATIS-related information and software will be added to this directory as it becomes available. This directory has read (and restricted write) capability. Contact Louis Boyd concerning uploads.

Answers to questions/suggested ATIS changes should be forwarded to:

ATIS 100, 200, 300, 400 series statements:
Louis Boyd
334 East Verde Lane
Phoenix, Arizona 85012 USA
Internet: boyd@pegasus.la.asu.edu
Phone: 602-234-2660

ATIS 500 series statements:
Donald Epand
Internet: epand@pegasus.la.asu.edu

ATIS 116 statement and its applications:
John Bresina
Internet: bresina@ptolemy.arc.nasa.gov

CREATE program:
George McCook
Internet: astronomy@ucis.vill.edu

Autoscope ATIS-compatible telescopes:
David Genet
Internet: dgenet@pegasus.la.asu.edu