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A newsletter for users of the NRAO
*A*stronomical *I*mage *P*rocessing *S*ystem

Written by a cast of *AIPS*

Edited by
Eric W. Greisen
National Radio Astronomy Observatory
520 Edgemont Road, Charlottesville, VA 22903–2475
804–296–0211, x209; TWX 910–997–0174; Fax 804–296–0278
aipsmail@nrao.edu

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

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

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^{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 *AIPSLetters*, 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 W. D. Cotton, NRAO
87	94/04/05	The NRAO *AIPS* Project — a Summary Alan H. Bridle, Eric W. Greisen, NRAO
88	94/05/16	The *AIPS* Gripes Database W. D. Cotton, Dean Schlemmer, NRAO
89	94/11/17	Baseline-Oriented Fringe Searches in *AIPS* 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 *AIPSLetters* 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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AIPS Order Form form 15JAN95 *(Unix)*

1. Name and address of Contact Person: _____
☐ Check here if address on back is ok. _____
(Include street address for UPS delivery) _____
_____

2. ☐ New order ☐ ReOrder

Do you have an AIPS user agreement? ☐ Yes ☐ No
(The agreement is a prerequisite for obtaining AIPS code)

3. Computer make, model and OS version: _____
(Include manufacturer and model of computer, and Version number of Operating System, e.g. Sun 4/SunOS 4.1.2, Intel 486DX2/66 Linux 0.99.15, IBM RS/6000-530/AIX 3.2, etc.)

4. DDT test package (15JAN94 version): ..... ☐ (includes small, medium, and large tests; 9-track 1600bpi tape does not have large)
(FITS tape)

5. VLA Calibration test tape:..... ☐

6. Tape "media" desired: ..... ☐ Internet FTP ☐ 4mm DDS DAT ☐ Exabyte (5GB)
(Unix "tar" format) ☐ Exabyte (2.2G) ☐ 9-track 6250 bpi ☐ QIC 150 (150MB)

☐ Check here for BINARY (load-and-go) tape [exabyte, DAT only] and indicate OS/hardware
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☐ Intel 386/486/Pentium, Linux 1.1 ☐ IBM RS6000/AIX 3.2 ☐ Dec Alpha/OSF-1 1.x

7. Are there "gripes" on the returned tape? ☐ Yes ☐ No

8. Printed Documents Requested: ..... ☐ 15OCT90 AIPS Cookbook (updated some)
☐ AIPS Memos: _____ Going AIPS (15APR90) ☐ Vol 1 ☐ Vol 2
(See separate list)

9. Custom 3-ring binders ..... Cookbook ☐
Going AIPS ☐ Vol 1 ☐ Vol 2

Send this order form (or an electronic equivalent) to:

AIPS Group
National Radio Astronomy Observatory
520 Edgemont Road
Charlottesville, VA 22903-2475
USA

Network Addresses
Internet: aipsmail@nrao.edu
UUCP: ...uunet!nrao.edu!aipsmail

January 15, 1995

CookBook revision begun:

Panel of *AIPS* users tests new recipes

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AIPSLETTER

Volume XV, Number 2: July 15, 1995

A newsletter for users of the NRAO
Astronomical Image Processing System

Written by a cast of *AIPS*

Edited by
Eric W. Greisen
National Radio Astronomy Observatory
520 Edgemont Road, Charlottesville, VA 22903–2475
804–296–0211, x209; TWX 910–997–0174; Fax 804–296–0278
aipsmail@nrao.edu

The Good News ...

The **15JUL95** release of Classic *AIPS* is now available. It may be obtained via *anonymous* ftp or by contacting Ernie Allen at any of the addresses given in the masthead. As of this writing, 119 copies of the **15JAN95** release have been given out electronically (7 tar.Z, 22 tar.gz, and 24 binary over 7 operating systems) or on magnetic tape (39 8mm, 24 4mm, 3 QIC, 1 3.5-inch floppies and *no* 9-track). 80 of the 119 were of the full binary release. Outside of NRAO, the 80 sites receiving **15JAN95** indicated their plans to run *AIPS* on 147 SUN OS 4, 198 SUN Solaris, 18 IBM AIX, 36 HP-UX, 41 DEC Alpha, 17 SGI Irix, 14 PC Linux and 1 Convex computers. A total of 472!

The **15JUL95** release is the first release under a new system designed to protect NRAO's intellectual property rights, while making *AIPS* more readily available to both the astronomy and non-astronomy communities. All files are now copyrighted by Associated Universities, Inc., NRAO's parent corporation, but are made freely available under the GNU General Public License (GPL). This means that User Agreements are no longer required, that you may obtain copies via anonymous ftp without contacting Ernie Allen, and that you may redistribute (and/or modify) the software, under certain restrictions, if you so choose. You may *not* sell this software; it remains free to everyone. Details on this new way to get *AIPS* and the text of the GNU GPL appear later in this *AIPSLetter*.

This release contains the new task **IMAGR**, intended to replace all previous imaging and Cleaning tasks (*e.g.*, **MX**, **HORUS**, **UVMAP**, and **WFCLN**). It offers all capabilities of these tasks, with some corrections, plus a wide range of new data weighting, TV interaction, and wide-field and wide-bandwidth correction options. The iterative self-cal and imaging task **SCMAP** now offers many of the same imaging and interactive options. The *CookBook* chapters on imaging and deconvolution were combined into one chapter describing **IMAGR** and the VLBI data reduction chapter was completely revised. It will need to be revised further, however, to describe numerous improvements and additions to the arsenal of VLBI calibration tasks, some of which appear in the current release.

We expect to be able to offer a position in the Classic *AIPS* Group, to be based in Charlottesville, in the near future. If you are interested, please contact us at the addresses given above.

... and the Bad

On May 1, Phil Diamond was promoted to Deputy Assistant Director of the Socorro Array Operations Center with responsibilities for computing and array operations. While this may be good news for Phil, it is not for the *AIPS* group. We are now reduced to two general-purpose programmers, but see above.

While we are reduced in manpower, the official expectations on the longevity of the Classic *AIPS* project have been substantially increased. Phil's promotion came because Tim Cornwell was named Assistant Director for the AIPS++ project. Tim is reorganizing that project and has stated that he expects it will not replace Classic *AIPS* for about five years, *i.e.*, the year 2000. (Classic *AIPS* was first "frozen" by management in April 1991, but freon seems to be in short supply these days.)

