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59 THE LICK OBSERVATORY "OVERLAY" PROGRAM

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I. INTRODUCTION

OVERLAY is intended as an aid for locating objects on the Palomar-National Geographic Sky Survey for which only the coordinates are known. In its usual mode it generates a Calcomp plot for each desired object which shows the position of the object relative to nearby bright stars. This plot is at the scale of the Sky Survey.

OVERLAY is based on an NRAO program written largely by Dave Schaffer. It has been extensively modified to run on the UCSC computer system and considerably improved for greater user ease.

II. BRIEF PROGRAM DESCRIPTION

OVERLAY runs on the UCSC IBM 360/40, plus the PDP-11 if plots are desired. The user punches a card for each object for which an overlay is desired, giving its position at any epoch (the format is discussed in part III.A.). The computer precesses the given position to epoch 1950.0 and sorts the objects into order of increasing declination (epoch 1950.0). Then, for each object, the program catalog (a magnetic tape containing the combined AGK2 and Yale (Bright Star) catalogs) is searched for all stars within 1° (the actual area searched is a rectangle 2° in declination and 1.5° in right ascension centered on the object) of the object position.

The output can take several forms. There is always a printed output which has two parts. First, all of the objects are listed in the order in which they were input with their given and current epoch coordinates. Second, there is a list for each object (now in order of increasing declination) of the epoch 1950 coordinates and X-Y displacements from the object position of all stars found within the search area for the object position. (The X-Y displacements are in millimeters at the scale of the Sky Survey.) Also, the plate(s) containing the object is(are) given by (atlas) plate number and (1950) plate center coordinates.

The user may, if he wishes, generate a punched output (cards) which is identical with the second part of the printed output. It is expected that this option will not generally be used.

It is also possible to generate plots, and it is expected that this will generally be done. A plot will be made for each object (if an object appears on more than one plate, a plot will be made for each plate). On this plot,

the object position is a small broken cross mark ($\text{---}\frac{1}{|}\text{---}$) and the nearby bright stars are small cross marks ($\text{---}\frac{+}{|}\text{---}$). In addition the plate center is marked with a large cross mark and two edges of the plate are outlined (e.g. $\text{---}\frac{+}{|}\text{---}$). The plot is labelled with the object name and 1950 coordinates and with the 1950 plate center coordinates. A sample plot is on page (2a). Because this plot is at the scale of the Sky Survey, the appropriate plate may be placed on it on a light table, the stars lined up and the proper object identified. The plotter has a resolution of 0.01 inches, so that positions will only be accurate to about 12 arc seconds. It is also possible to make the plot on semi-transparent paper so that it may be used with the Sky Survey prints.

III. A USER'S GUIDE TO 'OVERLAY'

OVERLAY is designed for easy use. For normal applications only a few cards ever need to be changed.

OVERLAY has three major parts. The program itself exists as a binary (compiled) deck. This part should never be changed. Only the current High Guru of the Program (Howard French at the time of this writing) is permitted to make changes in the program and he must document them in supplements to this writeup. The second part are the data cards, discussed in part A below. Finally are the JCL (Job Control Language) cards. These control the processing of the program in the computer. Of these cards, only the JOB card (see part B below) will normally need to be changed.

A. DATA CARDS

1. PLATE DATA CARDS

There are 236 data cards with information about the Sky Survey plates. The first contains the number of plates in different strips and other initiallizing information. The others contain the plate center coordinates for every Sky Survey plate. These cards obviously never need to be changed and hence should not be altered. So that these cards can be easily identified, the first and last are red.

