AIPSLETTER

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A newsletter for users of the NRAO
Astronomical Image Processing System

Written by a cast of *AIPS*

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General developments in *AIPS*

Current and future releases

We have formal *AIPS* releases on an annual basis. While we offer a full binary installation method for both the frozen and development versions for MacIntosh OS/X (PPC and Intel chips), Solaris, and Linux systems, all architectures can do a full installation from the source files. The current release is called `31DEC06` and is now "frozen." If you took a development copy of this version at some earlier date, you may use the "Midnight Job" (MNJ) to bring it up to date. You need to run a MNJ only once in 2007 to convert your copy of `31DEC06` into the frozen version. When patches to 2006 are announced, you may apply them with the MNJ. This *AIPSLetter* is intended to advise you of corrections and improvements in this release.

We have begun a new version, called `31DEC07`, which is now under development by the *AIPS* Group. You may fetch and install a complete copy of this version at any time. Having fetched `31DEC07`, you may update your installation whenever you want by running the MNJ which uses cvs, rsync, and transaction files to copy and compile the code selectively based on the code changes and compilations we have done. We expect users to take their source-only or binary version of `31DEC07` *AIPS* over the Internet (via *anonymous* ftp). Both versions require you to copy the installation procedure `install.pl` via `ftp`; the source-only version also requires you to ftp the 88-Mbyte `31DEC07.tar.gz` compressed tar file.

From `mnj.aoc.nrao.edu`, the MNJ will serve up *AIPS* incrementally — or as a whole — using the Unix tool `cvs` running with anonymous ftp. Binary MNJs also use the `rsync` tool. Linux sites will almost certainly have `cvs` installed; other sites may have installed it along with other GNU tools. Secondary MNJs will still be possible using `ssh` or `rcp` or NFS as with previous releases. We have found that `cvs` works very well, although it has one quirk. If a site modifies a file locally but in an *AIPS*-standard directory, `cvs` will detect the modification and attempt to reconcile the local version with the NRAO-supplied version. This usually produces a file that will not compile or run as intended.

AIPS is now copyright © 1995 through 2007 by Associated Universities, Inc., NRAO's parent corporation, but may be made freely available under the terms of the Free Software Foundation's General Public License (GPL). This means that User Agreements are no longer required, that *AIPS* may be obtained via anonymous ftp without contacting NRAO, and that the software may be redistributed (and/or modified), under certain conditions. The full text of the GPL can be found in the `15JUL95` *AIPSLetter* and is included with every distribution in file `$AIPS_ROOT/`*release-name*`/COPYING`.

Installing a new version

If compiling locally, new releases must be installed from the tar ball for that release. If using the binary installation, a full new installation must also be done with `rsync`. The `cvs` system requires this. When installing a new *AIPS* release in a system that already has a previous release, we recommend that `install.pl` be used and that the previous release be left in place, at least until the installation has been seen to work. If you do this, then you will not have to re-edit the disk, printer, and tape lists and can simply skip all those pages in the `install.pl` menus. The old `$HOME/.AIPSRC` file may be left in place, but it will need to be edited. The lines giving the `DOWNLOADED` and `UNPACKED` parameters should be deleted and the `CCOMOPT` line should be changed to point to the current release rather than the previous one — the `-I` parameter really should be `-I$INC` but it gets its full path name instead. This forces a re-edit with each release. If you have made special versions of `UPDCONFIG` and `do_daily.`*host*, you should preserve them under new names and restore them after the install. If you have an odd set of *AIPS* versions, the `$AIPS_ROOT/AIPSPATH.*SH` files may need to be edited after the install to set the desired versions.

For Linux, Solaris Ultra, and MacIntosh systems, a binary installation is available from CDrom, supported by `install.pl`. Alternatively, the frozen version may be installed with the binary installation method now present in `install.pl`. The ftp site for downloading files directly has been eliminated.

Binary installations and updates

GNU has provided compilers for the *AIPS* community at no cost for many years. While remarkably good, these compilers have suffered from both minor errors and from their generality. When some vendor sets out to make a compiler for a very specific architecture, it is possible — not guaranteed — to create a compiler that produces binaries that run faster than those produced by GNU's `g77`. Unfortunately, these vendors have to recover their costs in producing these compilers and so may charge for them at a rate that is difficult or prohibitive for many *AIPS* users. Such is the case with IBM's `xlf` compiler for PPC chips, including the MacIntosh OS/X systems, for SUN's SUNWspro compiler suite, and for Intel's `ifort` compiler. These compilers produce executables that run about 50% faster (30% faster for Intel) than those produced by `g77` on these operating systems and cpus. Fortunately, their licensing agreements allow us to ship executables to our users along with the required run-time libraries. The binaries produced by the Intel compiler for Linux are quite large because they contain optimizations for modern PIV cpus, older PIV cpus, and for general computers such as AMDs. The specific optimizations to be used are selected automatically at run time.

