# AIPSLETTER

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A newsletter for users of the NRAO
*Astronomical Image Processing System*

Written by a cast of *AIPS*

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## The Good News ...

The `15JAN95` release of Classic *AIPS* is now available. Contact Ernie Allen at any of the addresses given in the masthead to obtain a copy. As of this writing, 87 copies of the `15JUL94` release have been given out electronically (21 tar.Z, 19 tar.gz) or on magnetic tape (32 8mm, 10 4mm, 4 QIC, 1 9-track). The increase in magnetic tapes over network transmissions is due to the availability of a full binary distribution, but only on magnetic tape. 36 sites took advantage of this with the `15JUL94` release (20 Sun OS, 10 Solaris, 2 IBM AIX, 1 DEC Alpha, 3 Linux).

The new release contains 12 new tasks, including significant ones for "on-the-fly" imaging using the NRAO 12-meter telescope and for VLBI spectral-line polarization calibration, fringe-rate imaging, and data display. Subtle effects in VLBA processing, resulting in not-so-subtle data problems, were corrected in bandpass calibration and in delay and rate smearing of amplitudes. The number base used to name data files was changed from 16 to 36, allowing for many more extension files of each type per catalog entry, plus more simultaneous disks, tapes, etc. This change will require the execution of `UPDAT`, the old format correction program which we have not used in five years (or so).

Completely updated chapters on displays and spectral-line data reduction have been placed in the *CookBook*. In addition, new appendices, provided by people outside the *AIPS* Group, have been added to provide more genuinely "cookbook" views of continuum and line processing.

## ... and the Bad

The *AIPS* User Agreement has been required for non-NRAO sites to obtain a copy of *AIPS* and was designed to protect NRAO's intellectual property rights. It also helps protect all *AIPS* users from having their use of *AIPS* compromised by such things as having *AIPS* locked up in legal proceedings (which can last for years). This Draconian agreement may no longer be essential — the AIPS++ group plans a GNU-like license — but it appears that we are stuck with it. One aspect of this Agreement is that "This Agreement shall remain in effect for a period of five (5) years from the date hereof." Since the first Agreements were signed late in 1989, they are now expiring. If your site has had *AIPS* since then, it may have to sign a new Agreement to receive the `15JAN95` and subsequent release.

Each month, Ernie Allen notifies those sites whose licenses have expired and requests that they execute a new one. He also sends a site information form, requesting *AIPS* Managers to bring our information on their site up to date. We appreciate your cooperation with these onerous details.

# AIPS++ Review

The AIPS++ project was reviewed by a panel consisting of Ray Offen, Wim Brouw, James Coggins, Tim Cornwell, Dennis Gannon, and Bob Hanisch. They met, along with many "observers" and members of the AIPS++ project, in Charlottesville on December 12 and 13. Their full report and a reply from the Steering Committee have been checked into an anonymous ftp area in Charlottesville. The anonymous ftp access is to `aips2.cv.nrao.edu` in directory `pub/aips++/RELEASED/review-docs`. The World-Wide Web URL is therefore `ftp://aips2.cv.nrao.edu/pub/aips++/RELEASED/review-docs`.

# *CookBook* Update Continues

The *AIPS CookBook* was last updated for the `15OCT90` release. Because a lot has changed in *AIPS* since then, we have decided to modernize the *CookBook*. We are doing this one chapter at a time and are making each chapter available via the World-Wide Web as soon as it is ready. For details of the Web, see the publications article in this *AIPSLetter*. The chapters changed so far are

- 1 — *Introduction* — Added new sections giving a project summary and a diagram of the structure of *AIPS*.
- 2 — *Starting Up AIPS* — Changed to describe workstation use, *AIPS* in networked environments, and managing the TV server `XAS`.
- 3 — *Basic AIPS Utilities* — Updated information about history files and disk allocation, added `ABOUT` and `APROPOS` to the help section, moved and updated tape mounting, and added a discussion on external disk files (Fits, text, ...).
- 4 — *Calibrating Interferometer Data* — With much help from Rick Perley and Alan Bridle, rearranged and corrected everything, adding a substantial discussion of when and how to edit and bringing the description of `TVFLG` up to date including a picture.
- 7 — *Displaying Your Data* — Rewrote old chapters 7 and 8, to make a coherent, current, and complete description of printing, plotting, TV, and graphical data displays. Renumbered all chapters after 8.
- 9 — *Spectral-Line Software* — Rewrote old chapter 10, replacing old outline format with a more coherent (and wordy) description of line analysis, emphasizing continuum subtraction and other more modern imaging techniques.
- 14 — *Current AIPS Software* — Replaced old lists with new ones produced for the `ABOUT` verb.
- A — *Summary of AIPS Continuum UV-data Calibration* — Inserted a new appendix giving an updated version of Glen Langston's outline of continuum calibration.
- B — *A Step-by-Step Guide to Spectral-Line Data Analysis in AIPS* — Inserted a new appendix by Andrea Cox and Daniel Puche giving *their* outline view of spectral-line data reduction in *AIPS*.
- Z — *System-Dependent AIPS Tips* — Replaced with whole new discussions including color printers, screen copying, film recorders, workstation environments. A method for people to have NRAO make slides for them is described.