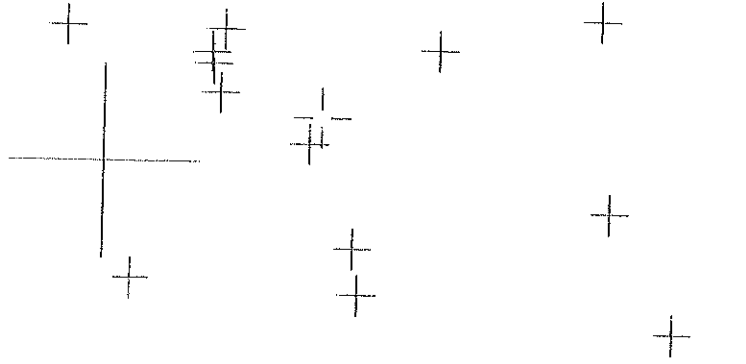
2. CONTROL DATA CARDS

There are four cards which are necessary to set up program options. Normally these cards will not need to be changed, but may be, by the user, for special applications. Afterwards he must change them back.

The first card enables the user to adjust the scale of the plots. It is discussed in detail in Appendix A.

NGC 7603 23^H 16^M 25^S.2 -0° 1' 12".3
PLATE CENTER 23^H 16^M 52^S 0° 31' 9"

ALL COORDINATES ARE FOR EPOCH = 1950.0



The second card controls the punch option. If the user desires the punched output, this card should read PNCH in the first four columns. Otherwise it should read NPCH. (Normally it will read NPCH.) The FORTRAN format is A4.

The third card controls plotting. If the user desires plots, this card should read PICT in the first four columns. Otherwise it should read NPCT. (Normally it will read PICT.) The FORTRAN format is A4.

The final card gives the current epoch so that current positions of all objects may be calculated and listed. The epoch (e.g. 1976.5) must appear in the first six columns and must contain a decimal point. This card should be updated periodically, as the epoch changes. The FORTRAN format is F6.1.

The control data cards are green for ease in locating them in the deck.

3. OBJECT DATA CARDS

The user must supply one card for each object for which he desires an overlay. These cards must be punched on a 29 keypunch (the modern-looking one in the Data Handling Room or any of the keypunches at the computer center).

There cannot be more than 200 objects in any run of OVERLAY and all must be located north of $-31^{\circ}0$ in declination. There cannot be more than 20 objects within any 1° strip in declination (e.g. between $+38^{\circ}$ and $+39^{\circ}$).

The object data cards have the format:

<u>COLUMNS</u>		<u>FORTRAN FORMAT</u>
1-8:	Object name	2A4
20-29:	Right ascension	F10.0
35-44:	Declination	F10.0
50-55:	Epoch (for these coordinates)	F6.0

Right ascension and declination must be in the format HHMMSS.SS or + DDMSS.SS because they are read as real numbers. Especially, the decimal point MUST APPEAR! For example $6^{\text{h}}20^{\text{m}}17^{\text{s}}$ would be 62017.,

$17^{\text{h}}8^{\text{m}}.7$ would be 170842., $-5^{\circ}13'$ would be -51300. and $+0^{\circ}25'23''$ would be 2533..

Epoch must be in the format EEEE.E. Again, the decimal point MUST appear. If epoch is left blank, it is assumed to be 1950.0.

The object data cards must be followed by a card which reads END in the first three columns.

B. JOB CARD

Every job must start with a JOB card. This must be a plain white card, available on the counter at the computer center. The JOB card should be prepared by each individual user and has this form:

Col 1

//jobname~~✓~~JOB~~✓~~(acct,n,5,m),name,MSGLEVEL=1,TIME=n

~~✓~~ leave blank; DO NOT LEAVE ANY OTHER COLUMNS BLANK!

jobname the name the user assigns to the job; it consists of one to eight alphanumeric characters (e.g. OVERLAY)

acct the computer account being used; it consists of four digits

n the job runtime in minutes. n = 10 should be sufficient for most uses

m the number of cards to be punched. If a punched output is desired set m = 50x number of objects; otherwise
m = 0

name the user's last name

Everything else must appear exactly as listed above.