The code to implement the binary installation and binary updates via the MNJ is comparatively simple. Every night, a `cron` job run on the master *AIPS* machine in Socorro, does the necessary magic to make the daily cvs snapshot of *AIPS*, builds the tar-ball, orders the four architectures at the AOC to do ordinary text MNJs, and then `rsync`'s the binaries and text to a special area on the computer used for public `ftp` access to NRAO in Socorro. The installation script must be fetched from the AOC anonymous ftp area to your desired `$AIPS_ROOT` area and then executed with

```
perl install.pl -n
```

With the `-n` option, the script will skip fetching and unpacking the tar-ball and the compiler queries and usage. It does a variety of `rsync` commands to fetch a complete copy of the *AIPS* version including libraries and all executables. It marks the installation as a binary one by creating a special 0-byte file in `$SYSLOCAL`. The MNJ then detects this file and replaces the compile steps with `rsync` operations on the binary areas. The `cvs` utility is still used for updating the source code and other text areas.

There are some limitations with binary installations. The AP size for `31DEC06` will be 20 Megabytes which is a good size for most machines and problems, but too small for the largest-memory computers and biggest problems. (See below for a change in this limitation coming in `31DEC07`.) Furthermore, without a matching compiler, it will be difficult to develop any local programs as additions to the standard *AIPS* package.

Preview of coming attractions in 31DEC07

The 31DEC07 release already contains a major change to the software which was judged too risky to install in a version which was about to be frozen. In 31DEC06 and all previous releases of *AIPS*, the "pseudo array processor" was preallocated and compiled into every "AP" task under control of a particular include file. Each site could choose, during source-code installation, how big an AP to compile into the system. This led to conflicts between those users at a site with large imaging or fringe-fitting problems and those users who have older small-memory machines. The binary versions have an NRAO-controlled AP size which is not adjustable to the needs of the local site. Also, since the memory is finite and variable, the *AIPS* tasks had to be prepared to cope with both small and large memories. This means that many of the algorithms for gridding, model computation, and the like had to be very clever and, of necessity, complicated. Such complications inhibit the development of new or improved algorithms.

Therefore, it was decided to change the "AP" memory from pre-allocated to dynamic. In 31DEC07, each portion of each task specifies to the subroutine QINIT how much memory is required. If the request is small or zero, QINIT will allocate the amount of dynamic memory specified in the traditional PAPC.INC control file. If the request is larger, QINIT will free any already allocated dynamic memory and allocate the requested amount. The actual pointers used to reference the dynamic memory need to be of type LONGINT, which will be INTEGER*8 on 64-bit computers and normal INTEGER on traditional machines. The call arguments to all Q routines remain normal integers and are 0-based pointers to the "AP" memory. Inside the Q routines these pointers have always been converted to proper subscripts of APCORE by the addition of 1. Now the conversion requires a change to LONGINT and the addition of the offset returned in the dynamic memory allocation. Messages have been put in QINIT to report when memory is allocated and freed.

The new code has been tested on an AMD-64 computer and on Linux 32-bit computers. It appears to work and produce essentially identical answers to the old code. Note that a Clean inside a small AP will get different results from a Clean in a larger AP whether the memory is pre-allocated or not. Surprisingly, since the new code does not use disk for temporary storage in FFTs, gridding, gridded subtraction, etc., the new code is not particularly faster than the old. We will continue to investigate to see if we can find out why this is happening. In any case, a new structure has been established which should be amenable to the development of new, simpler algorithms.

Improvements of interest to users in 31DEC06

We expect to continue publishing the *AIPSLetter* approximately every six months along with the annual releases. There have been a number of changes in 31DEC06. In the last six months, we have developed the new verb IMCENTER to find the centroid of the emission in a sub-image and new procedures in the VLAPROCS RUN file to list the latest SN gains and to download data for use by TECOR. Described in the June 30 2006 *AIPSLetter* were changes in 31DEC06 including new tasks ANBPL which plots and prints *uv* data, particularly weights, converted to antenna-based values, UVHIM which constructs images of two-dimensional histograms of *uv* data, and DDBGR which displays the contents of disk files for debugging purposes. New verbs include PLGET which sets a task's adverbs to those used when making a selected plot file, DELBOX which deletes Clean boxes in CLBOX interactively, DFILEBOX which deletes Clean boxes in a BOXFILE interactively, and GETPOPSN which returns the *POPS* number of the AIPS session for use in procedures. New RUN file procedures include STUFFR which merges multiple days worth of *uv* data into a much more compact data set and PEELR which performs a nearly magical self-calibration of image facets containing "interfering" sources. *AIPS* support for MacIntosh OS/X systems using Intel cpu chips has been implemented including binary installations based on the Intel compiler.