There exists a draft of Chapter 10, *Reducing VLBI Data in AIPS*, which will be released in the relatively near future. The VLBI chapter is a major rewrite to account for the advent of the VLBA. It is our hope to update the other chapters, add a chapter on single-dish data in *AIPS*, and even to add an index to the *CookBook*.

# Improvements for Users in 15JAN95

## Format change

The first format change since the code overhaul (completed in 1989) is included in the `15JAN95` release. In a sense, it is a relatively minor format change. No file has had its *contents* changed in a significant way, but virtually all data files have had their *names* changed. (The image header files had some previously unused areas initialized in anticipation of a new system of coordinates.) Before the format revision, file names had the form

*tt*`C`*mmmnn*`.`*uuu*`;1`

where *tt* is the file type (*e.g.*, `MA`), *mmm* is the catalog slot number in hexadecimal, *nn* is the version number in hexadecimal, and *uuu* is the user number in hexadecimal. With this form, user and slot numbers were required to be less than 4096 and version numbers were required to be less than 256. The former were worrisome, but the latter restricted spectral-line Cleans to 255 channels, a very serious limitation. After the format revision, file names have the form

*tt*`D`*mmmnnn*`.`*uuu*`;`

where *mmm* is the catalog slot number in "extended hexadecimal," *nnn* is the version number in extended hexadecimal, and *uuu* is the user number in extended hexadecimal. This numbering system is base 36, using the characters 0 through 9, followed by A through Z. The new limit on user numbers, catalog slots, *and* versions is 46655, which should be sufficient.

This switch from regular hexadecimal to extended has a number of other consequences. To assist users (and Unix procedures) in determining numbers in this system, two procedures were written: `EHEX` *n* converts *n* from decimal to base 36, while `REHEX` *m* converts *m* from base 36 to decimal. Logical names for disks, tapes, display devices, and the like in *AIPS* have used hexadecimal for some time and now use extended hexadecimal. This means that users may have up to 35 disks in a single *AIPS* session and that a local environment may have up to 1295 workstations rather than the previous limit of 255.

To perform the format conversion, only two simple steps are required. After `15JAN95` is installed (complete with new system files for all hosts, using `SYSETUP` if necessary), but before any users are allowed on it, the local *AIPS* Manager runs the stand-alone program `UPDAT` over all user and disk numbers. Then, each user renames his or her RUN files changing the user-number extension from base 16 to base 36 with the help of `EHEX`. More details are included in the installation documentation.

## VLBI data processing

### Spectral-line polarization calibration

A new task, `SPCAL`, has been implemented to perform instrumental feed calibration for spectral-line polarization VLBI data where the program source has low or moderate linear polarization. A subset of velocity channels in the program source cross-power spectrum is used in a composite fit for the feed terms. This task may not be appropriate for all spectral-line polarization VLBI data, but is part of a continuing effort to expand the software available in this area within *AIPS*. For further information please contact Athol Kemball (`akemball@nrao.edu`).

### Fringe-rate mapping

A multiple-point fringe-rate mapping task, `FRMAP`, has been implemented in the `15JAN95` release. This task uses a new fringe-rate mapping algorithm which is less sensitive to erroneous peaks in the fringe-rate spectra caused by missing data. The map area is subdivided into rectangular sub-regions and the number of lines crossing each of these regions is used to define the initial component positions. Final positions are determined using a least-squares minimization. The task produces an output file listing the right ascension, declination, and estimated flux density of each component. A graphical display of the lines is also produced. For further information please contact Leonia Kogan (`lkogan@nrao.edu`).

