A I P S L E T T E R

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

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Recent Developments

The structure and focus of the *AIPS* programming group was re-defined in January 1991. In summary, the *AIPS* group, under the leadership of Geoff Croes, has decided to re-write *AIPS* in order to incorporate software capabilities needed for the coming decade.

The *AIPS* re-write will be discussed in the 15APR91 **AIPSLETTER**. The new *AIPS* software will be written in the language C++, and here after, the new *AIPS* will be called *AIPS*++.

Personnel

There has been one recent personnel change: Patrick Murphy, formerly of NRAO Tucson (and before that NRAO, Socorro), has joined the *AIPS* group and moved to NRAO, Charlottesville. Pat is in charge of helping *AIPS* system managers install new releases and is also updating the *AIPS* interface to the various flavors of operating systems. Welcome Pat! (Pat can be contacted at (804) 296-0372 or e-mail address **pmurphy@nrao.edu**)

New VLA data and Old Releases of *AIPS*

Scientists using the VLA often calibrate their *uv*-data at NRAO using the latest release of *AIPS* then take the data back to their home institution for further processing. This can cause problems if the the home institution has not recently installed the latest release of *AIPS*. The newest releases of *AIPS* support *multi-IF* VLA observations in a different manner than previous *AIPS* releases. (*Multi-IF* observations are observations in which two or more separate band passes are observed simultaneously *e.g.*, two 50 MHz

observations at 4885 and 4835 MHz). In addition, the VLA now allows many new observing modes (with many simultaneous observing frequencies) which are not supported in old releases of *AIPS*.

Old releases of *AIPS* were geared toward *uv*-data calibrated with the DEC-10 at the VLA site. The continuum *uv*-data calibrated by the DEC-10 could contain data with only a single VLA IF pair (AC or BD). New *AIPS* tasks place the *uv*-data for these *multi-IF* observations in one file to facilitate some of the new data processing algorithms. Old versions of *AIPS* either ignore the second *IF* or incorrectly process the second frequency. (*AIPS* tasks **UVMAP** and **ASCAL** **ignore** the second *IF*. In 15JAN91 tasks **MX** and **CALIB** handle *multi-IF* data correctly, and replace **UVMAP** and **ASCAL**.)

If observers are taking data back to sites running old versions of *AIPS* they should use the task **UVCOP** to copy each *IF* into a separate *uv*-data set. The old *AIPS* tasks are believed to handle the single frequency data correctly. Note that spectral line data from a single *IF* is believed to be processed correctly in older versions of *AIPS*.

Getting *AIPS* over the InterNet

Over the past few months, we have been investigating the feasibility of using InterNet for distribution of the Unix *AIPS* source. Several sites have obtained the 15JAN91 release of *AIPS* in this manner, and the experience so far has been very positive. The procedure is quite simple: the system manager uses the standard **ftp** program to copy a compressed Unix **tar** file from NRAO to their computer. The system manager can also retrieve copies of the Installation guide and reference manual or can request that they be sent via electronic mail. The tar file is about 36 Mega-bytes in size, and compresses down to 10 Mega-bytes. The system manager can choose between a single monolithic file and the split version (52 files).

As *AIPS* code is proprietary, we are unable to make it generally available over anonymous ftp. The procedure currently in use is to use a password-based account; the password is changed for each system manager.

We are now adding "**ftp**" as an option for distribution medium on the *AIPS* order form at the end of this **AIPSLETTER**. Please note that this applies *only to the Unix version* of *AIPS*. If you wish to make use of this option, you should either use the form or send an e-mail equivalent to **aipsmail@nrao.edu**. Your site does need a current *AIPS* license in order for us to process **ftp** orders. Contact Pat Murphy for more information concerning *AIPS* via InterNet.

Changes in 15JAN91

There were 403 "significant" changes applied to 15JAN91. A selection of these changes are summarized below.

Changes of interest to Users:

FQ ids Bugs were removed from several tasks which handled several *IF*s simultaneously.

IBMs Subroutine libraries were added for the IBM 6000/RISC computers.

Print All printing tasks were modified so that output could be re-directed to a file.

TVs Improvements were made to the three workstation TV emulators.

CALIB The task **CALIB** was split into two tasks, **CALIB** to do amplitude and phase calibration as well as self-calibration. **FRING** was created for fring fitting VLBI data. Several Calibration bugs were fixed.

CVEL Numerous improvements and bug fixes were applied.

DAYFX A new task to fix occasionally garbled Day numbers in *uv*-data read by **FILLM**.

FILLM Numerous improvements to *AIPS* ability to read VLA archive tapes.

HORUS Errors in applying UNIFORM Weighting in **HORUS** were corrected.

IBLED An Interactive Baseline EDitor is available. This task is particularly suited to VLBI data and provides a graphics interface to *uv*-data editing.

MK3IN Major improvement to *AIPS* ability to process Mark III VLBI data.

MX The image deconvolution task **MX** has been modified to accept un-sorted *uv*-data. This significantly reduces disk space needed to process observations.

VBPLT Several improvements to VLBI Baseline Plotting tasks.

MX/HORUS modifications for large images and improved efficiency

Software modifications are described which speed up the *AIPS* tasks for computers with large amounts of main memory. The task MX will execute much more quickly if the entire image to be Fourier Transformed fits in a work array. Note that these changes are **not** needed for 15JAN91 *AIPS*, but are included to allow *AIPS* system managers to update older versions of *AIPS*.

Before the 15JAN91 version of *AIPS*, the Pseudo-Array Processor (Pseudo-AP) work array (called APCORE) had a default size of 64k real words. This is too small to make a large, 4k×4k pixel, map. In order to make 4k×4k images, the *AIPS* system manager must replace three files, DAPC.INC, QCFFT.FOR and QINIT.FOR.

Also note that the *AIPS* system managers can increase program efficiency if the Pseudo-AP size is large enough to contain the image typically produced at their site. If scientists are producing 512×512 pixel images typically, the 1 Mega-word Pseudo-AP size in $INC/DAPC.INC should be selected instead of the default 0.25 Mega-word Pseudo-AP size.

The system manager must replace the three files in these directories:

1) $INC/DAPC.INC = .../15JAN91/INC/DAPC.INC

2) $QPSAP/QINIT.FOR = .../15JAN91/Q/DEV/PSAP/QINIT.FOR

3) $QPSAP/QCFFT.FOR = .../15JAN91/Q/DEV/PSAP/QCFFT.FOR

(Replace 15JAN91 with the AIPS version you are updating, *i.e.*, 15OCT90, etc.)

The three files required for the MX/HORUS changes are available via anonymous **ftp** (File Transfer Protocal) on the computer **baboon.cv.nrao.edu** (= **192.33.115.103**). A sample **ftp** session is listed below; commands typed by the user are in *italics*:

```
% ftp 192.33.115.103
Connected to 192.33.115.103.
220 baboon FTP server (SunOS 4.1) ready.
Name (192.33.115.103:glangsto): anonymous
331 Guest login ok, send ident as password.
Password:glangsto@nrao.edu
230 Guest login ok, access restrictions apply.
ftp> cd /pub/aips/15JAN91/INC
250 CWD command successful.
ftp> get DAPC.INC
200 PORT command successful.
150 ASCII data connection for DAPC.INC (192.33.115.6,1218) (1278 bytes).
226 ASCII Transfer complete.
local: DAPC.INC remote: DAPC.INC
1302 bytes received in 0.04 seconds (32 Kbytes/s)
ftp> cd /pub/aips/15JAN91/Q/DEV/PSAP
250 CWD command successful.
ftp> get QINIT.FOR
200 PORT command successful.
150 ASCII data connection for QINIT.FOR (192.33.115.6,1219) (1776 bytes).
226 ASCII Transfer complete.
local: QINIT.FOR remote: QINIT.FOR
1822 bytes received in 0.06 seconds (30 Kbytes/s)
ftp> get QCFFT.FOR
200 PORT command successful.
150 ASCII data connection for QCFFT.FOR (192.33.115.6,1220) (1005 bytes).
226 ASCII Transfer complete.
local: QCFFT.FOR remote: QCFFT.FOR
1030 bytes received in 0.02 seconds (50 Kbytes/s)
ftp> quit
221 Goodbye.
```

For sites without `ftp` capability, we will electronically mail the required files, if requested.