The use of Sun OS 4.1.*x* is being phased out at the NRAO in favor of the Solaris operating system, currently at Solaris 2.4 (also called SunOS 5.4). This means that the **15JUL95** version will be the last to be tested extensively under the old Sun Berkeley-based operating system. We will keep one or more computers on the old system as long as we can and we do not anticipate major problems anytime soon, but it is inevitable that the quality of our support for the old OS will diminish with time.

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.
- 5 — *Making Images from Interferometer Data* — Rewrote old chapters 5 and 6 to describe the new **IMAGR** task rather than several old imaging tasks, to modernize the self-calibration description, and to replace the discussion of **IBLED** with one describing the current program.
- 6 — *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.
- 8 — *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.
- 9 — *Reducing VLBI Data in AIPS* — Rewrote the old chapter to describe the nearly completely new software now available for the VLBA. This chapter will remain under active development for some time.
- 13 — *Current AIPS Software* — Replaced old lists with new ones produced for the **ABOUT** verb. Now current to the **15JUL95**version.
- 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.

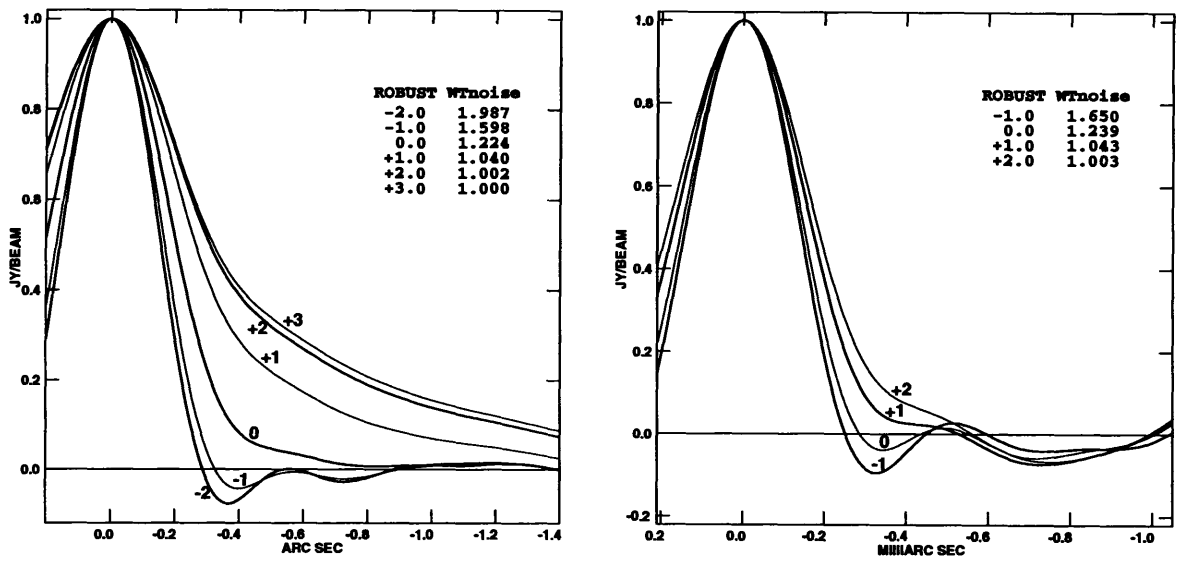
Improvements for Users in 15JUL95

Imaging

IMAGR

The new task **IMAGR** is intended to become the primary image making task in *AIPS*, replacing **UVMAP**, **HORUS**, **MX**, and **WFCLN**. It offers all of the capabilities of these tasks, including applying calibration to data from multi-source *uv* files. It does the Schwab-Cotton *uv*-plane subtraction form of the Clark Clean, in up to 16 fields, and can apply a variety of wide-field and wide-bandwidth corrections. The really new parts of the program lie in its ability to make 8192x8192 images, to sort the data (if needed), to use the TV display interactively, and to weight the data flexibly. Previous imaging tasks required the user to pre-sort the data, to accept poor forms of uniform weighting, and/or to put up with very inefficient multiple passes through the input data; **IMAGR** sorts the data if needed to avoid these things. The older tasks offered, at most, a TV display of one of the residual images and the option to terminate the Clean at the end of the current major cycle. **IMAGR** does its display before each major cycle, allowing you to interact with the dirty images or the current residual images. You may zoom and enhance the display and select both circular and rectangular Clean windows for each of the fields. The choice of field to display and window is made from a menu displayed on the TV. The menu offers numerous familiar functions including **CURVALUE**, **TVZOOM**, **TVPSEUDO**, **TVBOX**, and window setting as well.

IMAGR offers a large number of "knobs," in the form of adverbs, with which you may adjust the data weighting. To be honest, we must admit that we do not know what the optimum setting of the knobs might be, but we do know that they can make a significant difference in the signal-to-noise on images, can alter the synthesized beam width and sidelobe pattern, and can produce bad striping in the data when mildly wrong samples get substantially large weights. **IMAGR** allows the user to control the size of the "cells" in the *uv* plane used for counting samples in uniform weighting. It offers both circular and rectangular functions to control how a sample is counted as a function of distance from its location in the *uv* plane. It allows modification of the input data weights by various exponents for counting and/or weighting and performs the usual tapering. Finally, it offers a variation of Dan Briggs' "robust weighting" scheme to temper the wide divergence of weighting factors attempting to make the weights "uniform." The effect of this "**ROBUST**ness" parameter on synthesized beam patterns is illustrated in the accompanying Figure taken from the *AIPS CookBook*. **IMAGR** computes the effect of all of this weighting on the expected noise (compared to that expected from "natural" weighting) in the image and reports it in the image headers as parameter **WTNOISE**. The values of this parameter found for the beams in the Figure are shown in the accompanying tables.



Slices taken through the centers of synthesized beams for various values of the **ROBUST** parameter. Plot at left for a VLA A- and B-array data set, while the plot at right is for a VLBA data set. Do not assume that these plots apply to your data sets, however. Tables give noise increase over natural weighting (≡ large **ROBUST**).