### VLBA bandpass calibration

In the VLBA correlator, fringe rotation is applied to both stations on each correlated baseline, with the Earth's geocenter as the coordinate reference point. This differs from previous correlators where only one station had fringe rotation applied. As a consequence, the differing VLBA coordinate reference introduces a time-variable frequency offset in the autocorrelation and cross-correlation spectra with respect to the recorded edge frequency at each station. `BPASS` has been modified to take the time-variable offset in the data into account in determining the bandpass solutions so that the `BP` entries are at a fixed frequency and can be averaged in time. The offset is taken into account again in applying the bandpass correction.

This mode is triggered in `BPASS` if the array name keyword in the `AN` table is "VLBA." The user is warned when this mode is entered. At present in `BPASS`, only autocorrelation bandpass determination incorporates the VLBA frequency offset corrections fully. Cross-correlation bandpass determination for data from all correlators is affected by the time-variable fringe rotation of at least one of the stations on any baseline. This effect appears only to be significant at high frequencies ($>$ 22 GHz) and for narrow bandwidths ($<$ 1 MHz). Baseline-based methods may be necessary in this case and this is a research area within *AIPS* at present. Please contact Phil Diamond (`pdiamond@nrao.edu`) for further information; an *AIPS* Memo is planned.

### Baseline-oriented fringe fitting

The baseline-oriented fringe-fitting tasks `BLING` and `BLAPP` have been extensively modified for the `15JAN95` release of *AIPS*. The good news is that `BLING` should fail much less often than before and will give more realistic error estimates and that `BLAPP` will detect antennæ that cannot be connected to the reference antenna and will flag solutions for such antennæ rather than assigning them random delays and rates.

If you use `BLING` and `BLAPP` you should note that the inputs to `BLING` have changed. In particular, the coherence factor (expressed as a percentage) is now used as the acceptance criterion rather than the signal-to-noise ratio. The default value deliberately errs on the conservative side and you may need to use lower values for weak sources. You should also note that the `BS` table now carries more information than it did in earlier releases of *AIPS* and that, as a consequence, the `15JAN95` version of `BLAPP` cannot handle `BS` tables from earlier versions of `BLING`.

The following suggestions should help you make the best use of the new `BLING`.

- Run `BLING` on a machine that does not penalize double-precision arithmetic (*e.g.*, an IBM RS/6000 or DEC Alpha) whenever possible; `BLING` makes heavy use of double precision during the chi-squared fit and takes a relatively large performance hit on machines where double-precision arithmetic is slower than single-precision (*e.g.*, SPARCs).
- Apply *a priori* amplitude calibrations before running `BLING`. If you don't do this, the data weights will not reflect the expected noise in the data and `BLING` will fail spectacularly (in some cases it may crash).
- Don't turn on the fringe acceleration search (`DPARM(7)` to `DPARM(9)`). This is a special option for space VLBI and will merely slow `BLING` down and degrade the quality of the solutions for ground-based arrays.

Further information about the revised editions of `BLING` and `BLAPP` is available in *AIPS* Memo 89 (see below).

### VLBA data handling

As usual, `FITLD` received a number of improvements for this release. The option to select spectral channels from each IF was added as was the ability to remove the FFT artifacts from total-power spectra. (These artifacts are washed out in the correlator on cross-power spectra.) The pulse-cal table was defined and a new task, `PCLOD`, was written to read the ASCII-format pulse-cal tables generated from the VLBA monitor system. Task `SNPLT` was enhanced to enable it to display the contents of `PC` tables and software is now under development to apply these VLBA phase-cal tables to the data. The *uv*-data display task `SHOUV` was changed to display closure phases with increased accuracy.

### VLBA amplitude correction

An improvement has been made to the calibration of VLBA data within *AIPS*, by allowing an amplitude correction for data that have been averaged in frequency in the VLBA correlator in the presence of uncorrected residual delays. This correction is significant only for the higher channel bandwidths (*e.g.*, about 0.5–1 MHz, as obtained with 16 spectral channels or fewer and an 8 MHz or 16 MHz BBC filter setting). The correction is of order

$$\mathrm{sinc}\ (\pi \times \mathrm{Channel\_bandwidth/Hz} \times \mathrm{Residual\_delay/s})\ .$$

Residual delays for the VLBA are generally low and, to date, this effect has only been seen clearly in one dataset. Data from MkIII and MkII correlators are not affected.

This correction is applied only if the `AN` table specifies that the array name is "VLBA" and there exists an additional keyword `SPEC_AVG` in the `AN` table header which records the factor by which the data have been pre-averaged in frequency. A value greater than unity is required to trigger the correction. For full polarization data, it is important to correct for any delay offsets between the RCP and LCP delay solutions before applying this correction. Please contact Athol Kemball (`akemball@nrao.edu`) for further information.