C. DECK SET-UP

Normally the deck has the following structure (\emptyset means zero; all JCL cards start with a slash in column 1):

(column 1) (column 16)

↓

↓

JOB card

```

/*MESSAGE      *****
/*MESSAGE      MOUNT SC0406 NO RING
/*MESSAGE      MOUNT SC0357 WITH RING
/*MESSAGE      *****
//EXECFRTGLG
//LKED.SYSINDD*

```

.
.

.

OVERLAY binary (compiled) deck

.
.

.

```

//GO.PLOTTERDDUNIT=2400,DISP=NEW,LABEL=(1,SL),
//VOL=SER=SC0357,DSNAME=OVERLAY
//GO.FT07F001DDSYSOUT=B
//GO.FT08F001DDUNIT=2400,VOL=SER=SC0406,DSN=CATLOG,DISP=OLD
//GO.SYSINDD*

```

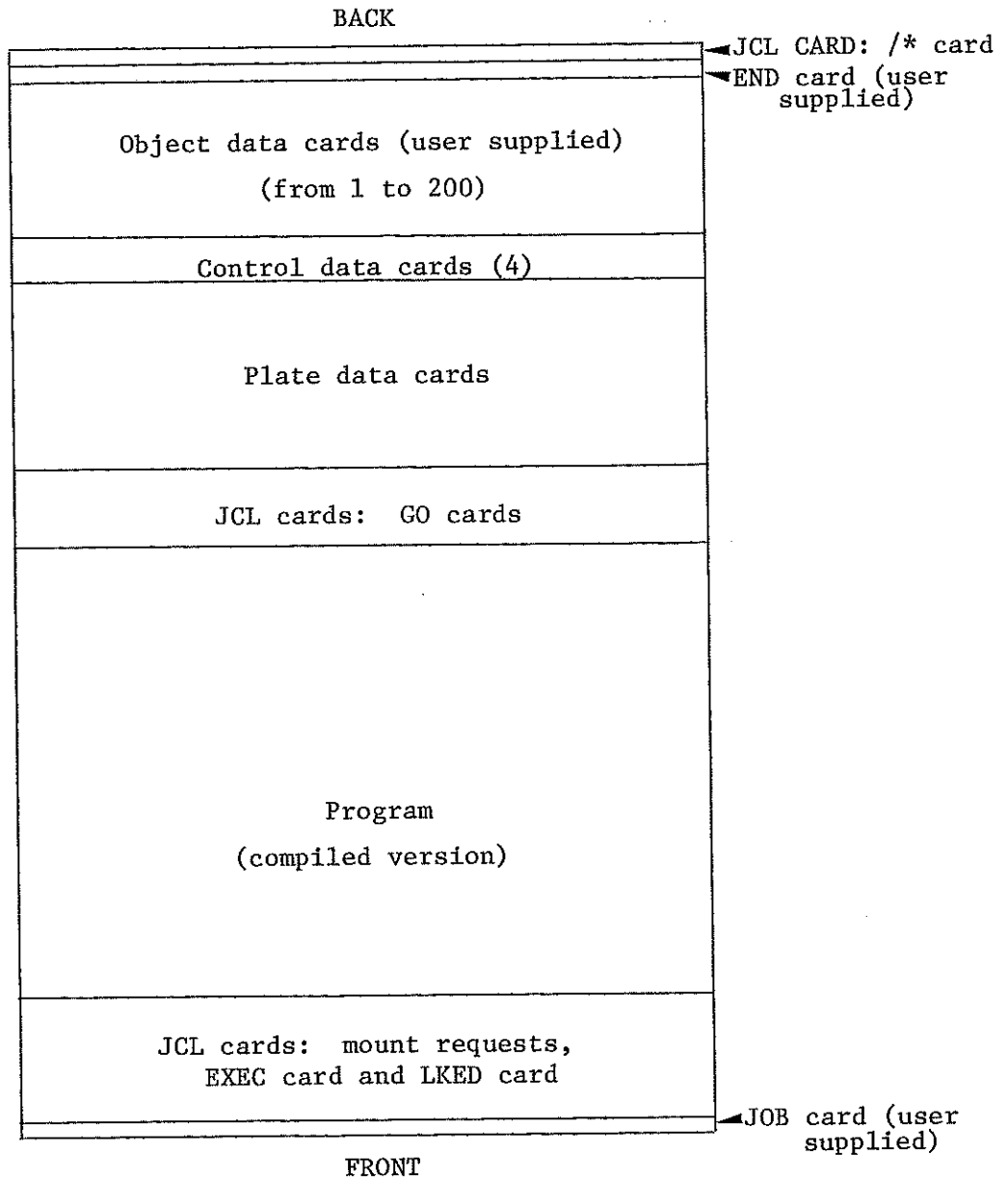
```

plate data cards (236)
control data cards (4)
object data cards (1 - 200)
END card