To assist in the use of this new task, a new verb **FILEBOX** was written, **TVBOX** was revised to set circular as well as rectangular boxes, and the *CookBook* chapters on imaging and deconvolution were rewritten. **FILEBOX** assists the user to prepare a text file containing up to 500 (!!) rectangular and circular Clean boxes for each of up to 16 fields which can be fed to **IMAGR** as the initial selection of source-searching areas. It allows you to build up the list gradually, interacting with the TV display to prepare the list for the visible portion of the displayed field. All Clean box setting with the TV (verbs **TVBOX**, **REBOX**, **FILEBOX** and tasks **IMAGR**, **SCMAP**, **PLAYR**) uses the same subroutine which sets either kind of area and lets you modify existing Clean boxes and add new ones. Thus, **NBOXES** is now an *output* adverb from **TVBOX** and both an inputs and output adverb to **REBOX**. The new *CookBook* chapter combines old chapters 5 and 6 to describe **IMAGR**, **SCMAP**, and numerous other changes to imaging since the 1990 edition.

SCMAP

SCMAP is an OOP-based task intended to do imaging and Cleaning iterated with self-calibration. For this release, it has been improved by the addition of all of the new data-weighting and imaging options of **IMAGR**. **SCMAP** offers **IMAGR**'s interactive TV options during Clean plus a similar interactive TV display before each self-calibration cycle. The latter will, some day, have an interactive data editing capability and a variety of other options to adjust the self-calibrations. At the moment, it is mostly just another way to adjust the Clean boxes. **SCMAP** has the ability to determine the basic **SOLINT** from the times found in the data set, but is currently restricted to a single **SOLINT** for all iterations.

Bugs and other worries

When doing Clark Cleans, programs have to make the decision about when to do another major cycle. Previously, all *AIPS* tasks chose not to start another major cycle when they were within 10% of the iteration limit. That is often a sensible choice, but is very wrong when the number of iterations in each major cycle previously has been very much less than 10% of the iteration limit. All tasks have been changed to extend a major cycle by no more than half of the previous major cycle.

Several bugs in the Clean component subtraction were corrected during the development of **IMAGR**. Subroutine **ALGSUB** did not compute the number of rows needed for bandwidth synthesis correctly and could, as a consequence, have failed to subtract the model from some channels of some *uv*-data samples. Subroutine **ALGSTB**, used for rotated or unsorted data sets, computed the maximum baseline wrongly and, as a consequence, put very large and erroneous fluxes in the residual data file. The gridded component subtraction routine replaced the correct (and simple) cell coordinate correction with an elaborate erroneous and non-linear correction. In some cases, *i.e.*, large fields near the North Pole, this caused error messages to appear and, more importantly, could cause the gridding of the components to be done erroneously. These bugs affected **MX**, **UVSUB**, **WFCLN**, **CALIB**, *et al.* and were capable of producing either subtle ripples in the Clean or completely erroneous (and hence obvious) outputs. Because these bugs had to be found by programmers in new tasks, it is believed that they did not affect very many people in a significant way. **WFCLN** had bugs which caused a scaling error when imaging with **BIF** $\neq 1$ and which could have caused addressing exceptions in bandwidth synthesis imaging.

Image analysis and display

Plot labeling

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 led to misplacement of the strings in other ways. The solution was 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 also added the adverb **LTYPE** to all plotting tasks which did not already have it and added new values for additional control over the labeling of plots. The verb **EXTLIST** was brought up to date for most, if not all, tasks.

KNTR, PCNTR

The task **KNTR** was changed to plot grey-scale images as well as contours. Either of the two input images can be used as the contour image and/or the grey-scale image. If one of the two images is a cube, multiple panels can be displayed. The other image can then be either a cube or a plane. The Clean beam may be plotted in a separate frame or in any of the four corners with various degrees of cross hatching. This makes **CNTR** and **GREYS** obsolete. **KNTR** can plot the edges between blanked and good pixels or leave them invisible under control of the new adverb **DOBLANK**.

PCNTR was improved to convert Stokes I, Q, and U on the fly rather than require the input of total polarization and angle images found by **COMB**. The latter are still accepted of course. The input images can now be polarization cubes or three separate images. The Clean beam may be plotted with various degrees of cross hatching in any of the four corners.

Displaying *uv* data

The display of *uv* data received some minor improvements and bug fixes for this release. **UVHGM** was brought into the modern world by teaching it to read compressed data, to do some Stokes conversion, and to plot more than one Stokes, channel, or IF on each plot. The meaning of the plot scaling adverbs was changed in **UVPLT** to give more freedom with partially self-scaled plots. The data binning mode in **UVPLT** was given the choice of weighted or unweighted averaging. **VPLOT** acquired greater flexibility in the selection of antennas and baselines to be plotted and became more understanding about strange values of the averaging interval. The averaging of frequency channels was corrected in **CLPLT**, the task which plots closure phases.

The task **POSSM** got a fair amount of attention. Various barriers to plotting single-dish "*uv*" data were removed. The scaling of multiple-frame plots was improved. It now appends to the output text file rather than replacing it, and will write multiple spectra to the file when the averaging interval **SOLINT** is set greater than zero. Spectrum reversals are now corrected in writing out the file. Labeling of reversed axes in channels was corrected, as was the computation of velocity labels.

LISTR got a new option. With **OPTYPE = 'GAIN'**, setting **STOKES = 'POLD'** will get a display of the right versus left polarization gain ratio or their phase difference depending on the setting of **DPARM(1)**. Other minor bugs in the gain listings were corrected, as were bugs in handling the list of antennas and baselines in the matrix mode.

TV improvements

The *AIPS* TV was changed in useful ways for the **15JUL95** release. Four more graphics overlay channels were added. These four are treated in a new way. The first four graphics channels actually require 15 colors so that places where they overlap will show in different colors. If we were to do that with four more planes, then all 256 levels would be used up and we could not display the images. Therefore, the second four graphics planes appear only if no lower-numbered plane is turned on at the pixel. Channel 8 is used for the black background surrounding lettering now, so there are four usable graphics channels with full coloring and three additional ones with partial capabilities. Users may need to change their **.Xdefaults** file; see **HELP XAS** for details. The image catalog files now need four more records for the new graphics planes, which will normally require them to be replaced.

The way in which **XAS** allocates its colors was also changed. If it cannot get enough colors in the system's default color table, then **XAS** allocates its own color table. When the cursor moves into the **XAS** window, this non-default table applies and the colors of the other windows on the workstation screen may change. In the new release, **XAS** takes its colors beginning at the top of the table. Then, if **XAS** does not use all 256 colors, the entries at the bottom levels of the table are not touched. This trick means that the first windows created as you log in — your basic **xterms** usually — will keep their colors when the cursor moves into the **XAS** window. In this way, you may actually get to see the instructions for using the TV while you are using the TV!