## Single-dish data in *AIPS*

Single-dish data analysis in *AIPS* had fallen into disuse since the programs that translated some Green Bank data into readable files were lost with the Convexes. The current "single-dish binary-tables FITS" format involves many more than *AIPS*' limit of 128 columns (although few are used or even initialized) and does not tell the truth about the actual contents of the data arrays. It would appear that this FITS format and the UniPops SDD format on which it is based can only be used by software specialized to the observing mode of interest. For the `15JAN95` release, one such specialized task was written. It is called `OTFUV` and translates SDD binary files from the NRAO 12-meter when it is observing in "on-the-fly" mode (up to four spectra so far every 0.1 seconds as the telescope is continually re-pointed). `OTFUV` applies associated "off" and gain scans to the data as they are read.

To make use of these voluminous data, a new data-gridding task `SDGRD` was written. It is an efficient combination of data selection, sorting (if needed), weighting, gridding, correcting, and cube building. In building this task, it was necessary to change the single-dish data handling to support compressed data and flag tables. Flagging tasks such as `UVFLG` and `TVFLG` needed modification to support these data as well (see below). `DBCON` was changed so that it would not trash single-dish data coordinates and `PRTSD` was changed to print more accurate times and to convert the "beam" into a pseudo-antenna number if it has the correct pattern (257 times an integer). The new task `BASRM` (see below) was intended for VLBA users, but has obvious applications to single-dish spectroscopy.

## *UV* data calibration and manipulation

### Calibration

The new task `BASRM` was written to copy a *uv* data set, removing a spectral baseline from total power data along the way. Cross-power data are untouched by this operation. The user is able to fit and remove an $n^{\mathrm{th}}$-order polynomial from line-free channels of the total-power spectra.

`UVLSF` was improved to offer a couple of options for flagging data based on the quality of the fits to the *uv*-spectral baseline. It was also given the option to shift data phases for a coordinate shift before the baseline fit (and shift the phases back afterwards).

Two significant bugs were corrected in `CALIB`. The mean gain modulus was computed separately for each sub-array and the last sub-array's value was written to the table. It has been corrected to average over all sub-arrays. The other bug was an error in the range of a `DO` loop causing it to loop over much too large an array with spectral-line data. This caused addressing problems and might, on some computers, have caused mysterious corruptions. `SNPLT` was multiplying by the mean gain when it should have been dividing. `ANCAL` was made rather more robust in its handling of missing and blanked table and input entries.

### Single-source files and data editing

For some reason, a number of *uv*-data tasks forbade single-source files from using flag and other calibration tables, while the rest happily applied them to single-source files. For the `15JAN95` release, these arbitrary restrictions were removed from `SPLIT`, `CALIB`, `FRING`, and `HORUS`. `TVFLG`, `SPFLG`, `IBLED`, and `UVFLG` were changed to use `FLAGVER` even for single-source files, creating a flag table if needed and `FLAGVER` $> 0$. They will write in a flag table if one already exists. Only if `FLAGVER = 0` and no `FG` table exists will they actually flag the single-source data.

The universal problem in gridding irregularly-spaced data is where to put the boundaries of the grid cells. `TVFLG` and `SPFLG` were basing that decision on the first data sample alone, which could cause it to get severely out of step with later samples. They have been changed to examine a significant number of data samples at the beginning of the data set and use the peak in the histogram of their times (modulo the cell size) to control the positioning. Both of them had trouble averaging across times with no samples, which can arise even with the improved grid construction. The averaging routines were improved to ignore missing data rather than terminating the summation.

`UVFLG` was changed to support compressed *uv* data and to flag single-dish data if requested rather than forcing the use of a flag table. The option to limit flagging (or unflagging) only to those samples outside a specified range in amplitude and/or inside a specified range in weight was also added.

### *uv* display and data handling

A new version of `VBPLT` was written. It is called `VPLOT` and is very much faster than the old task. `VPLOT` also offers the new option of plotting both amplitude and phase simultaneously.

`UVCOP` was improved to correct output tables for the various data selection parameters applied. A user-set option and other controls were added to estimate the output file size to avoid the slow process of creating an enormous output file when only a small file is required. `UVDIF` was corrected to report differences in data flagging. A typo was causing it to ignore these important differences.