Next, all files in the $QPSAP directory must be re-compiled. Use the standard *AIPS* Compile procedures:

% $CDNEW	Creates environment variables for Re-compilation
% COMRPL $QPSAP/*.FOR	Re-compile all subroutines using Pseudo-AP Code
% COMLNK $QPGNOT/*.FOR	Re-link the programs using the AP
% COMLNK $QPGM/*.FOR	"
% COMLNK $QYPGNOT/*.FOR	Re-link the programs using the AP and *AIPS* TV
% COMLNK $QYPGM/*.FOR	"

Finally, set the *AIPS* parameter file, indicating the AP size. The *AIPS* program SETPAR is used to set the parameter file. A sample session is listed below, with commands typed by the user in *italics*.

```
% RUN SETPAR
Starting up SETPAR (RELEASE OF 15APR91)
Enter:  1=Start Over, 2=Change parameters, 3=Change DEVTAB, 4=Quit
2

 1  No. of AIPS data disks                  6
       ... Several Lines of Print Out ...
29  Pseudo-AP 2nd memory (1024s)            0
30  Max length of "short" vector            0
31  Graphics (TK) screen size: x, y      1024   780
32  Graphics (TK) character size: x, y     14    22
33  Disk \& reserved users or -1 scratch (9 I)
Enter number to change or  0 = Print, -1 = Return
```

```
 29  Pseudo-AP 2nd memory (1024s)            0

 192
 Enter number to change or 0 = Print, -1 = Return
 -1
 Password:
 Enter:  1=Start Over, 2=Change parameters, 3=Change DEVTAB, 4=Quit
 4
 SETPA1:  SaipS 15APR91 TST: Cpu= 0.68 Real= 17.0
 %
```

The *AIPS* tasks are now ready to make big maps efficiently.

The files are also listed below. First is a version of DAPC.INC which should be placed in $INC.

```
C                                                        Include DAPC.
C                                       Include for AP memory and work
      INTEGER   APSIZE, PKPWRD, PKPWD2
C                                       PKPWRD="primary" AP size
      PARAMETER (PKPWRD=64)
C                                       PKPWD2="secondary" memory
C                                       APSIZE and PKPWD2 are related by:
C                                       PKPWD2=((APSIZE/1024)-PKPWRD)
C                                       "1.25 Megaword = 5 Megabyte" size
C     PARAMETER (APSIZE=1310720,PKPWD2=1216)
C                                       "1.00 Megaword = 4 Megabyte" size
C     PARAMETER (APSIZE=1048576,PKPWD2=960)
C                                       "0.50 Megaword = 2 Megabyte" size
C     PARAMETER (APSIZE=524288, PKPWD2=448)
C                                       "0.25 Megaword = 1 Megabyte" size
      PARAMETER (APSIZE=262144, PKPWD2=192)
C                                       "256 Kbyte size"
C     PARAMETER (APSIZE=65536,  PKPWD2=0)
      REAL   APCORE(APSIZE)
      INTEGER   APCORI(1), SPAD(16)
      COMMON /APFAKE/APCORE
      COMMON /SPF/ SPAD
      EQUIVALENCE (APCORE, APCORI)
C                                                          End DAPC.
```

Below is a version of QCFFT.FOR which should be put in $QPSAP.

```
      SUBROUTINE QCFFT (C, N, F)
C-----------------------------------------------------------------------
C! Pseudo AP routine: Complex 1-D FFT.
C# AP-FFT
C-----------------------------------------------------------------------
C   Pseudo-AP version
C   Full complex 1-D FFT.
C   Inputs:
C      C  I  Base address (0-rel) of complex array to transform
C      N  I  Number of points in array (must be power of two).
C      F  I  Transform direction; 1 -> Forward
C                                -1 -> Backward
C-----------------------------------------------------------------------
      INTEGER   C, N, F, IF
      DOUBLE PRECISION DWORK(8200)
```

```
      INCLUDE 'INCS:DAPC.INC'
C-----------------------------------------------------------------------
      IF = F
      CALL QXFOUR (APCORE(C+1), N, IF, DWORK)
C
      RETURN
      END
```

Below is a version of QINIT.FOR which should be put in $QPSAP

```
      SUBROUTINE QINIT (I1, I2, APNUM)
C-----------------------------------------------------------------------
C! Pseudo AP routine: Initialize "AP".
C# AP-appl
C   This software is the subject of a User agreement and is confidential
C   in nature. It shall not be sold or otherwise made available or
C   disclosed to third parties.
C-----------------------------------------------------------------------
C   Initialize the AP.  For the pseudo-AP the size of the arrays in
C   COMMON /APCORE/ are defined and the AP roller common is
C   initialized.
C   Inputs:
C      I1     I  Dummy
C      I2     I  Dummy
C   Outputs:
C      APNUM  I  AP number (Neg. to indicate virtual AP, ie. not
C                to be rolled.
C    Output to common /BPROLC/
C      TRUEAP L  True if a real AP (to be rolled) (FALSE)
C      XTLAST D  Real time AP assigned (min).
C      DELTIM D  Time interval between rolls (min).
C      DELAY  R  Time to delay task (seconds).
C-----------------------------------------------------------------------
      INTEGER   I1, I2, APNUM
      INCLUDE 'INCS:DDCH.INC'
      INCLUDE 'INCS:DAPC.INC'
      INCLUDE 'INCS:DBPR.INC'
C-----------------------------------------------------------------------
C                                     Mark as non-rollable AP
      APNUM = -1
C                                     Fill values into /BPROLC/
      TRUEAP = .FALSE.
C                                     Delay time = 10 sec.
      DELAY = 10.0
C                                     Time between rolls = 5 min.
      DELTIM = 5.0D0
C                                     Set time.
      XTLAST = 0.0
C                                     Set AP memory size.
      KAPWRD = PKPWRD
      KAP2WD = PKPWD2
      RETURN
      END
```

AIPSLETTER

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6654::aipsmail or **...!uunet!nrao.edu!aipsmail**

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Recent Developments

The structure and focus of the *AIPS* programming group was redefined in January 1991. In summary, the *AIPS* group, under the leadership of Geoff Croes, has decided to re-write *AIPS* in order to incorporate software capabilities needed for the coming decade. The new *AIPS* software will be written in the language C++, and here after, the new *AIPS* will be called *AIPS*++.

A major consequence of this plan is that *AIPS* has been frozen. Current software development in *AIPS* is limited to improvements needed in the short term for VLBA calibration and certain experimental imaging tasks. Of course, bugs will be fixed as soon as possible. However, if bugs can be "worked around" using existing *AIPS* software, these bug fixes will have very low priority. Because most software development effort must go towards *AIPS*++, no extensive software modifications to old *AIPS* can be supported.

As a consequence of the *AIPS*++ development, the manpower we have available to support *AIPS* has been dramatically reduced, therefore we have decided not to release *AIPS* every quarter. The 15APR91 version of *AIPS* is the last planned release until 15APR92. However, we may release another version in 15OCT91. The decision as to when to release the next *AIPS* version depends on the amount of VLBA software development that occurs over the next few months.

Personnel

Bill Cotton has given up his leadership rôle in the development of *AIPS* in order to concentrate on *AIPS*++. He will contribute to *AIPS*++ the expertise and experience gleaned from his decade-long involvement in *AIPS*. Bill will also provide support for the VLBA calibration effort in *AIPS*.

Phil Diamond has accepted a position as a VLBA support scientist. In this capacity, he will continue his work to provide a path for VLBA data to be read into *AIPS*. Phil will also act as a friend to the VLBI

MK II correlator, and will continue in that capacity for the VLBA correlator when it arrives in Socorro from Charlottesville.

Gareth Hunt continues as head of the *AIPS* user support in Socorro. Glen Langston heads *AIPS* user support in Charlottesville.

AIPS++

The goals and design requirements for *AIPS++* will be described in a separate document. Because many man-years of work will be needed to create *AIPS++* most of the *AIPS* scientists will be working only on *AIPS++*. The *AIPS++* development is headed by Geoff Croes. The *AIPS++* software development is planned as an international collaboration. The following observatories agreed, in principle, to develop *AIPS++*: the Australia Telescope, Berkeley-Illinois-Maryland Array, the Manchester University Nuffield Laboratories (Jodrell Bank), the Netherlands Foundation for Research in Astronomy (Westerbork), and the Tata Foundation for Fundamental Research in India. Other institutions might join this effort later. The *AIPS* astronomers currently working on *AIPS++* are Bill Cotton, Chris Flatters, and Brian Glendenning.