```

/*

The deck setup looks like:



(One exception to this deck setup can arise because of plotting. In generating a plot, the IBM 360/40 writes the plotter commands onto a user supplied magnetic tape. This tape is read by the PDP-11 which controls the plotting. We have been using SC0357 as a scratch tape for this purpose and other users are free to do the same, or they can supply their own scratch tape. The current general use scratch tape will be listed on the program box.

The entire run and plot procedure can be done in one step by submitting an Operator Plot Request card with the deck (see part D.1) The user may then pick up his plots the next morning at the counter.

These plots are on normal Calcomp paper and some users may wish to make use of the semi-transparent paper. In this case he may try to ask the computer center operators to use this paper for the plot (supplying his own roll); we have not yet tried this and do not know if the operators will oblige. Alternatively the user may do his own plotting.

If for this or any other reason the user decides to do his own plotting, it is recommended that the user supply his own scratch tape. Otherwise some other user may run the program after he has and write over his plot data before he has a chance to plot it. Tapes may be purchased or rented from the computer center or signed out from Lick Observatory. For this application the tape should be given standard labels (and consequently an SCxxxx serial number, where xxxx here and hereafter is a four-digit number). This will be done by the operator at the computer center. In this case the JCL needs these modifications:

Column 1	Column 16
↓	↓
/*MESSAGE	MOUNT SCxxxxx WITH RING

replaces

/*MESSAGE	MOUNT SC0357 WITH RING
-----------	------------------------

and

//VOL=SER=SCxxxx,DSNAME=OVERLAY

replaces

//VOL=SER=SC0357,DSNAME=OVERLAY

)

READY

RUN \$FORPLT

VOLUME LABEL? SC0357

(or SCxxxx for user-supplied tapes)

SC0357 MOUNT REQUEST ISSUED

(Sit patiently or impatiently while the operator finds and mounts your tape. Wake up the operator as required.)

FILE #? 1

IBUF DIMENSION 1000

ZERO CALCOMP, CHECK PEN AND HIT <CR> TO BEGIN PLOTTING <CR>

(<CR> means carriage return)

(plotting is now done)

DO YOU WISH ANOTHER RUN? NO

READY

BYE

CONFIRM: YES

(take your plots and leave.)

3. PDP-8 PLOTTING

At times the PDP-11 is in heavy time sharing use and plotting can take forever (in some cases 45 minutes per plot). For this reason a simple OVERLAY plotting program has been written for the PDP-8. This program asks for the X-Y positions of reference stars (the numbers in the printed output) and then produces a plot of the position of the object relative to these stars. It takes more work and is not as fancy as the PDP-11 plots, but if you can type fast it takes about 5 minutes per plot. The program is essentially self-explanatory and copies exist on the Koski Special Tape and elsewhere.

IV. LOCATING 'OVERLAY'

Because of the transient nature of scientific personnel (especially graduate students), it is deemed advisable to have a permanent staff member responsible for keeping OVERLAY and its backup materials (the program with compiled deck, the current source deck, a spare copy of the catalog, the program listing and semi-transparent paper). Laura Toepfer (in room 176 NS II

at the time of this writing) has been given this dubious honor. See her to locate any of the materials for OVERLAY. However, she is not a technical expert on the program so that if this writeup is not clear you may have to puzzle some things out on your own!

