Minutes of the June 1997 EVN/TWG Meeting

Ari Mujunen, Ari.Mujunen@hut.fi *Revision* : 1.5, 28-Oct-1997

Minutes of the EVN Technical Working Group (TWG) meeting held on Friday and Saturday, the 26–27th of June 1997 at Siikaranta Congress Hotel, Metsähovi, Finland.

Contents

1 List of action items

1. *Wunderlich* to distribute the vacuum switching memo together with a blank PCB to upgraded EVN observatories before end of July.
2. All stations planning to use vacuum switching: adjust your tape recorder now for 15in operation with thick tape.
3. *Perea* remebered that he had got an email about suitable recontouring tapes and he promised to email it to *Ruf* for distribution.
4. *Ruf* to ask NRAO for thin tapes for verification of station compatibility with the VLBA correlator. *Porcas* suggested that this can be actually assigned to *Mioduszewski.*
5. All stations with thin tape upgrade: record (RF/IF) noise on this thin record quality verification tape and send it to Socorro for analysis.
6. *Porcas* to ensure that pointers to EVN station Mark IV capability status table and SCHED setup files for Mark IV observing can be found in the proposal guide.

7. *Burgess* or Ralph Spencer to organize this "VIV kick-off" meeting.
8. All stations: Send updates of station information (especially including when thin tape is available on your station) to *Porcas* (`porcas@mpifr-bonn.mpg.de`).
9. *Porcas* to contact Mike Garrett (JIVE) to arrange for station status table updates in JIVE WWW and PI information.
10. *Ruf* contacts Arthur Niell (Haystack) to get details of the thin tape purchase plans of the geodetic community and to discuss the possibility of combining purchases.
11. *Himwich* to encourage geodetic stations to use Track, either the Web or the terminal version. (Contact "`vlbatape@nrao.edu`" for new station arrangements and passwords.)
12. All stations: list the boundary conditions and timescales for reaction to target of opportunity proposals.
13. *Perea* to send JPL IF switchbox capabilities documentation to *Ruf*. *Altunin* to email possible Web references about the box to *Ruf*.
14. *Ruf* to send the block schedule to DSN/Madrid as early as possible indicating especially the CAL observation.
15. *Gurvits* to ask Rolf Schwarz (MPIfR/Bonn) for an ASCII version of the block schedule and to arrange that it gets updated to JIVE Web pages.
16. *Gurvits* contacts Richard Schilizzi (JIVE) to enforce the EVN Board of Directors' meeting decision in March 1997 to provide 24 hours before the beginning of a given session for system checkout, plus an additional 12 hours before each frequency change.
17. *Porcas* to "publicize" on the "`evntech@nfra.nl`" mailing list the email addresses of the PIs of a given session at the moment when the schedule files should be frozen on "`astbo1`". This enables station technical friends to easily contact PIs for clarifications.
18. *Gurvits:* to recommend to the EVN Board of Directors (BD) that manpower to scheduling software should be allocated.
19. *Porcas* promised to make sure that next call for proposals will include enough pointers that the PIs can understand the new features available with SCHED+VEX+Mark IV.
20. *Burgess* will talk to Ralph Spencer (Jodrell) about a possible candidate for writing Linux/FS-compatible control software and asks Ralph to add this to the EMU/VIV meeting agenda in September.
21. Whenever the amplitude calibration of a given station is off by more than 5%, *Conway* feeds this back to station(s) involved.
22. *Conway* to make sure that all JIVE support scientists know about good calibrators and will recommend putting them into schedules.
23. *Porcas* to distribute guidelines to proposers as how to propose a "TOO" to the EVN.
24. *Altunin* to send DSN scheduling and station contact information to "`jive@jive.nfra.nl`" for inclusion in JIVE/EVN Web pages `<http://www.nfra.nl/jive/evn/network/members.html>`.
25. *Mioduzsewski* to look up this information, i.e. how to arrange access to "weight plots" and send the results of this to "`evntech@nfra.nl`".
26. *Foley* to send these Westerbork updates to *Porcas* for inclusion to the EVN status table.

2 Participants

The first item in parenthesis indicates an email address and the second item is an abbreviation used to identify a given person in the rest of this document, i.e. (`email`, *Abbrev*). Action items are later indicated with a boldfaced word "**Action:**".