## Imaging

Two new tasks were written as aid to the imaging process. `CONPL` plots the *AIPS*-standard convolution functions and a selection of the consequences of them (*i.e.*, the FFT of the function, the expected signal-to-noise for uniformly sampled synthesis imaging, or the convolution of the function with a Gaussian). This turned out to be surprisingly informative and should be of special interest to single-dish users of `SDGRD`. The other new task, `IMCLP`, limits the values in an image to a specified range, replacing pixel values outside the range with the closest value in the range.

Boxes to limit searches by Clean algorithms were renamed `CLBOX` in order to allow up to 50 such areas to be specified. For `WFCLN` only, an option was added to read from a text file up to 50 boxes for each of the 16 simultaneous fields allowed.

## Image analysis and display

There were several relatively minor changes in this area. `IMEAN` now attempts to compute the true signal-free rms of an image by fitting a Gaussian to the peak in the histogram. It may require two passes through the data to do this and does not depend on the histogram plot option. `SAD` also fits this true noise level, but now it adds it as a keyword to the output model fit (`MF`) file. A new task called `MF2ST` converts selected components from this `MF` file into the stars-file format used by many plotting programs. The `STARS` task and the `ST` file itself were changed to label the width columns as major and minor axes, to treat the position angle correctly as East from North, and to stop dividing by the cosine of the declination (since the width is not a right ascension).

The new task `SKYVE`, contributed by Mark Calabretta, will regrid a Digitized Sky Survey image to a coordinate frame and projection recognized by *AIPS*. The DSS is based on photographic material obtained using the UK Schmidt Telescope and was produced by the Space Telescope Science Institute. DSS images may be extracted from the CD set as FITS files by a program called `getimage` and read into `AIPS` with `IMLOD` or `FITLD`. `SKYVE` retrieves the plate solution parameters from the *AIPS* history file and regrids the image into a coordinate system recognized by *AIPS*.

### Miscellaneous changes of interest to users

**MOVE** New task to copy or move all of one catalog slot to another catalog slot belonging to the current user or to any other user. It is faster than `SUBIM` and `UVCOP` and, unlike them, copies all files of any kind without examination or modification and can give the data to another user number.

**TVCPS** This task now selects landscape or portrait modes depending on the relative sizes of the input and output images. It can be forced to use portrait mode with `APARM(9)`.

**TV pointing** The verbs `TVPOS`, `IMXY`, `IMPOS`, and probably others now prompt you to move the TV cursor and press any button.

**holography** `HOLGR` was improved to offer a phase model appropriate to antennæ with sub-reflectors in addition to the older model appropriate to prime-focus antennæ. `UVPRT` was changed to simplify the automatic flagging and to allow the option to have multiple reference antennæ for a single output antenna.

## Improvements Primarily for Programmers in 15JAN95

Other matters of interest to programmers in `15JAN95` include

**functions** Most Fortran compilers take exception to the use of the function names `IAND`, `IOR`, and `IEOR` since they think they know what they mean and that that meaning is not within the ANSI standard. We have always provided subroutines to do these functions, but it is not clear that those subroutines were actually used in all cases. Therefore, we changed all function references to `ZAND`, `ZOR`, and `ZEOR`, respectively, and renamed our function subroutines.

**headers** New parameters were added to the image headers in anticipation of changing over to the new proposed standard for coordinates. They are `KRCOK` for a code to indicate that the other WCS parameters are usable , `KDLON` for the value of `LONGPOLE`, `KDPRJ` for up to nine projection parameters (`PROJP1` etc.), and `KRPCM` for the `PC` 7 by 7 pixel conversion matrix. There are still 17 free words in the header!

**ZCREA2** Unix systems require *AIPS* to write to all records of a file in order to reserve the disk space requested. *AIPS* did this, but neglected to control what it wrote. Now it writes zeros. Programmers should not depend on this since not all systems will be Unix forever.

**ZFIO** This basic I/O routine attempts to read 1024 8-bit bytes in each operation. In order to allow it to be used to read non-*AIPS* binary data files, it was changed to accept (and report through the error return) a partial data record, presumably at the end of the file.

**ZDAOPN** This fundamental open routine for disk files attempted to open all files with both read and write access. It has been changed to attempt a read-only open when exclusive use is not requested and the read/write open fails. This allows us to circumvent privilege issues for files that only need to be read.

**TOUCH** Some algorithms keep scratch files open for very long times during enormous computations. In fact, these times got so long that the files could be deleted by execution of `TIMDEST` from another computer in the local network. File locking does not always work across NFS and is not a reliable defense. The new `TOUCH` routine is designed to be called periodically to update the last access times of all standard scratch files within the calling program to defend them from precipitate deletion.