V. ACKNOWLEDGEMENTS

This program owes much to many people. Dave Schaffer of NRAO wrote the original version of the program. Bruce Balick called the program to our attention and rewrote much of the formatting. Alan Koski, Mark Phillips, Steve Hawley and especially Jack Baldwin helped with various aspects of the programming. Mark Phillips supplied me with the precession subroutine. Alan Koski wrote the PDP-8 plotting program. Finally, many thanks to all of the people who had the program bomb on them so that we finally got all of the major bugs out!

Appendix A

SCALE FACTORS

If it appears that the plots have the wrong scale for the Sky Survey, this can be adjusted through the scale factors. To change the scale factors, first find the current scale factors. These are on the first Control Data Card in the following format:

<u>COLUMNS</u>		<u>NOMINAL VALUE</u>	<u>FORTRAN FORMAT</u>
1-7:	RA scale factor	0.99866	F7.0
8-14:	Dec scale factor	0.99866	F7.0

Both factors should be near 1.0 and they MUST contain a decimal point. Now, by comparing the plots to the plates, determine for both right ascension and declination the factor by which you wish to expand the plot. Multiplying these factors by the old scale factors gives the new scale factors. Punch these in the format listed above and use this as the scale factors card.

It is suggested that if the scale factors need to be adjusted, the user consult the High Guru of the Program and let him make the changes. If you alter the scale factors in a deck used by other people, either change them back when you are through or accept the responsibility for notifying each and every user (violators will be "disappeared"!)

The scale factors can be used to adjust the scale for other telescopes in the same manner (e.g. for 20" Astrograph plates). The same rules apply for changing the scale back!

Appendix B

CATALOG TAPES

There should always be two copies of the star catalog on tape. One will be left at the computer center and in common use; the other should be in storage with Laura. When (if) the tape in use begins to show signs of wearing out, the storage tape should be copied onto a new tape (not the faulty one!). The former storage tape should then be put into use and the new tape become the storage tape (not the other way around; this way there will always be a tape which has only been spun twice -- once to be written and once to be tested -- and therefore can be assumed to be in perfect shape in case a new copy must be made).

The catalog tapes have the parameters:

DSNAME = CATLOG

LABEL = (1, SL)

RECFM = VS

BLKSIZE = 804

LRECL = 80

This information should also be placed on each tape with a paper label so that it can be found when (if) new copies must be made.

The label name of the tape in use (when this is written) is SC0406 and that of the backup tape is STRCAT (it was not possible to assign this tape an SCxxxx number; numbers which do not appear at the computer center for two years are subject to being reissued. We hope SC0406 will have a life much longer than two years.). When (if) STRCAT must be put into use, it should be outwardly labelled (with a paper label) with an SCxxxx number so that it may be more easily handled at the computer center. Do NOT try to change the magnetic tape label (which reads STRCAT) OR YOU WILL RUIN THE TAPE!! The JCL should be modified so that the mount request asks for tape SCxxxx, but the //GO.FT08F001 statement needs to ask for VOL=SER=STRCAT.

Appendix C

SOURCE DECK

In normal use the compiled version of 'OVERLAY' will be run. However, if it is desired to make changes in the program, the source deck must be run instead. It has the following components:

```

MAIN          (program)
COORD         (subroutine)
OVERLA        "
PRECES        "
PREPAL        "
RADDMS        "
SEARCH        "
DMSRAD        (function)

```

BLOCK DATA

If the source deck is run, the following JCL is needed:

```

JOB card
Mount Requests
//EXEC/FORTGCLG
//FORT.SYSIN/DD/*
.
.
.
source deck
.
.
.
//LKED.SYSIN/DD/*

```

The only differences occur in this part.

```

GO cards
data cards
/*

```

If a new compiled deck is desired, the EXEC card should read instead:

```

//EXEC/FORTGCLG,PARM.FORT='DECK'

```