The way in which **AIPS** and tasks handle errors while talking to the TV was corrected. Previously, the close-down sequences could cause **AIPS** or the task to abort when trying to issue commands to a dead display. The *AIPS* startup procedures were modified to check for the environment variable **$AIPS_TV_BUFFERED** and to set the TV to a buffered mode if it has the value **YES**. This mode of talking to the TV is faster since it leaves out some of the error testing and other handshaking. The loss in reliability is probably insignificant, especially over slow network connections where any help with the speed is desirable.

VLBI data processing

Two-bit VLBA sampler corrections: ACCOR

The voltage thresholds of the two-bit VLBA samplers, which define the four states measured in this digitization scheme, may deviate slightly across the network and may also differ from the optimal theoretical values. The effect of errors in these level settings is to introduce amplitude scaling errors in the two-bit data, most generally showing up as an amplitude offset between the RR and LL cross-power data. These scaling errors can reach 10–20 percent in some cases. This effect can be removed by using the mean level of the autocorrelation data to determine the sampler scaling error (L. Kogan, VLBA Scientific Memo 9). The new task **ACCOR** in *AIPS* implements this method. **ACCOR** produces a solution (**SN**) table containing the amplitude scaling factors which can be applied using **CLCAL** in the standard manner. The sampler scaling errors for one-bit VLBA data are generally negligible. For further information contact L. Kogan (**lkogan@nrao.edu**).

Amplitude calibration with ANTAB and APCAL

Two new tasks have been introduced to improve amplitude calibration of VLBI data, replacing and expanding the functionality presently offered by **ANCAL**. The first task, **ANTAB**, reads a priori calibration text files containing system and/or antenna temperature data and gain curve information and updates the information in the system temperature (**TY**) and gain curve (**GC**) tables accordingly. Greater flexibility is offered in reading the calibration files, including improved handling of VLA calibration data, more flexible assignment of tabulated data to individual IF and polarization pairs, and an allowance for tabulated and IF dependent gains. The second task, **APCAL**, uses the system temperature and gain curve information to generate a solution (**SN**) table containing amplitude calibration information. **APCAL** allows a simultaneous solution for atmospheric opacity and the corresponding adjustment of the amplitude gains, a consideration which may be important for observations at 22 GHz and 43 GHz. The use of **ANTAB** and **APCAL** allows greater selection and control of primary amplitude calibrators. These tasks are the presently recommended route for a priori amplitude calibration of VLBI data. For further information contact Athol Kemball, **akemball@nrao.edu**.

VLBA delay decorrelation corrections

Further to the notice in the last *AIPSLetter*, development has continued regarding the correction of VLBA delay decorrelation losses within AIPS. The two major effects are spectral averaging decorrelation, which is caused by spectral pre-averaging in the correlator in the presence of unknown residual delays, and alignment or segmentation losses caused by the misalignment of FFT segments due to residual delay errors. The **15JAN95** release of *AIPS* allowed corrections for the more significant effect of spectral averaging decorrelation (typically a few percent). This release adds the smaller correction for FFT alignment losses (usually a few tenths of a percent).

To incorporate these corrections fully, we have added a new **CQ** table containing VLBA correlation parameters for each *AIPS* IF. The correction is now activated if the **AN** table array name keyword identifies the data as originating from the VLBA correlator and the **CQ** table is present. This more comprehensive solution supersedes the previous use of the **SPEC_AVG** keyword in the **AN** table as described in the last *AIPSLetter*. The **CQ** table is created by **FITLD** via adverb **DELCORR**. Task **FXVLB** will build a missing **CQ** table but must be used before any averaging or selection in frequency. The corrections are thereafter automatically made whenever delay corrections are applied. If the correction is not activated, a warning is given.

A full description of these corrections can be found in a forthcoming *AIPS* Memo (No. 90) by A. Kemball. For further information contact him at **akemball@nrao.edu**.

VLBA correlator digital corrections in FITLD

The *AIPS* data filling task FITLD has been upgraded to make digital corrections for data processed by the VLBA correlator. These include constant amplitude scaling corrections (b-factor) for cross-power data and full digitization corrections for autocorrelation data. Cross-power digitization corrections are performed in the frequency domain while autocorrelation data, which have higher correlation coefficients, are transformed to the lag domain before digitization corrections are applied. The autocorrelation digitization correction is only exact if zero-padding is used in the correlator due to the lag domain response of an FX correlator. Without zero-padding this correction becomes more exact as the autocorrelation data approach flat, continuum spectra. The autocorrelation correction is recommended even if zero-padding was not used as the digitization correction will generally exceed any errors due to incorrect zero-padding. The digital corrections are controlled using adverb DIGICOR in FITLD. Further details regarding digitization corrections can be found in VLBA Scientific Memo 6 by L. Kogan. For general information regarding FITLD, contact P. Diamond (pdiamond@nrao.edu).

Pulse calibration of VLBA data

VLBA pulse-calibration information can be loaded into the new *AIPS* pulse-calibration (PC) table using task PCLOD. This task, which will be used temporarily until this information is passed directly through FITLD, reads an external text file containing the VLBA pulse-cal data. Users are directed to their technical contact person for information on how to obtain the PCLOD text file for their experiment.

The task PCCOR uses the pulse-cal data in the PC table to generate a solution (SN) table which corrects the instrumental delay and phase offsets between individual baseband converters. This can be applied prior to fringe fitting using CLCAL in the standard manner. This is the first release of PCCOR and further development is expected. General information regarding VLBA pulse-calibration corrections can be found in VLBA Scientific Memo 8 by C. Walker. For further information contact L. Kogan (lkogan@nrao.edu) or A. Kemball (akemball@nrao.edu).

Polarization calibration tasks contributed

Two new polarization calibration tasks have been implemented in this *AIPS* release. These tasks were developed by Kari Leppanen as part of his thesis work and offer an alternative method of solving for instrumental feed polarization when the polarization calibrator is spatially resolved. As such, these methods are useful in processing polarization data taken at high frequencies. Further details of the algorithms can be found in Leppanen, Zensus and Diamond (Ap.J., in press). The tasks are BLAVG, which allows a more robust estimation of differential polarization delay offsets and LPCAL, a feed polarization calibration task which allows for spatial structure in the polarization calibrator. The use of these tasks and their interaction with other tasks in *AIPS* will be included in a forthcoming update to the VLB chapter of the *CookBook*. For further information contact A. Kemball (akemball@nrao.edu).