31DEC06 contains a revision of FILLM which is essential to support the new data form to be produced by the VLA beginning sometime in 2007. VLA users will have to upgrade their copy of *AIPS* to 31DEC06 or 31DEC07 by that time.

31DEC04 and later releases use a new numbering scheme for magnetic tape logical unit numbers that is incompatible with previous versions. Thus all tape tasks and the server TPMON must be from one of these two releases. Other than this, 31DEC06 is compatible in all major ways with the with the 15OCT98 and later releases. There are significant incompatibilities with older versions.

UV data calibration

FILLM was changed to handle data which have not been scaled by the nominal sensitivities. Such data will appear in 2007, *forcing VLA users to update their version of AIPS to at least* `31DEC06`.

VLAPROCS was enhanced with a new `HELP` file and two new procedures. `VLATECR` fetches the necessary data from the web and then runs `TECOR` on VLA data. `VLALIST` lists the latest gain file using `LISTR`. `VLACALIB` was changed to use the *AIPS*-provided models for the standard amplitude calibration sources automatically.

3C138 21-cm calibrator model was installed in the usual place (`$AIPSTARS`). We now provide complete models for 3C48, 3C138, and 3C286 (at all VLA bands except for P and 4) and some models for 3C147.

BPASS was changed to allow it to function correctly when solving for some but not all IFs.

PCAL was corrected to honor the usual default for `INSEQ`, to get the correct model correction factor for each IF, and to stop zeroing the I flux in the source table.

Gridded subtraction now does interpolation on models from images up to 4096 in size and recommends DFT for larger images. Previously it computed gridded models with no interpolation for images larger than 2048. This can be very inaccurate if there is significant emission away from the center of the image.

ELINT was given a print option to accompany its plot options.

Other VLBI changes

VBGLU was enhanced to glue `GC` and `IM` tables. It was improved to figure out the order of the UV times more quickly. The table routine was corrected to deal with data sets with only one Stokes and to correct a bad pointer.

VLBAFIX was enhanced to merge calibration tables if necessary using `VLBAMCAL`.

SNSMO was fixed to handle rates correctly when there is only one polarization. It used to mess up IFs 3 and above but recently did bad things to IF 2 as well.

APCAL was changed to display LL-only data correctly.

Other *uv*-data changes

WTMOD was enhanced with a new adverb to allow setting the weights of each antenna. An error handling a single `SUBARRAY` was corrected.

UVAVG was enhanced with the `'SUBT'` option to average all of the data by baseline, IF, Stokes, and channel and then subtract that average from the data set. This removes coherence happening because of mutual coupling between antennas.

QUACK was given the `BASELINE` adverb to control editing by baseline rather than simply by antenna. The default flag table was changed from 1 to the highest.

Imaging and analysis

IMAGR was changed to offer the option of plotting an inscribed circle on the TV to guide the eye when setting Clean boxes. It will now survive and correctly blank spectral channels with no data when making an image cube. An error was corrected for field numbers > 99 when doing the primary beam correction.

FLATN was enhanced to allow the full specification of the output image geometry, reference pixel, reference coordinate, pixel separation, and rotation. It allows mosaicing with no beam correction. Progress messages were replaced by ones with more useful information and warning messages were attached to some of the more esoteric options. Errors dealing with large numbers of facets and pointings were corrected.

IMCENTER is a new verb to find the intensity-weighted centroid in a sub-image and return the pixel and celestial coordinate of that point.

CCEDT was corrected to avoid a potential infinite loop when doing automatic boxing. Note that the new algorithm gets different and probably better answers than the old one did.

GAL was enhanced with options to control plotting and also changed to use logicals in a standard way and to have a more legible help file.

LTESS was corrected to honor blanked pixels and to allow a mode with no primary beam correction.

PEELR was changed to set defaults for `CALIB` to try to avoid loss of data due to failed solutions.