# AIPS Publications and the World-Wide Web

There has been a virtual explosion in the use of the *World-Wide Web* (WWW) protocol on the Internet. It is a method for sending hypertext over the network and has been made easy to use by clients such as *NCSA Mosaic, Netscape, Arena,* and *Lynx*. NRAO is among the many institutions which now offer informative Web pages and networks of additional information. The NRAO "home" page is at the Universal Resource Locator (URL) address

`http://www.nrao.edu/`

This page can lead you to information about each of the NRAO's sites and telescopes, library system, major new initiatives, software packages, phone directory, and Newsletter as well as information about other astronomy resources on the Internet and about the Web's mark-up language called **html**. The *AIPS* group home page may be found from the NRAO home page or addressed directly at URL

`http://www.cv.nrao.edu/aips/`

This page points at basic information ("What is AIPS?" and a "FAQ"), news items about *AIPS* (such as "15JAN95 Release imminent ..."), the PostScript text of recent *AIPSLetter*s, patch information for all releases after **15JAN91**, information about known bugs, the latest *AIPS* benchmark data from various computer systems, copies of **CHANGE.DOC** for every release since **15JAN90**, and *all* relevant *AIPS* Memos, *every* chapter of the *CookBook*, and all recent quarterly reports to the NSF. We recommend that you check this area occasionally since it changes with time. There is a new tool which allows you to read any help file from the latest help area (**15JUL95** now). This could be turned into a full WAIS service if enough of you request it. As we correct and update the *CookBook* and as we write new *AIPS* Memos and reports, we place the documents in PostScript forms in the area used by WWW and we have the **html** listings, indices, tables of contents, and the like updated to reflect the additions. In this way, you do not have to wait until **15JUL95** to get the latest *CookBook* chapters. We expect, for example, to have a revised version of the VLBI chapter in the very near future.

Below is a list of the latest *AIPS* Memos, of which only Memo 89 is new with this release.

| Memo | Date | Title and author |
|---|---|---|
| 86 | 94/03/16 | Wide-field Polarization Correction of VLA Snapshot Images at 1.4 GHz<br>W. D. Cotton, NRAO |
| 87 | 94/04/05 | The NRAO *AIPS* Project — a Summary<br>Alan H. Bridle, Eric W. Greisen, NRAO |
| 88 | 94/05/16 | The *AIPS* Gripes Database<br>W. D. Cotton, Dean Schlemmer, NRAO |
| 89 | 94/11/17 | Baseline-Oriented Fringe Searches in *AIPS*<br>Chris Flatters, NRAO |

A heavily revised edition of the Memo on Object-Oriented Programming in *AIPS* is available as file **AIPSOOF.TEX** and, in PostScript form, as **AIPSOOF.PS**.

Since some Memos are not available electronically and others do not yet have computer readable figures, you may wish to write for a paper copy of these. To do so, use an *AIPS* order form or e-mail your request to `aipsmail@nrao.edu`.

If you cannot use the Web, you can still use `ftp` to retrieve the Memos, *CookBook* chapters, etc.:

1. `ftp baboon.cv.nrao.edu` or `192.33.115.103`
2. Login under user name anonymous and use your e-mail address as a password.
3. `cd pub/aips/TEXT/PUBL`
4. Read **AAAREADME** for more information.
5. Read **AIPSMEMO.LIST** for a full list of *AIPS* Memos.

*AIPS* Memos from Number 65 through 89 are present in this area as are Numbers 27, 33, 35, 39, 46, 51, 54, 61, and 62. We have been filling in this list gradually, by finding and fixing old files in other areas of the authors' disks, by scanning in text and figures, or by retyping text and redrawing the figures. The *AIPSLetter*s from 1991 through the present are also available in this area. Many of the Memos are in both

TEX and PostScript forms, with the TEX ones stored in a subdirectory called `TEX`. Note that many, if not all of these may be found on your home *AIPS* system in an area called `$AIPSPUBL`. All Memos are available in paper form from Ernie Allen at the addresses in the masthead.