Other VLB-related changes

A variety of other changes and improvements were made in VLBI-related software. A bug in FRING affecting data sets for which the first IF was not at zero frequency was corrected, as was a bug in the handling of memory which led to failure messages mentioning SOLINT. FRING now also re-references the multi-band delays when appropriate. MK3IN was changed to allow up to 66 baselines and to accommodate data sets with a large amount of frequency switching. The handling of the reference date was corrected to prevent errors when the antenna tables were written to tape out of time order. UVGLU was given the smarts to glue together data sets that do not match exactly, but which are in time order. FITLD had a number of minor corrections made to stem the proliferation of FQ numbers and to deal with unusual sequencing of data sets. SNSMO had a number of changes including correcting for 2π ambiguities before direct smoothing of phases, fixing the sign of the phase in VLMB-type smoothing, and re-enabling clipping of fringe rates.

Ed Fomalont was also busy for this release. He added time range and IF selection to MBDLY and improved its testing for bad fringe fits. He corrected the geometric calculations in CL2HF for converting to Haystack-style delays and rates, changed some of the adverbs, and dropped observations below 0.5 degree elevation. He also

made lots of changes to **HF2SV** including adding the **OUTFILE** adverb. These two tasks convert *AIPS*-style **CL** tables into files that can be read by the Goddard **calc** and **solve** programs. Ed also created a new task called **HFPRT** to print the contents of the **HF** extension file.

UV data calibration and manipulation

This area of the code received a fair amount of attention for this release, but mostly in the form of small bug fixes to be mentioned in the miscellaneous section below. A number of bugs in **SPLIT** were corrected. The header frequency was calculated erroneously when the first IF was not at the initial reference frequency and also when some, but not all, channels were averaged. **BIF** > 1 was ignored for all but the first source written. The routine used to average spectral channels was replaced with a more reliable one, already used in other tasks. This better routine was also put into **AVSPC**.

UVCOP was given a new option to delete data with weights below a user-specified threshold. This will be especially useful as a method for deleting bad data from VLBA data sets. The saga of corrections to **UVCOP** to account for data selection in the output tables continued for this release with corrections made to the handling of **CL** and **IM** tables.

Single-dish data in *AIPS*

A potentially serious bug was found in **SDGRD**, the task used to convert single-dish "*uv*" data into images. One non-existent sample from each buffer was gridded on each call to the gridding routine. If that portion of the memory was not suitably zero, then a square box the size of the convolving function support and of significant strength could appear at some location in the images of some, usually not all, spectral channels. The problem got worse if multiple passes through the data were required to image all spectral channels. Observers using the 12-meter on-the-fly imaging mode with **SDGRD** should consider remaking their images with the corrected task. Note that this bug affected only some of the images computed by **SDGRD**. A number of lesser bugs mostly having to do with allocation of memory were also corrected. See the article on patches for additional details.

SDGRD was also improved. The default weighting was changed to natural since uniform makes less sense in the single-dish case. An option to compute and put out an image of the expected noise (actually of $1/\sigma^2$) was added. This image may be used with the new task **WTSUM** to do weighted sums of images. This should allow single-dish users to image portions of their data, combining the output images, rather than having to image all of the data at one time (in very large files). Time smoothing was added to **OTFUV**, the task that converts 12m OTF data to *AIPS*, in another attempt to reduce the size of OTF data files.

Miscellaneous changes of interest to users

FITTP A bug caused **FITTP** to write an extra header-like record in place of table data when the table file was empty. The bug was fixed and the *AIPS* FITS readers changed to ignore this error. The readers were ignoring all following tables instead of the error previously.

SAD The source rejection logic was changed to reject some rather than all components in a multi-component island when some of them fail to meet the inclusion criteria.

GET4NAME New verbs to get and clear the fourth set of image name parameters were added.

PLAYR New task to enhance TV displays, blink two images, and the like chosen from a menu. It is a demonstration task for the *AIPS* OOP TV class, but may be useful for preparing color tables or looking at your images.

VTESS All of the ***TESS** tasks, especially **UTESS** and **VTESS**, had their use of buffers corrected and/or changed to employ appropriately larger sizes.

CONVL Messages about the convolving beam size and about any failures in its deconvolution were added.

calibration Calibrator source lists must be ignored when using SN tables generated on single-source data sets; a table parameter to describe the origin of the SN table was implemented.

flag tables Copied flag tables also can have entries incompatible with the current data set. Bugs, producing unpredictable flagging and other effects, were exterminated.

CVEL A bug causing data to be flagged excessively was found; see the patches report for details. Another (unpatched) addressing bug caused the time and antenna number to be passed into the shifting routines as though they were data. This produced subtle differences in the output spectra.

UVFLG A DTIMRANGE option was added for text-file input to control the amount by which the stated times are expanded before being written into the flag table.

FILLM The wrong reference channel was put in the header for bandwidth codes 8 and 9. It was set to the end rather than the center. FILLM also overstated the number of samples deleted for shadowing by doing that test before any other tests for data eligibility.

CLCOR A common error in correcting antenna positions (OPCODE 'ANTP') was to fail to set CLCORPRM(7) to indicate the phase convention (VLA versus VLB). The task was changed to check the antennas file for this information.

UVFIT Array sizes were increased to allow the program to work with the number of parameters it now attempts to fit.

KEYIN Modes in which the input text lines are echoed were enabled to assist in debugging large KEYIN-style input files used in ANCAL, ANTAB, APCAL, BLING, FETCH, MK3IN, PCLOD, SETAN, UVFLG, and VLBIN (at least).

Improvements Primarily for Programmers in 15JUL95

The area of OOP code and the TV display received a fair amount of attention for the 15JUL95 release. A new AP class was created, primarily so that each "AP" application subroutine could claim the pseudo-AP memory for itself without fearing that other subroutines would also expect free access to that memory. Since it is all one big COMMON these days, some "device" allocation scheme seemed like a good idea. To reserve the pseudo-AP memory, call APOBJ with an OPEN operation code and the current subroutine name. Be sure to close it as soon as your subroutine no longer depends on the contents of the AP memory.