AIPS++ is still in the early stage of development, and discussion on various topics is being carried out via electronic mail. Several e-mail "exploders" for discussion of issues related to *AIPS++* have been created. The traffic to date has been logged, and is available via anonymous **ftp** from **baboon.cv.nrao.edu** (192.33.115.103) under the pub/mailing-lists/aips++ directory. After viewing the contributions to date, if you are interested in joining the general *AIPS++* mailing list, send e-mail to aips2-request@nrao.edu.

Here is a short example of retrieving the logged traffic via **ftp** from a Unix machine. If you are unable to use **ftp**, e-mail to aips2-request@nrao.edu and ask for the traffic to date to be mailed to you. (The text type by the user is in *italics*.)

```
% ftp 192.33.115.103                          (if baboon.cv.nrao.edu doesn't work)
Connected to 192.33.115.103.
220 baboon FTP server (Sun-OS 4.1) ready.
Name (192.33.115.103:bglenden): anonymous
331 Guest login ok, send ident as password.
Password:bglenden@nrao.edu                          (use your e-mail address)
230 Guest login ok, access restrictions apply.
ftp> cd pub/mailing-lists/aips++
250 CWD command successful.
ftp> get aips2.log
200 PORT command successful.
150 ASCII data connection for aips2.log (192.33.115.19,1301) (588302 bytes).
226 ASCII Transfer complete.
local: aips2.log remote: aips2.log
602684 bytes received in 4.5 seconds (1.3e+02 Kbytes/s)
ftp> quit
221 Goodbye.
```

Reports from the 1991 *AIPS* Site Survey

Two reports prepared from the 1991 *AIPS* Site Survey data are available as *AIPS* Memos.

The "1991 *AIPS* Site Directory" (*AIPS* Memo 69 by Alan Bridle and Joanne Nance) lists hardware and *AIPS* usage data for the 139 *AIPS* sites whose *AIPS* activity was measurable from the survey data. The directory lists data for 204 computer systems at these 139 sites. It also contains the postal and E-mail addresses, and telephone numbers, for the Contact People at each site. Its main purpose is to help *AIPS* Site Managers who want to locate other *AIPS* sites that have hardware, use patterns and scientific interests similar to their own. It was distributed in April to the designated Contact People at all sites that are listed

in the Directory.

The *AIPS* Memo 70, entitled "The 1990 *AIPS* Site Survey", analyzes the demography and growth patterns of the computing hardware in the worldwide *AIPS* community. Its main purpose is to help people who plan *AIPS* hardware development at the NRAO and elsewhere to interpret recent trends in the *AIPS* community. It also contains *AIPS* performance estimates for a wide variety of computers on which *AIPS* is now running. This report may be particularly interesting to anyone seeking to make, or to justify, a new CPU or major peripheral procurement for *AIPS* use. For your convenience, we reprint the summary of its main conclusions below:

1. There has been roughly three-fold growth in the average machine (CPU) power per user throughout the *AIPS* community since 1988. "Affordable" machine power is growing faster than the number of *AIPS* users, so we are now in a desirable growth phase in which the average resource per *AIPS* user can become a better match to the data-processing needs of array telescopes.

2. The *AIPS* computing power is increasingly concentrated into machines that use large fractions of their CPU time to run *AIPS* — the "share" of the computing burden borne by such "highly active" *AIPS* machines has increased, and is now almost 80% of the total.

3. UNIX-based systems now provide 93% of the concentrated machine power used for *AIPS* data processing. The need for long-term support of *AIPS* under VMS is now highly questionable. The *AIPS* sites that still use VMS machines should therefore be encouraged to convert to UNIX as soon as possible.

4. Most of the growth in active *AIPS* CPU power since 1988 has been in scalar RISC work-stations without classical vector processors, rather than in vector- register machines (mini-supercomputers). The number of scalar machines used for *AIPS* increased from 115 to 305 since 1988, while the number of vector-register machines increased only from 18 to 22. Only about a third of *AIPS* data processing is now done with the aid of classical vector hardware. The use of stand-alone APs continues to decline.

5. The fraction of *AIPS* use that is devoted to VLA data processing has increased to 74% at the U.S. sites outside the NRAO, but continues to decrease at the NRAO and in other countries. Most of the non-VLA use of *AIPS* is for other radio applications (VLBI, AT, MERLIN, WSRT etc.). Use of *AIPS* for non-radio applications continues to be about 12% of the total.

6. About 34% of all VLA data processing by *AIPS* in the U.S. is supported by NSF funds. The NSF and NASA together support about 54% of the *AIPS* CPU power in the U.S. "Local initiatives" have almost matched the total *AIPS* CPU power supported by the two main federal sources of funds for astronomy. At *AIPS* sites with any NSF funding for *AIPS* computers, the NSF's contribution to the *AIPS* CPU power averages 70%.

7. Computers at the NRAO now provide about 16% of the total *AIPS* CPU power devoted to VLA data processing, down from 19% in 1988. The NRAO's share of all active *AIPS* CPU power has stabilized near 14%.

8. The total *AIPS* machine power now in use for VLA data reduction around the world falls short of that needed to meet the full scientific potential of the VLA by a factor of about eight. Machine powers in the range from high-end "compute server" work-stations to second- or third-generation mini-supercomputers are particularly needed to augment the available hierarchy.

Sites that are still running *AIPS* under VMS should take particular note of conclusion 3! This report has been distributed to the standard *AIPS* memo recipients. If you want a personal copy, please use the *AIPS* order form at the back of this AIPSLETTER.

Please send any questions or comments about the *AIPS* Site Survey or these reports to Alan Bridle (abridle@nrao.edu, 804-296-0375).

AIPS Users' Group: Offers of Code Support

Several astronomers have offered *AIPS* compatible software to the astronomical community. Below these sites are listed. Note: please contact the contributors directly for advice or debugging of their code, especially when it refers to hardware to which the NRAO *AIPS* group has no access. The offers of code support have been divided into three categories, APPLICATIONS, PERIPHERALS, and DISPLAYS.

APPLICATIONS

Don Rudy	flyby::drudy
Jet Propulsion Laboratory	djr@venus1.gps.caltech.edu
California Institute of Technology	
4800 Oak Grove Drive	
Pasadena	
California 91109	

Don Rudy has modified/created the following *AIPS* tasks:

UVFIT Fits Bessel functions to *uv* data (a disk or planet in image plane).

CCMOD Modified to be consistent with UVFIT (above).

MX Modified so that multi-channel cleans can all have CC files. It won't start channels greater than 1 at a component of 1.

LSCR A task to search through *uv* databases looking for points that differ from the average by a user-specified value.

Lee J. Rickard
Naval Research Laboratory
Hulbert Center for Space Research
Code 4138R
Washington DC 20375

Lee J. Rickard has created several tasks useful for interpreting IRAS data.

IMMNT New task which is useful when analyzing IRAS images. IMMNT is similar to the task IMEAN. IMMNT computes the 95% confidence level for the mean brightness, and also computes the variance, average deviation, skew-ness, and kurtosis. It overrides the IMEAN default that demands units of Jy/beam before calculating total flux, and returns the total flux and integration area in proper units. It also computes the mean position of the integration area, $< X >$ and $< Y >$, and the emission centroid, $< IX > / < I >$ and $< IY > / < I >$. It does a two-dimensional linear regression to determine a best-fit plane, reports the standard deviation of the residuals around the fit, and does a Kolmogoroff-Smirnov test for whether they are distributed normally.

TCMAP Task constructed from the *AIPS* paraform TAFFY that converts all six possible IRAS input ratio maps 25/12, 60/12, 100/12, 60/25, 100/25, and 100/60 into maps of temperature or spectral index. It does a cubic spline interpolation within tables of band ratios computed for thermal spectra over a range as large as 4K to 10,000K (although with more restricted lower limits for the shorter wavelength cases), with a range of emissivity indices, and for power law spectra with indices ranging from -3.0 to +3.0. It uses separate tables for handling data with or without the nominal bandwidth corrections (typically Sky Flux and COADD data respectively) or with proper color corrections. It can also produce maps from the observed values (based on the current estimates of the relative errors in the absolute photometry).

OPMAP Task to compute the IR optical depth. The same calculation that generates the interpolation tables of band rations also computes the effective wavelengths of the convolution of the source emission within the IRAS filters. This enables you to compute the IR optical depth from the ratio of the observed radiance to the Planck emission at the appropriate effective wavelength for the source temperature. The *AIPS* tasks **COMB** has been edited to create a new task called **OPMAP** which, given an intensity map and a temperature map, computes the associate opacity map. It is set up to take inputs similar to those of **TCMAP**, handling all six possible band ratios and a range of emissivity indices. It can handle data with or without nominal bandwidth corrections, and with units of either $Jy/ster$ or $W/m^2/ster$. Instead of an opacity map, it can produce a color-corrected intensity map, a map of color corrections, or an energy map ($\nu \times I(\nu)$).