The latest version of the *AIPS CookBook* is also available (in the form of PostScript files) in this area. Initially the chapters from the 1990 version of the *CookBook* were placed in this area; whenever one of these chapters is updated, the latest version will be available immediately in this area. Updated so far are chapters 1 (Introduction), 2 (Starting Up *AIPS*), 3 (Basic *AIPS* Utilities), 4 (Calibrating Interferometer Data), 7 (Displaying Your Data), 9 (Spectral-Line Software), 14 (Current *AIPS* Software), A (Continuum Calibration), B (Spectral-line Data Analysis), Z (System-Dependent *AIPS* Tips). Chapter 10 (Reducing VLBI Data in *AIPS*) is nearly ready as well. The remaining old chapters were revised to include figures in the PostScript and improve the typesetting, but are full of outdated information in addition to the good stuff.

# Patch Distribution

Since *AIPS* is now released only semi-annually (or even less frequently), we make selected, important bug fixes and improvements available via *anonymous* `ftp` on the NRAO Cpu `baboon` (`192.33.115.103`). Documentation about patches to a release is placed in the anonymous-ftp area `pub/aips/`*release-name* and the code is placed in suitable subdirectories below this. (The patches and their documentation are also available on-line via the World-Wide Web.) Reports of significant bugs in `15JUL94` *AIPS* were less numerous than in the previous release, and many of the patches were actually for new or improved code rather than bug fixes. The documentation file `pub/aips/15JUL94/README.15JUL94` mentions the following items:

**gains** `CALIB.FOR` was corrected to average the gains over all sub-arrays rather than just the last one. It was also corrected to average over the number of IFs being averaged. It wrongly averaged over the number of spectral channels in an array that was not that large. `SNPLT.FOR` was multiplying by the mean gain when it should have been dividing.

**flagging** `SPLIT.FOR`, `CALIB.FOR`, `FRING.FOR`, and `HORUS.FOR` refused to apply flag and other tables to single-source data sets. Since most other tasks do what they are told, these arbitrary restrictions were removed. Changed `TVFLG.FOR`, `SPFLG.FOR`, `IBLED.FOR`, and `UVFLG.FOR` to make and use flag tables on single-source data sets if requested.

**WFCLN** `WFCLN.FOR` set the number of channels to average in "SUM" mode incorrectly.

**single-dish** `SDGET.FOR`, `DGETSD.FOR`, and `PRTSD.FOR` were corrected to handle compressed data and to select IFs and channels correctly. New tasks `OTFUV`, `SDGRD`, and `CONPL` were written to support on-the-fly mapping. Subroutines `ZFIO.FOR`, `ZFI2.C`, and `ZDAOPN.C` were modified to handle partial data records and read/write privilege problems. `DBCON.FOR` was corrected to stop damaging single-dish coordinates by rescaling and re-labeling them as *uv* coordinates.

**UVDIF** `UVDIF.FOR` failed to report differences in flagging between the two input data sets.

**UVLSF** `UVLSF.FOR` was changed to flag data based on the quality of the fit baseline.

**coordinates** `DIRCOS.FOR` was corrected to rotate large differences between `RA` and `RAO` by 360° rather than simply declare failure.

**linking** `LINK` was corrected to use the desired versions of `LIBR.DAT` depending on whether the module is to use shared or static libraries.

Note that we did not revise the original `15JUL94` tape or `tar` files for these patches. No matter when you received your `15JUL94` "tape," you must fetch and install these patches if you require them. See the publications article for an example of how to fetch a patch. Information on patches and how to fetch and apply them is also available through the World-Wide Web pages for *AIPS*. As bugs in `15JAN95` are found, the patches will be placed in the `ftp`/Web area for `15JAN95`. As usual, we will not revise the original `15JAN95` tape or `tar` files for any such patches. No matter when you receive your `15JAN95` "tape," you must fetch and install these patches if you require them.

# Preview of coming attractions

## Improvements in plotting

The task LWPLA has been using incorrect sizes for characters to try to correct for poor placement of the character strings by the plot tasks. These incorrect sizes lead to misplacement of the strings in other ways. The solution is to go through all plot tasks and adopt a better and more standard way to place the labeling around the main plot areas. While doing so, we are also adding the adverb LTYPE to all plotting tasks which do not already have it and adding new values for additional control over the labeling of plots. We expect to add grey-scale images to the contours drawn by KNTR as well. This work is already nearly done in the 15JUL95 release.

## Improvements in imaging

At present, the various *AIPS* tasks that make images from visibility data all make different assumptions about the uniform weighting algorithm and other data weighting options. It is proposed to give the user full control over (1) the *uv*-cell size used in uniform weighting, (2) the radius in these cells over which a sample is counted, (3) the weight used in that counting (the data weight, 1.0, and possibly others), and (4) a parameter that limits how widely the data weights may vary. The first two options will allow for weights inversely proportional to the approximate local density of data samples in a detailed way. The third is mainly to allow users all of the current choices. And the fourth, called "robust weighting" by Dan Briggs, has both a good theoretical justification and some lovely test results.