The big change in this area was the creation of a TV device class and a TV utility library to make its use straightforward. At present, these are documented only in the $APLOOP files TVDEVICE.FOR and TVUTIL.FOR, but they will appear in the general OOP documentation in due course. This class provides access to virtually all TV functions including the display of, and interaction with, TV menus. To implement this class, a number of AIPS verb subroutines were restructured to make the TV functions appear in separate $YSUB subroutines. These subroutines were also generalized to handle more labeling options, line directions, and so forth. Although you may use these directly in *AIPS* programs, new tasks should consider using the OOP package with one or more instantiations of the TV class.

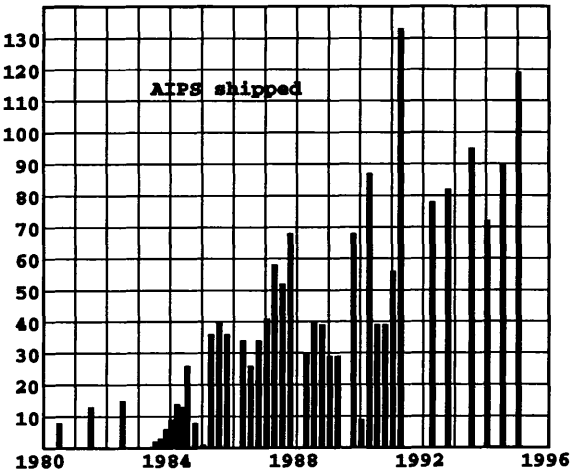
Other matters of interest to programmers in 15JUL95 include

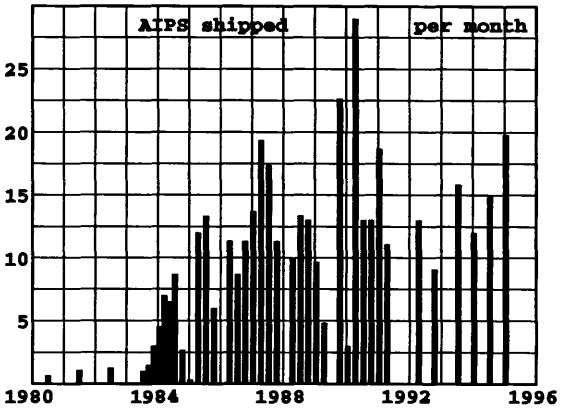
POPS A bug in the processing of the VERB and PSEUDOVB pseudo-verbs used in the NEWPARMS run file caused verb-like symbols to be re-compiled incorrectly and often caused more curious effects as well.

TKDEV The assignment of graphics device numbers was changed from the arbitrary 241–255 and the handling of the device assignment for "remote" graphics devices (namely the user's own terminal) was corrected.

GNU The GNU short copyleft statement was placed in all files in *AIPS*. It must be retained in every file and placed in, for example, the PostScript output files from TEX and dvips.

Perl To improve the speed of *AIPS* start-up scripts, versions of some of them have been written in Perl. They will be used if Perl is available on your system and can make quite a difference in the time it takes to get started.





release	tape	ftp	vms	unix	expfit	binary	total
ALL1980	8	0	8	0	0	0	8
ALL1981	13	0	13	0	0	0	13
ALL1982	15	0	13	2	0	0	15
15JUL83	2	0	2	0	0	0	2
15SEP83	3	0	3	0	0	0	3
15NOV83	6	0	6	0	0	0	6
15JAN84	9	0	9	0	0	0	9
15MAR84	14	0	14	0	0	0	14
15MAY84	13	0	13	0	0	0	13
15JUL84	26	0	14	12	0	0	26
15OCT84	8	0	8	0	0	0	8
15JAN85	1	0	1	0	0	0	1
15APR85	36	0	35	1	0	0	36
15JUL85	40	0	17	23	0	0	40
15OCT85	36	0	36	0	0	0	36
15APR86	34	0	32	0	2	0	34
15JUL86	26	0	25	1	0	0	26
15OCT86	34	0	20	14	0	0	34
15JAN87	41	0	29	11	1	0	41
15APR87	58	0	43	13	2	0	58
15JUL87	52	0	26	26	0	0	52
15OCT87	68	0	45	23	0	0	68
15APR88	30	0	10	19	1	0	30
15JUL88	40	0	20	20	0	0	40
15OCT88	39	0	17	22	0	0	39
15JAN89	29	0	11	18	0	0	29
15APR89	29	0	17	12	0	0	29
15OCT89	68	0	23	45	0	0	68
15JAN90	9	0	1	7	1	0	9
15APR90	87	0	35	52	0	0	87
15JUL90	39	0	12	27	0	0	39
15OCT90	39	0	13	26	0	0	39
15JAN91	56	0	16	40	0	0	56
15APR91	115	18	19	114	0	0	133
15APR92	37	41	0	78	0	0	78
15OCT92	24	58	0	82	0	0	82
15JUL93	33	62	0	95	0	0	95
15JAN94	16	56	0	72	0	0	72
15JUL94	48	42	0	90	0	37	90
15JAN95	66	53	0	119	0	80	119
total	1347	330	606	1064	7	117	1677

AIPS Distribution History

At a time when we are changing the method of distributing *AIPS*, it is good to look back and see the history of *AIPS*' distribution. Ernie Allen has prepared a list of the number of copies of *AIPS* given away by release. This list, which appears on the previous page, may be plotted as *AIPS* shipped for each release or as *AIPS* shipped per month. These plots also appear on the previous page and suggest that the demand for *AIPS* has been approximately constant in copies per month.

Note the rapid acceptance of ftp and binary forms of release and the gradual overtaking of VMS by Unix. We have not shipped a VMS system in rather a long time and shipped only a few in the last release in which VMS was fully supported. That same release was popular for Unix, mostly because it was around for a long time. More copies of **15JAN95** *AIPS* were shipped than has been usual for a 6-month release, perhaps because some sites took copies for more than one operating system.

AIPS Publications and the World-Wide Web

The *World-Wide Web* (WWW) is a method for sending and receiving hypertext over the Internet 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/

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, news items about *AIPS*, the PostScript text of recent *AIPSLetters*, patch information for all releases after **15JAN91**, the latest *AIPS* benchmark data from various computer systems, copies of **CHANGE.DOC** for every release since **15JAN90**, *all* relevant *AIPS* Memos, *every* chapter of the *CookBook*, and all recent quarterly reports to the NSF. There is even a tool to let you brouse the **15JAN96** versions of all help/explain files. We recommend that you check this URL occasionally since it changes when new software patches, revised *CookBook* chapters, and new *AIPS* Memos are released.