TVALT Given an image, **TVALT** constructs the histogram of pixel values within specified boxes. It then transforms the intensities to display brightnesses to accomplish histogram equalization (equal numbers of pixels in each display level), histogram projection (uniform distribution of the number of occupied display levels), or a linear hybrid. This task was created from **TAFFY**.

JMFLT An augmentation of the task **IMFLT** (which itself originated at NRL), which fits a linear base-plane to an image. This version can also compute a best-fit quadric surface, and it also has the option of entering base-plane parameters for subtraction without fitting.

ALTER A simple image modification task constructed from **TAFFY**. It replaces magic blanks with a constant, replaces the data with exp(data), or replaces the data with (data)**constant.

CREE8 A task created to support test of the color display. This creates an image of an equilateral triangle with an intensity gradient (either linear or inverse Beta) along one of the three axes.

Mark Calabretta	aipsmgr@rpepping.oz.au
Australia Telescope	nssdca::psi%rpepping::aipsmgr
P. O. Box 76	
Epping	
New South Wales 2121	
Australia	

Mark Calabretta has the following local tasks available immediately:

REGRD Re-grids an image from one co-ordinate frame and geometry to another - including precession.

SHADW Generates the "shadowed" representation of an image.

Local tasks available in the long term. These are currently in non-standard code but will compile on Suns:

ATLOD Reads and loads (or lists a summary of) an RPFITS format *uv* data file into *AIPS*. The RPFITS file can be on tape or disk.

HBCLN Performs a Högbom clean. Specifically for non-synthesis beams, and for MOST maps.

HOLGR Processes holography data. Reads visibility data from a file and Fourier transforms it to produce the aperture plane of the antenna.

HOLSR Generates a grey scale Postscript image of an antenna holography surface deviation map with an overlay grid indicating the position of the panels.

PERIPHERALS

Willem A. Baan wbaan@naic.bitnet
Arecibo Observatory
P. O. Box 995
Arecibo
Puerto Rico 00613

Willem A. Baan has developed two routines for Sun tape drive support.

Andy Feldt uokhep::atoml::feldt
Department of Physics
440 W. Brooks
University of Oklahoma
Norman
Oklahoma 73019

Andy Feldt's postscript plot task is superior to **LWPLA**. It does not hide vectors when grey scale is output.

Lyle Hoffman hoffman@lafayett.bitnet
Lafayette College
Department of Physics
Olin Hall
Easton
Pennsylvania 18042

Lyle Hoffman is willing to pass along **ZDOORT** for use on VMS 5.1 to plot on an HP Laser-Jet II; **AMLOD** for users with Amiga 500 running PAWS.

DISPLAYS

Edward B. Churchwell madraf::churchwell
Washburn Observatory churchwell%madraf.decnet@vms.macc.wisc.edu
Astronomy Department
University of Wisconsin
Madison
Wisconsin 53706

Edward Churchwell has implemented XAS for VMS — X Windows display server for VMS.

Gripes

A new system for maintaining the *AIPS* "Gripes" has recently been implemented and is now available for public use. Bill Cotton has created an "AIPS Gripes Database" which is built within the *emacs* editor. Each gripe (approximately 4800 to date) is now entered into the database as an individual file. These files can be accessed with various query modes (query by gripe number, user-name, gripe date, etc.), thus making it fairly simple and convenient to use.

The *AIPS* Gripe Database currently resides on the virtual machine called **gripe** at NRAO-Charlottesville. A public account has been set up on this machine; No user-name or password is required. To use the database from outside NRAO, you may telnet to **gripe.cv.nrao.edu** (or to address 192.33.115.103). From within NRAO, simply remote login to **baboon.cv.nrao.edu** with the account name "gripe".

To obtain a copy of the "User's Guide to the *AIPS* Gripe Database" we have set up an "anonymous **ftp**" account on a Unix machine in Charlottesville. The directory /baboon/ftp/pub/aips/gripes on **baboon.cv.nrao.edu** (or 192.33.115.103) contains an ASCII file called GRIPE.README which explains the basics of using the database.

As always, gripes may also be submitted via electronic mail to **aipshelp@nrao.edu** or to any one of the members of the *AIPS* group.

If you have any problems or comments, please contact either Pat Murphy (**pmurphy@nrao.edu**) or Dean Schlemmer (**dschlemm@nrao.edu**).

Documentation Available

The *AIPS* **COOKBOOK** was last updated for *AIPS* version 15OCT90. New chapters 4, 6, and 11 of the 15OCT90 **COOKBOOK** describe *AIPS* *uv*-data calibration, image deconvolution, and VLBI data reduction. Several new *AIPS* memos are also available.

Memo 66: An Overview of *AIPS* TV Servers.

Memo 67: *AIPS* DDT bench mark results for Sun's SPARC-station 2GX.

Memo 68: Summary of *AIPS* *uv*-data Calibration from VLA Archive tape to a *uv*-FITS tape.

Memo 69: The 1991 *AIPS* Site Directory.

Memo 70: The 1991 *AIPS* Site Survey.

Memo 71: A Comparison of DDT results for IBM RS/6000 and Convex C-1.

Memo 72: MAPIT: Automatic *AIPS* Imaging and Self-Calibration.

Memo 73: *AIPS* DDT History.

Memo 74: *AIPS* at the Australia Telescope National Facility.

To obtain documents, contact Ernie Allen via electronic mail at **eallen@nrao.edu** or by phone at (804) 296-0209. The **COOKBOOK** and *AIPS* memos are also available via anonymous **ftp** on **baboon.cv.nrao.edu**. The **COOKBOOK** is in directory /baboon/ftp/pub/aips/cookbook. The *AIPS* memos are in the directory /baboon/ftp/pub/aips/memos. The memos and **COOKBOOK** are in several formats: plain ascii text, Runoff, TEX, and/or Postscript format.

Changes in 15APR91

The changes to **15APR91** are summarized below. There were 301 "significant changes" to **15APR91**.

TVs Many improvements were applied to the *AIPS* workstation TV emulators.

Calibration A suite of procedures were created to validate the VLA calibration software.

FQ ids Several bugs were fixed in Multi FQ id *uv*-data processing.

Decstation The Decstation low level routines were added to the *AIPS* code hierarchy.

Westerbork Code was added to the *AIPS* Contribution area ($APLCONTR) to read and process Westerbork data.

Scratch The *AIPS* scratch file handling has been changed to allow several CPUs to create files on the same disk. Scratch files from one CPU are no longer inadvertently destroyed by other CPUs.

Pseudo-AP The Pseudo-Array processor include files have been modified to allow system managers to easily increase the array sizes. Increasing the Pseudo-AP size increases mapping efficiency.

Tapes *AIPS* now allows remote access of tapes. In particular, several work-stations may now share a single exabyte tape drive.

MAPIT A set of *AIPS* procedures, called **MAPIT**, has been developed to automatically image and self-calibrate *uv*-data. This set of procedures works particularly well for VLA snapshots and observations of radio sources with compact structure. The **MAPIT** procedures have been successfully used to produce images of VLBI observations.

ACFIT Now correctly handles dual polarization data.

ANCAL Added capability to give baseline dependent calibration factors by writing a BL table if "BASELINE" cards are present in the calibration file. This implementation allows only one set of baseline factors per uv data file.

BPASS Fix of Band Pass corrections for dual polarization data bases.

CCFND Task which finds the last clean component before a negative clean component then finds the clean component FACTOR brighter than the negative component. Useful for setting self-calibration parameters.

CVEL Now works properly for dual polarization data. Also for MK-III data corrections are applied for changing reference stations.

DBCON Fixed a problem with VLBI data that the AN tables in the two files which may be inconsistent. The ANntenna tables are merged if they have compatible AN table headers and the data are to be written as one sub-array.

DECOR New task to compute the de-correlation among a set of selected correlations. The output values have a real part that is the ratio of the scalar amplitude average of the selected correlations to the vector average. This program is especially useful for looking for coherence problems in multi IF and/or multi channel data. This task allows application of calibration and/or editing and will write a new multi source file.

GLENS Gravitational LENS modeling program. Makes models of a Blandford elliptical galaxy or a point mass (black hole).

FILLM A few more "rare" bugs fixed.