Plotting

FUNCTYPE implementations were changed to make a pleasing `LG` function and a new `L2` function which is a bit more extreme logarithm. Neither is as extreme as the useless one we offered previously.

VPLOT was enhanced to plot both polarizations at once, optionally separated by color.

UVPLT and `WIPER` were given the option to plot axes in reverse order and the order of the u axis was reversed.

GREYS and `KNTR` were changed in their handling of image alignment which could fail when reasonable requests were made. A buffer size was corrected as well.

POSSM was corrected for a one-channel error in plots with the velocity axis reversed.

IBLED was corrected for an error that could cause failures when plotting phase error bars.

Patch Distribution for `31DEC05`

As before, important bug fixes and selected improvements in `31DEC05` and `31DEC06` can be downloaded via the Web beginning at:

`http://www.aoc.nrao.edu/aips/patch.html`

Alternatively one can use *anonymous* `ftp` to the NRAO server `ftp.aoc.nrao.edu`. Documentation about patches to a release is placed on this site at `pub/software/aips/`*release-name* and the code is placed in suitable subdirectories below this. As bugs in `31DEC07` are found, they are simply corrected since `31DEC07` remains under development. Corrections and additions are made with a midnight job rather than with manual patches.

The patch system has changed because we now have binary installations. We now actually patch the master copy of the frozen version. This means that a MNJ run on `31DEC05` after the patches listed below will fetch the corrected code and/or binaries rather than failing. Similarly, patches announced for `31DEC06` during the next year will be available via MNJ as well as `ftp`. Installations of `31DEC05` and `31DEC06` after the patch date will contain the corrected code.

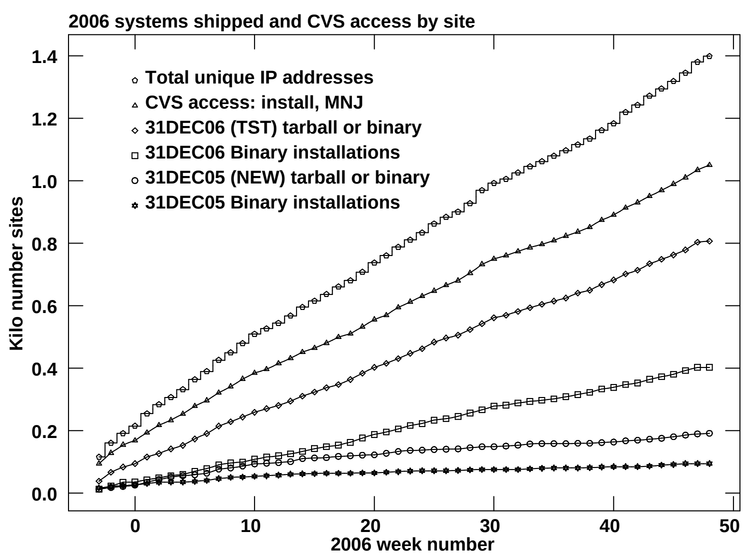
The `31DEC05` release is no longer available for installation. It had a few important patches. The first six changes were made on 2006-02-21 and the remaining four were released on 2006-08-23. They are

1. `DBCON` did not handle differences in frequency increment between `FQ` entries properly when changing reference channel to 1

2. DSMEAR subroutine did not handle FQ ID 0 correctly, affecting VLBI data with significant delays
3. SAD had an error in round off for RA and Dec display
4. WIPER did not handle source ID numbers correctly causing elevation et al. to be incorrect on single-source files
5. SETFC had a mathematical error in setting the X coordinate of boxes around NVSS sources
6. INTERPLATE subroutines assigned a LONGINT to an INTEGER causing trouble on AMD-64s
7. IBLED had trouble looking for model images, defaulting NMAPS, testing errors, and plotting error bars.
8. TABF3D did not set the correct default for column element count (1). This Affects FITLD and friends.
9. MBDLY had a bad call sequence causing aborts.
10. CCEDT had bad logic in separating CCs into multiple separate CC files which recent revisions exposed.