Since there were no new *AIPS* Memos in the last six months (Number 90 is nearly ready), we will not repeat the usual information about the Memo series here. 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 aips.nrao.edu** (currently on **192.33.115.103**)
2. Login under user name anonymous and use your e-mail address as a password (*yourname*@ will do; ftp will fill in the machine you are using).
3. **cd pub/aips/TEXT/PUBL**
4. **get AAAREADME** and read it for lots more information.
5. **get AIPSMEMO.LIST** for a full list of *AIPS* Memos.

Patch Distribution

Since *AIPS* is now released only semi-annually, we make selected, important bug fixes and improvements available via *anonymous* **ftp** on the NRAO cpu **aips.nrao.edu** (now located on **baboon** which is **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 **15JAN95** *AIPS* were not numerous, so some of the patches were actually for new or improved code rather than bug fixes. The documentation file **pub/aips/15JAN95/README.15JAN95** mentions the following items:

UVINIT The low-level basic routine **UVINIT** had an error allowing it to wrongly conclude that it could do fast I/O. It then set its safety margin to 0, checked the buffer size, changed the I/O method, and left the safety margin *wrongly* at 0. This was triggered by a combination of circumstances starting with **NVIS** equal to an integer multiple of 256.

CVEL An error in the use of the same array in two parts of the task caused **CVEL** to flag more and more channels as it ran through the data. This would only occur for data from the VLBA correlator when bandpass calibration was requested.

SWPOL The **GEODLY** array in **SWPCAL** is not dimensioned to cope with the 6-term polynomials used for VLBA data. **SWPOL** is therefore likely to crash when working with VLBA polarization data.

AIPS **PSEUDO** made errors when handling the pseudoverbs **VERB** and **PSEUDOVB** for previously defined symbols. The errors would cause the procedure containing the pseudoverb to be declared a verb or pseudoverb with some verb number such as 4 (an = or) the one trying to be declared.

SETPAR messed up the setting of assigned users. The **SP** file only supports 15 disks for this and applies to disk 1 now. Changed it to limit the disk numbers to 1 through **MIN (NVOL, 15)**.

SYSETUP did not handle the symbolic linking of the gripes (**GR**) and password (**PW**) files due to a couple of missing quote marks.

patching The file **$SYSLOCAL/USESHARED** was inadvertently included in the binary distribution for SunOS and Solaris systems. This causes the **COMLNKs** to fail when any patch or rebuilding is attempted as **LINK** attempts to use shared libraries which are not included in the distribution.

AIPS REMOTE The functionality of being able to display graphics on one's Tektronix or compatible terminal was broken. In previous releases since **15APR92**, devices 241-255 were reserved for possible "**REMOTE**" tek devices for **AIPS** numbers 1 through 15. Now, it is assumed that the first 35 devices *beyond* the last configured TV device (as set in the **SP** file via **SETPAR** or **SETSP**) are reserved for these devices.

SDGRD failed to place the **STOKES** adverb into the **COMMON** used by the data reading routines. Therefore, it always did Stokes **'I'**.

SDGRD had three addressing bugs in the in-core gridding. One could have caused data to overwrite the gridding function in the "AP" memory. This should have produced obvious problems. Perhaps various round-downs kept the gridding routine from actually doing this. The second left very little room in the "AP" for data and could have hit limits where it tried to do many channels and then said there was no room for the data. The third was the most serious: an extra "data sample" was gridded for each channel in the group using whatever was in the AP in that range of addresses. In the case in which this was found, values of 2, 4, 6, and 8 were gridded in some of the channels and appeared as 5x5 blocks of cells. The AP memory being used was probably correctly used in doing uniform weighting, so these values are likely to be counts of samples. Thus other integer-like values can occur. The weight image showed very large values at the affected pixels since the gridding routine was called numerous times (every 63 samples in my case). A minor change was made in the test to decide whether to do a weight map (> 2 was changed to ≥ 2 in the code and inputs to match the help).

SDGRD Improved the task to offer the option of computing an image of $1/\sigma^2$ where σ is the correctly computed expected rms in the gridded image (given that the data weights are all the same constant divided ny rms^2 where rms is the data sample's expected rms).

WTSUM New task of interest to single-dish users (and perhaps others) particularly in conjunction with the **SDGRD** change above. It does a weighted sum of two images using two images of weights or of rms's.

OTFUV Added the capability to specify an averaging interval and an output interval. The main benefit is a reduction in disk needs.

Note that we do not revise the original release tapes or **tar** files for patches. No matter when you received your **15JAN95** "tape," you must fetch and install these patches if you require them. Information on patches and how to fetch and apply them is also available through the World-Wide Web pages for *AIPS*. As bugs in **15JUL95** are found, the patches will be placed in the **ftp**/Web area for **15JUL95**. No matter when you receive your **15JUL95** "tape," you must fetch and install these patches if you require them.

Obtaining *AIPS* and the GNU General Public License

We have decided to make *AIPS* available via anonymous ftp under the GNU General Public License, the meaning of which will be spelled out later in this section. The installation of *AIPS* will now proceed something like the following example:

We assume that you have created an account for *AIPS* with a root directory called **/AIPS**. Then do

```
home_prompt<601> cd /AIPS
home_prompt<602> ftp aips.nrao.edu
Connected to baboon.cv.nrao.edu.
220 baboon FTP server (Version wu-2.4(1) Fri Apr 15 12:08:14 EDT 1994) ready.
Name (aips.nrao.cv:egreisen): ftp
331 Guest login ok, send your complete e-mail address as password.
Password: egreisen@
230- This is the National Radio Astronomy Observatory ftp server for the
230- AIPS, AIPS++, and FIRST projects.  Your access from primate.cv.nrao.edu
230- has been logged, and all file transfers will be recorded.  If you do not
230- like this, type "quit" now.  Counting you there are 1 (max 20) ftp users.
230-
230- Current time in Charlottesville, Virginia is Mon Jul 17 10:18:46 1995.
230-
230-
230-Please read the file README
230-  it was last modified on Wed Mar  8 14:01:24 1995 - 131 days ago
230 Guest login ok, access restrictions apply.
ftp> cd aips/15JUL95
250 CWD command successful.
ftp> get README
200 PORT command successful.
150 Opening ASCII mode data connection for README (nnnn bytes).
226 Transfer complete.
local: README remote: README
nnnn bytes received in T seconds (5 Kbytes/s)
ftp> get INSTALL.PS
200 PORT command successful.
150 Opening ASCII mode data connection for INSTALL.PS (mmmmm bytes).
226 Transfer complete.
local: INSTALL.PS remote: INSTALL.PS
mmmmm bytes received in TT seconds (5 Kbytes/s)
ftp> binary
200 Type set to I.
ftp> hash
Hash mark printing on (8192 bytes/hash mark).
ftp> get 15JUL95.tar.gz
200 PORT command successful.
150 Opening ASCII mode data connection for 15JUL95.tar.gz ( bytes).
226 Transfer complete.
local: 15JUL95.tar.gz remote: 15JUL95.tar.gz
mmmmm bytes received in TTTTT seconds (5 Kbytes/s)
ftp> quit
221 Goodbye.
```