MK3IN Extensive improvements and enhancements were made by Athol Kemball and Bill Cotton. Of particular note are improvements in handling Spectral Line Data. The new **MK3IN** produces an FQ table and allows multiple observing bands. Some changes in the Fourier transform conventions were necessary in handling multiple correlator module lag functions. In particular the lag order convention needed to be reversed to concatenate the output of the modules.

Auto-correlation (AC) functions are treated separately and are corrected for bias and clipping effects before being transformed to AC spectra. Auto-correlation functions are typically generated by cross-correlating half the XC lag range. Individual correlator modules can however be placed in auto-correlation mode and this may be used in the future. Some changes in the code were necessary to deal with the two methods of generating AC functions.

Correlation functions which do not have the same number of lags as the output file are skipped and a warning is printed. This is necessary to avoid 8-lag fringe finding scans which are often included in the output tape.

Some checks were introduced to ensure that the A-tape file structure is as expected by **MK3IN**. The A-tape file headers are decoded and the MK3 file parameters are extracted. A warning is printed if the tape is a member of a multi-volume SAVEM set, as this may cause loss of data. The type 50 records within each extent are required to be in the expected order and only complete scan-baseline headers are used.

These checks should diminish the effect of tape errors which may cause loss of synchronization and will also alert the user to any future changes in the MK3 data format.

The data rejection criteria used by FRNGE at the Haystack correlator were implemented in the new **MK3IN** version. A breakdown of the error statistics is available for each scan which can optionally be indexed on correlator module serial number. This feature was requested by the Bonn correlator group for spectral line data.

The MK3 tape format is baseline-based and consequently there is a high degree of redundancy in source- and antenna-based parameters which is the format that AIPS requires. The new version of **MK3IN** assumes that source and antenna parameters in files for different baselines may not be consistent and carries out several checks in this regard. The data are not rejected or changed in any way but a warning message is printed. The correlator model input parameters (or closely associated quantities) are also monitored throughout the run. A summary of the correlator model is printed at the end of the run. These consistency checks should help to isolate problems in the data set caused by changes in the correlation strategy or when merging data correlated at different times. These checks may also alert the user to any un-announced changes in the MK3 output tape format.

A correlate index is generated from the 20XX module cross-reference table before processing each new type 51 data extent. This allows video converters to be multiply assigned in a given scan and should allow XC/AC mixing. The delay offsets can be in arbitrary order in the cross-reference table.

MOMFT First, second and third moments of flux density distribution of images. Gives a more reliable measure of compact source structure.

MX Implementation of the Zero-spacing flux has been modified to allow a Gaussian model of the source for short spacing flux distribution. Data selection was modified to handle multi-frequency *uv*-data. Also cleaning now stops at first negative Clean Component (CC), if requested.

SHOUV A new task that does column listings of closure phases for selected triplets or listings with different IF/channels in different columns. These displays are very useful for detecting and analyzing problems in multi IF/channel data sets.

SNPLT Additional plotting options were added for VLBI data.

SNSMO New task to filter SN tables. Much of the smoothing functionality of **CLCAL** is reproduced but this task included two useful model for smoothing **FRING** VLBI solutions. Coupled smoothing of delay (single and multi-band), rate, amplitude and phase. The methods attempt to maintain coherence among the IFs of a given Stokes' parameter (but not between Stokes'). This task should be very useful for MK-III VLBI and VLBA data.

TVFLG A few bugs were found and fixed for graphical editing of *uv*-data.

UVPRM A task which determines three *uv*-parameters: finds a reference antenna, the maximum *uv*-spacing in the *uv*-data and finds the UV-spacing at which the average flux of the source is greater than the input FLUX. Useful for self-calibration.

AIPSLETTER

Volume XI, Number 3: July 15, 1991

A newsletter for users of the NRAO
Astronomical Image Processing System

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LaTeX set by GL

Recent Developments

In order to devote more *astronomer power* to the development of *AIPS++*, *AIPS* has been frozen. Current software development in *AIPS* is limited to improvements needed in the short term for improved *uv*-data calibration and certain experimental imaging tasks. Of course, bugs will be fixed as soon as possible.

The 15JUL91 release of *AIPS* has been **canceled**. The next planned release of *AIPS* will be 15APR92. However, a 15OCT91 release may be made public if sufficient changes are made to warrant an early release.

AIPS++

AIPS is being re-written in order to incorporate software capabilities needed for the coming decade. The new software, called *AIPS++*, is being developed and implemented by a consortium consisting of the NRAO and a number of other observatories and universities in the United States and around the world. It will be implemented in C++ using techniques of object-oriented programming. The specification of the new *AIPS++* software is underway. The *AIPS* group invites suggestions for the software specifications from the Astronomical Community. In order to record and distribute the suggestions of the astronomical community, a memo series, entitled *The AIPS++ User Specifications Memo Series*, has been started.

The *AIPS++* User Specifications Memo Series will be maintained and distributed with a serial numbering system. Submissions to the series should be sent to Robert M. Hjellming, National Radio Astronomy Observatory, P.O. Box O, Socorro, NM 87801-0379, USA. Because time is critical in late 1991 and early 1992, documents may be submitted in TeX or LaTeX form, in a single ASCII text file sent to rhjellmi@nrao.edu via E-mail; please do not use any macros except those defined in a single TeX or LaTeX input file. Submissions with figures should be sent by mail. Anyone may get on the memo distribution list by: writing to the above; sending an E-mail message to rhjellmi@nrao.edu; or calling 505-835-7310.

AIPS USER AGREEMENT

ASSOCIATED UNIVERSITIES, INC.
NATIONAL RADIO ASTRONOMY OBSERVATORY

BASIC RESEARCH IN ASTRONOMY

THIS AGREEMENT, made this ___ day of _____, 19___, between ASSOCIATED UNIVERSITIES, INC./NATIONAL RADIO ASTRONOMY OBSERVATORY, Charlottesville, Virginia, hereinafter called the Developer; and _____ hereinafter called the User.

WHEREAS, the Developer has developed an Astronomical Image Processing System (AIPS) under agreement with the National Science Foundation; and

WHEREAS, the Developer desires to promote basic research, particularly in astronomy, throughout the world; and

WHEREAS, the Developer has determined that distribution of AIPS to User will further such research.

NOW, THEREFORE, in consideration of the mutual covenants and agreements herein contained, the parties agree as follows:

1. For no charge, Developer hereby grants to the User a non-exclusive right to use the Astronomical Image Processing System (AIPS).
2. User acknowledges that the AIPS software/system, including all documentation, will be used primarily by User for basic research.
3. The Developer agrees that it will make available to User updates and modifications to AIPS; however, Developer is under no obligation to do so.
4. The AIPS software/documentation shall not be transfered, sold, or assigned to a third party.
5. AIPS shall not be copied or duplicated except as follows:
   a. AIPS may be copied for backup purposes.
   b. AIPS may be duplicated and run on all systems supported by the User's AIPS Manager, who will be the designated operational contact person between the User and Developer, provided that its use on all such systems is in accordance with the dictates of this agreement.
6. The obligation to use, install, and run AIPS shall be the sole responsibility of the User. It IS UNDERSTOOD THAT THE DEVELOPER MAKES NO WARRANTIES, CLAIMS, OR OTHER ASSERTIONS, IMPLIED OR OTHERWISE, CONCERNING THE PERFORMANCE OR INTEGRITY OF AIPS OR THE SUITABILITY OF AIPS FOR A PARTICULAR PURPOSE.
7. User acknowledges that any data, tapes, or containers received from the Developer are and shall remain Developer's property and shall be returned upon request of the Developer, when updated materials are requested by User or at termination of this agreement.

8. This Agreement shall remain in effect for a period of five (5) years from the date hereof.

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Institution	Signature
_____	_____
Signature	Print Name
_____	_____
Title	Title
_____	_____
Date	Date

Please indicate technical contact person (i.e. AIPS Manager):

_____

Rev. 05/16/91

AIPS Order Form for 15APR91

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
(If you received a plastic tape mailing container from us, you must return it with the old tape for a ReOrder.)