The current weighting and gridding routines have trouble when the weight or *uv* grid does not fit into the "AP" memory. We intend to build in a sort to the imaging task or tasks to be done when necessary to avoid multiple passes and other complications in the weighting and gridding.

## A plan for VLBI-specific modifications to Classic *AIPS*

A list of functions needed for full support of VLBI in *AIPS* follows. Priority 1, "(P1),"items are needed as soon as possible to fill gaps in the data-processing paths. Priority 2 items are less time critical, but are needed for full functionality. Priority 3 items are useful, but not essential. No time scales have been set, but we hope to complete most of the priority 1 and 2 items during 1995.

1. Loading of data
   (a) (P1) IF selection and time averaging in FITLD.
   (b) (P1) Application of external calibration tables while loading VLBA data in FITLD.
   (c) (P2) Enable FITLD to deal with sub-arrays.
   (d) (P2) Fix known problems with MK3IN (amplitude offset).
   (e) (P3) MK4IN to accommodate new Haystack format.
2. More automated *a priori* calibration of VLBA data, *i.e.*, using the information provided by the on-line system with less editing and in fewer steps. It is essential that the correlator software start passing the necessary calibration information ($T_{sys}$ tables, gain curve tables, phase-cal tables, flagging tables, weather tables etc.) through the distribution system to be read by FITLD.
   (a) (P1) Apply digital corrections properly, including sampler bias amplitude corrections.
   (b) (P2) Proper application of phase-cal data.
   (c) (P2) Upgrade ANCAL to use SN table; also add more versatile options to allow one-pass calibration even if some antennas are missing calibration data for both polarizations (plus other similar cases). Also, deal with phased-array VLA calibration more generally.
   (d) (P2) Opacity corrections.

3. Data editing
   (a) (P2) Modify `IBLED` to be more station oriented.
   (b) (P2) "Nearest neighbor" option in `IBLED`.
   (c) (P3) Table editing task with `IBLED` functionality.
4. Data examination
   (a) (P3) RR/LL options in at least one or two listing tasks.
   (b) (P3) 3-D visualization options (separate packages *e.g.*, ATNF, but some path from *AIPS* perhaps).
   (c) (P3) `POSSM` option for adjacent (RR,LL,RL,LR) plots.
   (d) (P3) Plots of polarization closure quantities.
   (e) (P3) Ability to plot spectra from different times on same plot with offset — useful for looking for time variations.
5. General *uv* calibration
   (a) (P1) Parameterized bandpass determination, including cross-power bandpass for VLBA.
   (b) (P2) BP editing, weighting as requested by Uson et al.
   (c) (P2) Different solution intervals for amplitude and phase self-cal solutions, other possible improvements.
   (d) (P2) Better convergence in `UVFIT`; add other options for improved amplitude calibration/b-factor calculations.
   (e) (P2) Phase-referencing software.
   (f) (P2) Add polarization self-cal software.
   (g) (P3) Add IF selection to `FRING`.
   (h) (P3) Further algorithm development for polarization calibration.
   (i) (P3) A `SPLIT`-like task that generates a multi-source output file.
6. Imaging
   (a) (P1) Add robust weighting option.
   (b) (P2) On-the-fly sorting in mapping tasks.
   (c) (P3) NNLS (Dan Briggs' algorithm).
7. Image Analysis
   (a) (P2) Kinematic modeling (written but needs tidying up).
   (b) (P3) 3-D `SAD` equivalent for extracting component properties.
   (c) (p3) Zeeman fitting for B-field determination.
8. Space VLBI software
   (a) (P1) Interactive model-fitter.
   (b) (P2) Data simulator for generating pre-`FRING` data plus Space VLBI type errors.
   (c) (P3) Define tables for passing Space VLBI information through the correlator.
9. System
   (a) (P1) Proper `DDT` for VLBA including simulator.
   (b) (P1) Upgrade scratch file requirements for `FRING`, `BPASS` etc.; try to avoid creating very large scratch files. Check disk space before trying to create the scratch files. If input data are compressed write compressed scratch file.
   (c) (P2) change of data structure to enable IF-dependent weights for compressed data.
   (d) (P3) AIPS GUI?

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