You should type in your name (not **egreisen**) followed by an **@** sign at the password prompt. The **hash** command is optional and may be inappropriate in some versions of ftp; it does give a useful indication of progress in the long **get** in most versions. If you do not have the GNU file compression code (**gzip**), you should **get 15JUL95.tar.Z** instead of the **gz** file.

At this point you should read the **README** file to review the latest changes, if any, affecting your installation of *AIPS*. You should print out the **INSTALL.PS** PostScript document and read, at least, its overview section. To create the rest of the **/AIPS** directory tree, and fill it with the *AIPS* source code

```
cd /AIPS
zcat 15JUL95.tar.gz | tar xvf -
                or
uncompress 15JUL95.tar.Z
tar xvf 15JUL95.tar
```

depending on which of the compressed source code files you fetched.

If you want to get the binary version(s) of *AIPS*, you should read the **README** file for further directions. They will tell you a procedure to run which will run a second ftp session to fetch the appropriate contents from the **$LOAD**, **$LIBR**, **MEMORY**, **BIN**, and **DA00** areas. You may run this procedure more than once if you need to fetch binaries for more than one architecture. You may also have to run portions of this procedure "by hand" if you encounter reliability problems with the network.

You will then have to run the **INSTEP1** procedure, as usual, to tell your *AIPS* about your computer environment. A new part of **INSTEP1** is its offer to assist you in "registering" your copy of *AIPS*. It will help you complete a registration form and will even e-mail it to us if you want. When we get a registration request, we will enter your information in our user data base and reply with instructions and registration numeric "keys" which you may use to complete the registration process (using **SETPAR** and **SETSP**). This may seem cumbersome and onerous, but we have two reasons for doing this. The first reason is to provide us with information about the use of *AIPS*. This information is useful to us to justify, to management and funding agencies, our existence and our need for more employees or computers or disk or whatever. The second reason is a concern about excessive demands on our employees' limited time to provide assistance to sites in installing and running the software. If an excessive demand should arise, information from the registration process will allow us to set priorities among the different sites. This registration is entirely optional. We will use transaction logging in ftp and, hence, know which sites have fetched the code. We will assume that sites which do not register are not "serious" in their use of *AIPS* and we will be unable to provide any assistance to unregistered sites (except, of course, to help them register).

As of the **15JUL95** release, *AIPS* is available under the GNU General Public License. The short statement of this license is in every *AIPS* file, is available on-line via **HELP GNU**, and is given (once) in the *AIPSLetter* as follows.

```
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MA 02139, USA.

Correspondence concerning AIPS should be addressed as follows:
       Internet email: aipsmail@nrao.edu
       Postal address: AIPS Project Office
                       National Radio Astronomy Observatory
                       520 Edgemont Road
```

Charlottesville, VA 22903-2475 USA

You should have received the GNU General Public License from several sources, most notably GNU themselves with their **emacs**, **gcc**, and numerous other software products. Since *AIPS* now applies that license to itself — and intends to import and use other GNU-licensed routines — we also include the full license text on-line via **EXPLAIN GNU** and, once, in the *AIPSLetter*:

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675 Mass Ave, Cambridge, MA 02139, USA

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Preamble

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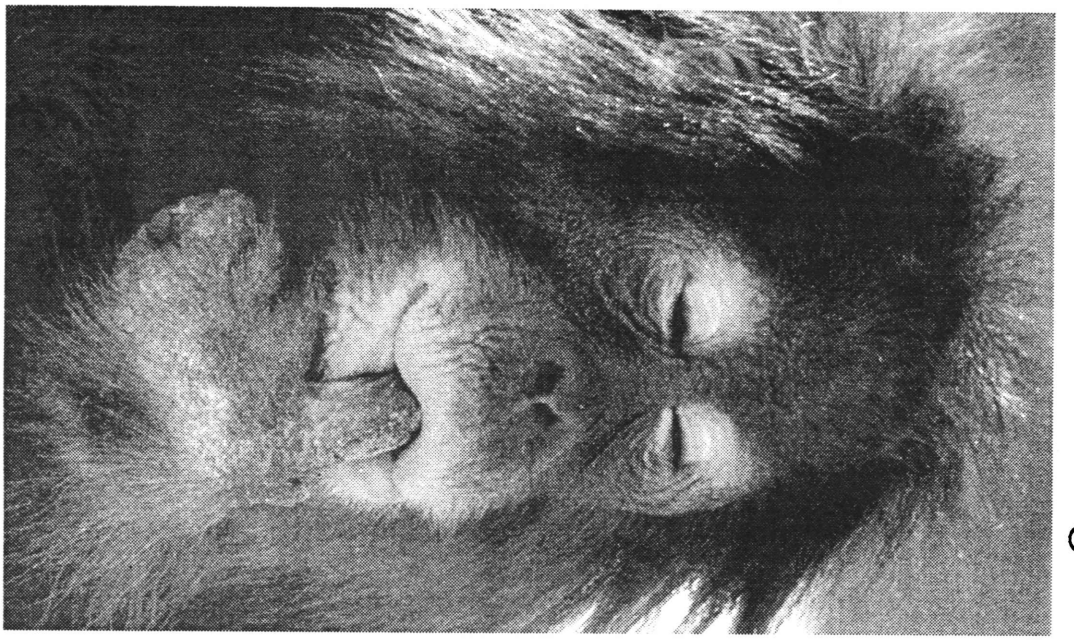

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