3. Tape type desired:..... ☐ AIPS Unix ☐ AIPS VMS ☐ Other
For Unix, we need to know system level: _____
(e.g., SunOS 4.1.1, Ultrix 4.0, AIX 3.1, ...)
DDT test package desired:..... ☐ Small ☐ Medium ☐ Large
(large not available on 6250bpi)

4. Tape "media" desired:..... ☐ 9-track 1600bpi ☐ 9-track 6250 bpi
☐ Exabyte (2.2G) ☐ Internet FTP
☐ QIC 24 Cartridge

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

6. Printed Documents Requested:..... ☐ 15OCT90 AIPS Cookbook (no binder)
Going AIPS (15APR90) ☐ Vol 1 ☐ Vol 2
☐ AIPS Memos: _____
(Memos 66 to 73 are new for 1991)

7. Custom 3-ring binders (now free)..... ☐ Cookbook
Going AIPS ☐ Vol 1 ☐ Vol 2

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

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

Bitnet: aipsmail@nrao
Internet: aipsmail@nrao.edu
SPAN/Hepnet: 6654::aipsmail
UUCP: ...uunet!nrao.edu!aipsmail

THIS ISSUE CONTAINS THREE AIPSLETTERS

(Volume XI - Numbers 1, 2, & 3)

JANUARY 15, 1991
APRIL 15, 1991
JULY 15, 1991

AIPSLETTER
National Radio Astronomy Observatory
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AIPSLETTER

Volume XI, Number 4: October 15, 1991

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

Edited by
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LaTeX set by GL

Recent Developments

As was reported in previous *AIPS* Letters, a major upgrade of *AIPS* is in progress. An entirely new set of programs, called *AIPS*++, is being written in the computer language *C* ++.

Because considerable effort is required for the development for *AIPS*++, *AIPS* will be released annually, not quarterly. The 15OCT91 release of *AIPS* has been *canceled.* The next planned release of *AIPS* will be 15APR92. However, we will be making significant bug fixes available via anonymous **ftp** (file transfer protocol), so that important fixes will be more readily available. This will also reduce the total effort required to maintain *AIPS* at NRAO and the user's home institution.

We urge you to obtain the latest version of *AIPS* so that you can better utilize the new capabilities of the VLA. Versions of *AIPS* earlier than 15APR91 do not contain all the modifications required to handle the multi-frequency continuum VLA observations. Obtaining the latest version of *AIPS* will help the *AIPS* group to provide you better support, by making it easier to identify and fix bugs.

Personnel

There have been several personnel changes, made in order to support the new *AIPS*++ development. Gareth Hunt has been promoted to head of NRAO software development. He will coordinate *AIPS*, Single Dish and other software projects. Gareth will be moving from Socorro to Charlottesville in December 1991. The AOC is recruiting a software scientist-astronomer to fill Gareth's *AIPS* support role.

Bill Junor has moved from *AIPS* user support to VLBA system scientist. David Adler has joined the *AIPS* group and is providing *AIPS* help, advice and counseling to visitors at the AOC. Welcome Dave!

VLBA/VLBI Post-processing Software

Below is a summary of the status of *AIPS* VLBI software compiled by Phil Diamond for the 15APR91 version of *AIPS*. (This summary was intended for the 15APR91 *AIPS* Letter.) Phil Diamond is coordinating VLBA/VLBI software development, and all comments and suggestions should be directed to him, at e-mail address **pdiamond@nrao.edu**.

Due to the major changes occurring within the *AIPS* project we felt that we should inform the community of the status of VLBA/VLBI post-processing software within AIPS. Since the manpower that was devoted to the VLBA software is being trimmed somewhat, due to the effort being diverted to *AIPS++*, we shall be unable to fulfill the goals that we would have liked. We have therefore defined a limited subset of the software that we feel the community needs in order to process VLBA data. Some items (described below) are being postponed until *AIPS++*, none are being cancelled.

There has been a significant amount of development over the past two years and most pieces of the system are now in place and working to some extent. The major pieces that have recently been implemented are:

MK3IN a task that reads 'A' tapes from a MkIII correlator.

FRING Development and debugging of the fringe-fitting and calibration software dealing with MkIII/VLBA style data.

IBLED an interactive TV based editor, most useful for VLBI data, edits data on a baseline-by-baseline basis.

Spectra several tasks for the calibration of spectral line VLBI data.

Display several utility tasks for the display and diagnosis of VLBI data.

The areas in which we have recently been concentrating our effort are:

(1) The definition of a FITS format for the VLBA distribution/archive, and the development of routines to read/write this format.

(2) The development of a suite of tasks and procedures to make VLBI self-calibration easier for the novice user. This is an area which has traditionally deterred newcomers from entering the VLBI arena. We feel that some effort should be expended on making this process less painful.

(3) Minor development and extensive debugging of the fringe-fitting, polarization calibration, imaging, self-calibration, spectral-line and editing tasks.

The areas in which we have to postpone our effort, possibly until *AIPS++* is in place, are:

(1) Astrometry/phase-referencing: there will be some development continuing outside of the *AIPS* group but we do not have the manpower to devote effort, other than advisory, in this area for some considerable time.

(2) Spectral line fringe-rate mapping: this is a technique that has been used with some success in the past on spectral line VLBI data. Any effort in this area will wait until *AIPS++*.

Below is a brief summary of the latest VLBI related tasks and improvements to existing tasks in 15APR91 that the users will probably be most interested in.

New tasks:

DECOR a task to compute the phase de-correlation among the various channels and IFs of a *uv*-data set. It will create an output file containing the ratio of the scalar averaged amplitude of the selected data to the vector averaged amplitude.

SNCOR a task to apply various corrections to an SN (solution) table. Very similar to CLCOR.

DIFRL a task to divide the RR correlations by the LL. Should be generalized to perform phase-referencing for spectral line data.

SHOUV a task to give column listings of closure phases, or will display amplitude and phase for selected channels and IFs.

CLSMO a task to smooth CL tables in a variety of ways.

PHSRF a task to perform phase-referencing for spectral line data.

Improved tasks:

VBPLT will now work on multi-source databases, will apply calibration on the fly, will plot error bars, will plot closure phases.

FRING extensive debugging for multi-IF (MkIII style) data.

ANCAL will calibrate multi-IF and dual polarization data, will also generate baseline-dependent calibration factors.

BPASS will work correctly on multi-IF data.

MK3IN extensive debugging.

IBLED extensive debugging, new user interface, works on dual polarization, multi-IF (MkIII data) and spectral line data.

Again, all of these tasks are available in the 15APR91 version of *AIPS*.

Patches to 15APR91

Reports of bugs in 15APR91 *AIPS* have been relatively few; however, a few bugs have been discovered and fixed. These bugs are described below.

CALIB Recently that the *AIPS* self-calibration task, CALIB, was incorporating only up to 1000 clean components into self-calibration solutions. The problem was due to an array being declared to small in the main program. The problem was fixed by increasing the array size, and a new version of CALIB is now available which handles an arbitrarily large number of clean components.

MX/HORUS A problem was found with UNIFORM weighting for spectral line images with 1024 by 1024 pixels. The problem *only* occurred while imaging spectral line data, and *only* while producing a data cube with more than one plane. The problem was also only for Time-Baseline sorted *uv*-data, not for data sorted by *u-v* (called XY sorted). The problem occurred when an array used to calculate the uniform weighting was not being fully initialized on passes after the first. The first spectral plane was correctly imaged, but each subsequent image was produced from data with erroneous weights. The subroutine UVUNIF was fixed and must be compiled and re-linked with both MX and HORUS.

MAPIT Several improvements have been made to the logic of the *AIPS* procedures for automatic imaging and self-calibration. A new interactive mode has been added as well as the ability to restart self-calibration from previous *uv*-data de-convolutions.

Below is a listing of a documentation file, README.15APR91, containing instructions for applying the patches. This documentation file and the patches are available electronically via `ftp` from the CPU `baboon` (192.33.115.103).

```
% README File FOR AIPS Release 15APR91
% This File describes the patches to known bugs in 15APR91

Tasks for which patches have been made:
Task:       VTESS
Bug:        Did not make 4K by 4K Images, because a buffer was
            too small.
```

File(s) 15APR91/QY/PGM/NOTST/VTESS.FOR
Fix: Compile and Link new Version of VTESS.FOR
COMLNK $QYPGNOT/VTESS.FOR
Documentor: Glen Langston, NRAO C'ville (804) 296-0328.
Date: 1991 July 26

Task: INSTEP4
Bug: Does not rebuild all the AIPNOT tasks on Unix install. This is not serious enough to break the installation, as INSTEP3 will explicitly compile/link the vital tasks from this area. However, there are some useful utility programs to be found there.
File(s): 15APR91/SYSTEM/UNIX/INSTALL/INSTEP4
Fix: Add AIPNOT to the list of areas processed by INSTEP4
- or get the replacement INSTEP4 from SYSTEM/UNIX/INSTALL here
- or just do a "COMLNK $AIPNOT/*.FOR".