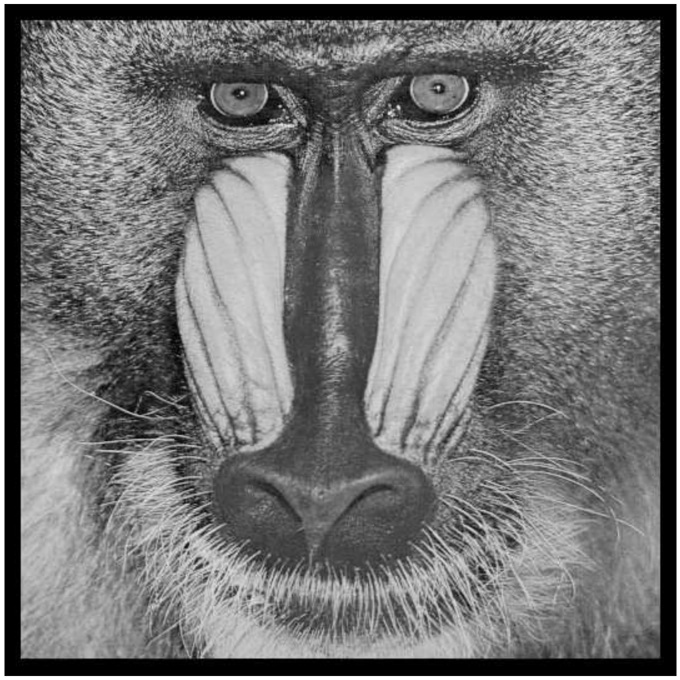
AIPS Distribution

We are now able to log apparent MNJ accesses, downloads of the tar balls and rsync accesses. We count these by unique IP address. Since dial-up and some university connections may be assigned different IP addresses at different times, this will be a bit of an over-estimate of actual sites. However, a single IP address is often used to provide *AIPS* to a number of computers, so these numbers are probably an under-estimate of the number of computers running current versions of *AIPS*. We have abandoned the registration system as obsolete and onerous. In 2006, a total of 191 different IP addresses downloaded the frozen form of 31DEC05 and 806 IP addresses downloaded 31DEC06 in tarball or binary form. Fully 1050 IP addresses accessed the NRAO cvs master. Each of these has at least installed 31DEC06 and 268 appear to have run the MNJ on 31DEC06 at least occasionally. The total number of unique IP addresses in these three lists was 1398. 94 sites accessed 31DEC05 in binary form, while 402 sites used the binary form of 31DEC06. The attached figure shows the cumulative number of unique sites, cvs access sites, tar-ball/binary download sites and binary access sites known to us as a function of week in 2006. A change in the ftp server computer appears to have affected the counts in the last week.



Since the registration system, always under-utilized, has now been abandoned, we are left with analysis by IP address. The table below lists the IP addresses for 2006 by the final qualifier for shipments of 31DEC06, 31DEC05, and access to the cvs site. The numbers in the cvs column include those sites that install or run a midnight job for these releases. The comments come from what appears to be a semi-official list of Internet codes. Sorting is on the "unique" column, which counts unique IP addresses over the other three columns:

Code	`31DEC05`	`31DEC06`	cvs site	unique	Comments
edu	35	175	250	314	US Educational
net	16	78	133	176	Network
uk	5	55	48	69	United Kingdom
jp	9	37	55	65	Japan
es	6	29	37	44	Spain
it	6	28	34	43	Italy
com	6	26	25	41	US Commercial
org	1	13	35	37	Non-Profit Organization
pl	1	22	26	34	Poland
au	6	13	27	31	Australia
de	2	18	17	29	Germany
in	15	16	9	27	India
gov	3	16	18	24	US Government
nl	4	16	13	21	Netherlands
ca	2	13	14	20	Canada
ru	8	9	14	20	Russian Federation
pt	2	12	10	16	Portugal
za	1	7	11	15	South Africa
fr	1	10	7	12	France
br	1	6	6	11	Brazil
mx	1	8	6	10	Mexico
kr	0	4	10	10	Korea (South)
mil	0	5	7	7	US Military
ie	3	4	3	6	Ireland
ar	2	2	3	4	Argentina
at	0	4	3	4	Austria
se	0	3	2	4	Sweden
il	0	4	3	4	Israel
tw	2	2	3	3	Taiwan
cn	3	2	3	3	China
cz	1	1	0	2	Czech Republic
ch	0	2	1	2	Switzerland
fi	0	1	2	2	Finland
cl	0	1	1	2	Chile
hu	0	1	2	2	Hungary
gr	0	2	1	2	Greece
nz	0	2	0	2	New Zealand (Aotearoa)
inva	1	0	1	1	invalid IP address
be	1	1	0	1	Belgium
ro	0	1	0	1	Romania
ua	0	1	0	1	Ukraine
pe	0	1	0	1	Peru
dk	0	0	1	1	Denmark
eg	0	0	1	1	Egypt
None	1	4	11	12	
Unknown	46	151	197	261	
Total	191	806	1050	1398	



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FIRST CLASS

To:

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