Documenter: Pat Murphy, NRAO/CV.
Date: 1991 Aug 19

Task: All (SunOS with Sun Fortran 1.3 through 1.4)
Bug: Interaction of TMPFS kernel option with compilation. There is a bug in certain versions of Sun Fortran that causes some data statements to be initialized incorrectly. This bug is only active when the SunOS TMPFS kernel option is enabled and the "/tmp" area is mounted on the swap partition. It also only seems to affect data statements where the first item is to be a zero. The usual symptom is a series of messages complaining about "LUN 12 (or 6) ALREADY CLOSED (or open) IN FTAB".
File(s): All Fortran modules with DATA statements
Fix: The following fixes may work with varying degrees of effectiveness; only the first two are guaranteed to work.
1) Apply the Sun patches 100174-01 (and 100175?)
or 2) remake your kernel with the TMPFS line commented out from the config file, and mount /tmp on its own partition. Then rebuild all of AIPS.
or 3) Change the COMP= line in $SYSLOCAL/FCOPTS.SH and CCOPTS.SH to include "-temp=$HOME/tmp" or something like this, i.e. force fortran to use a different area for temporary file placement.
or 4) don't mount /tmp on the swap partition. This approach has NOT been tested. Let us know if this works!

Documenter: Pat Murphy, NRAO/CV.
Date: 1991 Aug 19; updated 1991 Dec 03.

Tasks: MX and HORUS
Bug: When making 1024x1024 (or larger) images of spectral line data using UNIFORM weighting. All channels after the first were incorrectly weighted, creating something which was similar to, but slightly worse than, NATURAL Weighting. (Note: there were NO problems with Natural Weighting or Images smaller than 1024x1024.)
Bug was found by Ralph Gaume of the Naval Research Lab.
File: 15APR91/Q/SUB/NOTST/UVTBUN.FOR
Fix: Grid used for UNIFORM Weighting was not initialized each execution, and for large images, sections already contained values which corrupted the weighting.
Fix: Get new copy of UVTBUN.FOR, compile UVTBUN and re-link tasks

```
            MX and HORUS.
              COMRPL $QNOT/UVTBUN.FOR
              COMLNK $QYPGNOT/MX.FOR
              COMLNK $QPGNOT/HORUS.FOR
Documentor: Glen Langston, NRAO C'ville (804) 296-0328
Date        1991 October 15

Task:       CALIB
Bug:        Was not using more than 1000 clean components.
            If more than 1000 were supplied, they were not used.
            Bug found by Frazer Owen at the VLA.
File:       15APR91/Q/PGM/NOTST/CALIB.FOR
Fix:        Array size was increased.  Get new version of CALIB and
            compile and link it.
              COMLNK $QPGNOT/CALIB.FOR
Documenter: Glen Langston, NRAO C'ville (804) 296-0328
Date:       1991 October 15.

Runfile:    MAPIT.001
Bug(s);     Overwrote ADVERB FLUX, did not allow user to look at
            intermediate images, no interactive mode.  Major improvements
            in latest version, including ability to restart
            self-calibration process.
Files:      15APR91/RUN/MAPIT.001
            15APR91/HELP/MAPIT.HLP
            15APR91/HELP/MAPIT_NA.HLP
            15APR91/HELP/MAPIT_UV.HLP
            15APR91/HELP/MAPIT_MX.HLP
Fix:        Get new RUNFIL containing procedures, place it in the
            AIPS $RUNSYS area.  Place help files in the $HLPFIL directory.
Documenter: Glen Langston, NRAO C'ville (804) 296-0328
Date:       1991 November 25.
```

These patches are available via **ftp** from the CPU **baboon** (192.33.115.103). Below is a sample **ftp** session for retrieving an *AIPS* patch. Commands typed by the user are in *italics*.

```
% ftp 192.33.115.103                                  (if baboon.cv.nrao.edu doesn't work)
Connected to 192.33.115.103.
220 baboon FTP server (SunOS 4.1) ready.
Name (192.33.115.103:glangsto): anonymous                          (any one can log in)
331 Guest login ok, send ident as password.
Password:  glangsto@nrao.edu                              (use your e-mail address)
230 Guest login ok, access restrictions apply.
ftp> cd pub/aips/15APR91                          (go to the directory with patches)
250 CWD command successful.
ftp> ls                                                (list the directory contents)
200 PORT command successful.
150 ASCII data connection for /bin/ls (192.33.115.103,3154) (0 bytes).
HELP
Q
QY
README.15APR91
226 ASCII Transfer complete.
42 bytes received in 0.0064 seconds (6.4 Kbytes/s)
```

```
ftp> get README.15APR91                                    (get the instruction file)
200 PORT command successful.
150 ASCII data connection for README.15APR91 (192.33.115.103,3155) (4741 bytes).
ftp> cd Q/PGM/NOTST                                (go to the directory with CALIB.FOR)
250 CWD command successful.
ftp> ls                                                          (list the contents)
200 PORT command successful.
150 ASCII data connection for /bin/ls (192.33.115.103,3164) (0 bytes).
CALIB.FOR
226 ASCII Transfer complete.
11 bytes received in 0.03 seconds (0.35 Kbytes/s)
ftp> get CALIB.FOR                                               (get the program)
200 PORT command successful.
150 ASCII data connection for CALIB.FOR (192.33.115.103,3165) (102399 bytes).
226 ASCII Transfer complete.
local: CALIB.FOR remote: CALIB.FOR
104866 bytes received in 1.1 seconds (90 Kbytes/s)
ftp> quit                                                        (exit the program)
221 Goodbye.
```

Progress on 15APR92

VLBI Polarization Calibration

A major priority of *AIPS* software development is polarization calibration of VLBI observations. A major problem with VLBI polarization is the determination of instrumental polarization corrections, caused by feed contamination, *i.e.*, observing polarization in un-polarized sources. The linear feed model is sufficient for the VLA, but a more complete orientation-ellipticity model is needed for general VLBI observations. For the orientation-ellipticity model, the orientation of the reference antenna must be tracked relative to the orientations of all the other antennas in the array.

In addition, good (compact) polarization calibration sources are not available for VLBI observations. The effect of resolved polarization structure in the calibration sources also greatly adds to the complexity of finding solutions.

Bill Cotton has, after much labor, had success in applying an antenna polarization orientation-ellipticity model to a VLBI observation. The solution for antenna polarization had no analytic solution, and the model solution must be found in an iterative manner. The iterative method is very CPU expensive, but works. Bill found that earlier phase calibration has corrupted the polarization calibration and all data requiring orientation-ellipticity calibration must be re-phase-calibrated.

Data have also been reduced for an even more complex observation, spectral-line polarization observations of highly polarized maser sources. Scientists interested in this topic should contact Athol Kemball, Bill Cotton or Phil Diamond at NRAO.

VLBA Correlator

The VLBA correlator should be producing usable data by the summer of 1992. The VLBA correlator output must be read into *AIPS* for calibration. Phil Diamond and Bill Cotton, along with the VLBA correlator group, have defined the data format for archiving VLBA data (stored as FITS binary tables). This FITS format will also be the one used to distribute the *uv*-data. The *AIPS* task FITLD (a generalized FITS reader) has been developed to read the VLBA distribution format.

Network Tape Handling

Considerable progress has been made in *AIPS* ability to handle remote access of tape drives (Exabyte and 9-track tapes). The goal is to allow users running *AIPS* on one CPU to access tape drives on another CPU without cross-mounting disks. This is particularly useful for systems with relatively few tape devices but many work stations. The new tape control package will provide, for instance, access of a Convex tape drive at the AOC from a Sun Workstation in Charlottesville.

Weighting of *uv*-data

The *uv*-data weighting algorithm used by the *AIPS* Fourier Transform tasks is, it appears, not generally understood. A frequent question is "what is the origin of the difference between the synthesized beam sizes for UNIFORM and NATURAL weighting as a function different image sizes?" This is due to the weighting algorithm. In order to perform a *Fast* Fourier Transform the *uv*-data must be gridded, *i.e.*, each *uv*-data point must be placed in the nearest grid cell. (The visibilities are actually convolved into the *uv*-grid with a variety of gridding corrections). Also, the size of each *uv*-grid pixel MUST be the reciprocal of the field of view of the image. Thus for smaller images and a constant image pixel size (CELLSIZE), the field of view is *smaller*, so the *uv*-grid pixel size is *bigger*. (*i.e.*, more visibilities fall in a given *uv*-grid cell for smaller images.) This causes the Weights assigned in UNIFORM weighting to change as a function of image size. It has been observed that new users of *AIPS* will use too small a pixel size and too small an image size, thus causing tens of thousands of observed visibilities to be placed in a few hundred *uv*-grid cells. If there is structure within a *uv*-grid cell, it will be smeared and not be visible in the resulting image.

In *AIPS*, UNIFORM weighting is implemented in a two step process. First, the number of *uv*-data points in each *uv*-grid cell are counted; second the ORIGINAL *uv*-data are re-read and the original weights are divided by the number of visibilities in the given *uv*-grid cell. UNIFORM weighting decreases the emphasis of *uv*-data in cells where there are many other *uv*-data. For Natural weighting, the weights are not affected by the location of visibilities in occupied *uv*-grid cells, yielding similar beams for most image sizes.

For full 12 hour synthesis observations in several VLA configurations, where virtually every *uv*-grid cell is occupied, a smaller image size reduces the short spacing emphasis, because the short spacings are more occupied than long spacings. For such observations, making the image smaller makes the beam smaller. For "snap shot" observations, where the visibilities are in small regions of the *uv*-grid, the opposite is true, small images produce bigger beams, because all of the short spacing visibilities are already in a few *uv*-grid cells. Making the image smaller, puts more long spacing, high-resolution, visibilities in a few cells, making the beam bigger. For a very large number of grid cells (a very big image), when every visibility is in a *uv*-grid cell by itself, then UNIFORM and NATURAL weighting produce identical images.

The difference in images produced with UNIFORM and NATURAL weighting is illustrated in Figure 1, a montage of 4 images created from the same *uv*-data. The *uv*-data are from a 4 minute "snap shot" with the VLA at 3.6cm wavelengths. The source, 1312+192, contains a bright compact jet extending west from the core and faint extended emission east of the core. The differences in features revealed by the different weightings are illustrated by comparison of the images. The table lists the measured synthesized beam size for the test images, as well as the RMS noise found in the 512 pixel images. Note that the 256 pixel square UNIFORMLY weighted image has a larger beam than the 512 pixel square UNIFORMLY weighted image.

Image	Weighting Type	Image size (pixels)	Beam Major Axis (")	Beam Minor Axis (")	Beam Angle (degrees)	RMS Noise (μJy/Beam)
a)	Uniform	256	0.78	0.76	-40.8	
b)	Natural	256	0.90	0.88	-41.4	
c)	Uniform	512	0.72	0.71	-44.0	77.0
d)	Natural	512	0.90	0.88	-41.4	49.6

The ratio of signal-to-noise for uniform to natural weighting is related to the ratio of the areas of the two synthesized beams. (The relationship between the RMS noise levels of images with different weights is a complex function of the *uv*-data, but is linear with synthesized beam area, to first approximation.) In the example of 1312+192, the ratio of the Uniform and Natural image RMS noises 77.0/49.6=1.55 is nearly identical to the inverse ratio of the synthesized beam areas, 0."90×0."88 / 0."72×0."71 = 1.55. (The noise ratios are not usually this exactly related to the beam sizes. This may be due to high spatial frequency noise in the *uv*-data.)

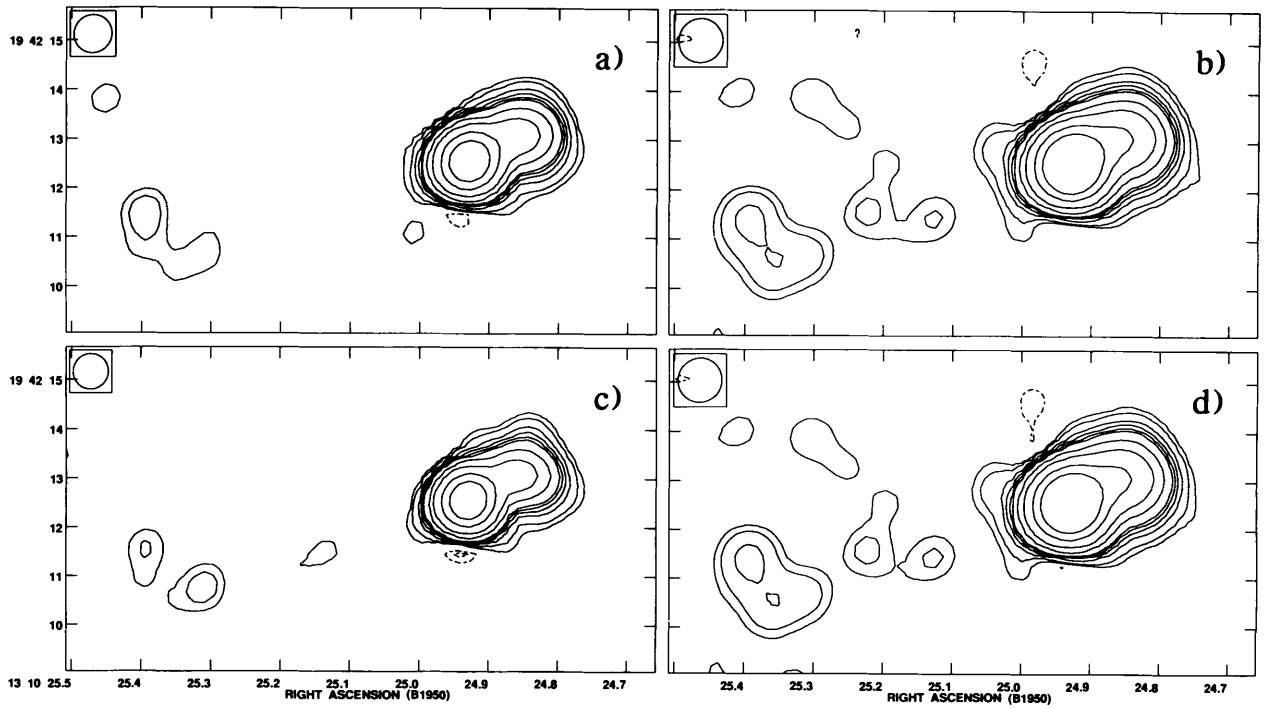

Figure 1: Radio source 1312+192 imaged with a VLA X-band B-array snapshot, illustrating the differences between the UNIFORM and NATURAL weighting. *a)* Uniform weighted 256 pixel image, *b)* Natural weighted 256 pixel image, *c)* Uniform weighted 512 pixel image, and *d)* Natural weighted 512 pixel image. The size of the synthesized beam is shown in the upper left corners. Note that image *a)* has lower angular resolution than image *c)*. Image *a)* has angular resolution closer to the 0."90×0."88 size of the naturally weighted images. Images *b)* and *d)* have nearly identical angular resolution. The change of the synthesized beam as a function of image size is shown for UNIFORM weighting. The contour levels are -5, -3, 3, 5, 10, 15, 20, 25, 50, 100, 250, 500 times the RMS noise of the 512 pixel images.

New *AIPS* Memos

Two new *AIPS* Memos are available from Ernest Allen at NRAO Charlottesville, e-mail `eallen@nrao.edu`.

Memo 75: 15APR91 DDT results on a Sun IPC, Sun Sparc 2, Convex C-1, and an IBM RS/6000-Model 550.

Memo 76: Summary of *AIPS* Continuum UV-data Calibration. *From VLA Archive Tape to a UV FITS Tape.* (Supersedes AIPS memo 68)

AIPS Order Form for 15APR91

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
(If you received a plastic tape mailing container from us, you must return it with the old tape for a ReOrder.)

3. Tape type desired:..... ☐ AIPS Unix ☐ AIPS VMS ☐ Other
For Unix, we need to know system level: _____
(e.g., SunOS 4.1.1, Ultrix 4.0, AIX 3.1, ...)
DDT test package (15APR89 version):.... ☐ (includes small, medium, and large tests; 9-track 1600bpi tape does not have large)

4. Tape "media" desired:..... ☐ 9-track 1600bpi ☐ 9-track 6250 bpi
☐ Exabyte (2.2G) ☐ Internet FTP
☐ QIC 24 Cartridge

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

6. Printed Documents Requested:..... ☐ 15OCT90 AIPS Cookbook
Going AIPS (15APR90) ☐ Vol 1 ☐ Vol 2
☐ AIPS Memos:_____
(Memos 66 to 76 are new for 1991)

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

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

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October 15, 1991

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