- EVN station representatives (in random order, loosely grouped and alphabetically ordered by geographic location):
  - Alessandro Orfei, IRA/Medicina (`orfei@astbo1.bo.cnr.it`, *Orfei*)
  - Tiziana Venturi, IRA/Bologna (`tventuri@astbo1.bo.cnr.it`, *Venturi*)
  - Corrado Trigilio, IRA/Noto (`trigilio@ira.noto.cnr.it`, *Trigilio*)
  - Gino Tuccari, IRA/Noto (`tuccari@ira.noto.cnr.it`, *Tuccari*)
  - Jan Buiter, JIVE/Dwingeloo (`buiter@nfra.nl`, *Buiter*)
  - Tony Foley, NFRA/Westerbork (`foley@nfra.nl`, *Foley*)
  - Leonid Gurvits, JIVE/Dwingeloo (`lgurvits@jive.nfra.nl`, *Gurvits*)
  - Amy Mioduszewski, JIVE/NRAO (`amiodusz@nrao.edu`, *Mioduszewski*)
  - Paul Burgess, Jodrell Bank (`pb@jb.man.ac.uk`, *Burgess*)
  - Alastair Gunn, Jodrell Bank (`agg@jb.man.ac.uk`, *Gunn*)
  - Walter Alef, MPIfR/Bonn (`walef@mpifr-bonn.mpg.de`, *Alef*)
  - David Graham, MPIfR/Bonn (`p062gra@mpifr-bonn-mpg.de`, *Graham*)
  - Richard Porcas, MPIfR/Bonn (`porcas@mpifr-bonn.mpg.de`, *Porcas*)
  - Klaus Ruf, MPIfR/Bonn (`kruf@mpifr-bonn.mpg.de`, *Ruf*)
  - Michael Wunderlich, MPIfR/Bonn (`mwunderlich@mpifr-bonn.mpg.de`, *Wunderlich*)
  - Jan Engelberg, Metsähovi (`jen@kurp.hut.fi`, *Engelberg*)
  - Juho Heikkilä, Metsähovi (`Juho.Heikkila@hut.fi`, *Heikkilä*)
  - Kirsi Karlamaa, Metsähovi (`kirsu@kurp.hut.fi`, *Karlamaa*)
  - Ari Mujunen, Metsähovi (`Ari.Mujunen@hut.fi`, *Mujunen*)
  - Jouko Ritakari, Metsähovi (`jr@kurp.hut.fi`, *Ritakari*)
  - Pasi Suvikunnas, Metsähovi (`Pasi.Suvikunnas@hut.fi`, *Suvikunnas*)
  - Kaj Wiik, Metsähovi (`Kaj.Wiik@hut.fi`, *Wiik*)
  - John Conway, Onsala (`jconway@oso.chalmers.se`, *Conway*)
  - Antonis Polatidis, JIVE/Onsala (`apolatid@oso.chalmers.se`, *Polatidis*)
  - Stawomir Jakubowicz, Torun (`sj@astro.uni.torun.pl`, *Jakubowicz*)
  - Eugeniusz Pazderski, Torun (`ep@astro.uni.torun.pl`, *Pazderski*)
  - Hayo Hase, IfAG/Wettzell (`hase@wettzell.ifag.de`, *Hase*)
  - Pablo de Vicente, OAN/Yebes (`vicente@cay.oan.es`, *Vicente*)
- NASA representatives:
  - Valery Altunin, JPL/DSN (`via@vlbira.jpl.nasa.gov`, *Altunin*)
  - Ed Himwich, NVI/NASA GSFC (`weh@vega.gsfc.nasa.gov`, *Himwich*)
  - Jose A Perea, INSA/NASA DSN (Madrid) (`japerea@oort.mdscc.nasa.gov`, *Perea*)

The meeting was chaired by *Ruf* and *Mujunen* took notes for minutes.

2.1 Getting this document in various different formats

To get another version of this document:

- PostScript version of the DVI file <ftp://kurp-ftp.hut.fi/pub/evn/twg97min1.ps>
- "gzip" compressed PostScript version of the DVI file <ftp://kurp-ftp.hut.fi/pub/evn/twg97min1.ps.gz>
- ASCII only version <ftp://kurp-ftp.hut.fi/pub/evn/twg97min1.txt>
- SGML version <ftp://kurp-ftp.hut.fi/pub/evn/twg97min1.sgml>. You will need the `linuxdoc-sgml` package to transform this file into other formats. See section 4.3.2.
- A "tar" archive of all the previous files, including HTML files for WWW <ftp://kurp-ftp.hut.fi/pub/evn/twg97min1.tar>. A "gzip" compressed version with the suffix "`.tar.gz`" is also available.

3 On Friday, 26.06.1997

Ruf welcomed all present and opened the meeting. *Mujunen* was assigned to take notes for the minutes.

3.1 Approval of agenda

The following was approved as the agenda for this meeting:

1. EMU-Related Matters
   - thin tape upgrade
   - vacuum switching
   - thin tape usage
   - formatter bugs / upgrades
   - all-modes tests
2. Operational Matters
   - the transitional period of mixed thick/thin tape operation
   - thin tape purchase
   - thin tape repacking
   - tape logistics
3. EVN Network Operation
   - the Field System
   - recent TAC developments
   - target of opportunity proposals
   - calibration experiments and reports
   - amplitude calibration
   - progress on phase calibration units
   - polarization

4. Reports
   - DSN status and EVN relations to DSN
   - PC Chairman's report
   - correlator reports (Bonn, Socorro, JIVE)
   - station reports
   - VSOP report
5. AOB

3.2 EMU-related Matters

Ruf opened the discussion about EMU-related issues. *Burgess* told us that a Mark IV formatter manual has been ordered from Jim Levine and that there are a few unresolved issues with formatter firmware which are being investigated by Arno Freihold (MPIfR/Bonn).

Burgess continued to explain that a company called "Spin Physics" has offered a new kind of "triple cap" headstack which apparently avoids the need for a vacuum change when switching between thin and thick tape. *Ruf* commented that Haystack has already approved these headstacks for VLBI use but that we are waiting for a detailed report on "triple cap" performance by Hans Hinteregger (Haystack). *Burgess* revealed that Jodrell has ordered one with a delivery time of about 60 days. *Foley* asked if we can afford these new headstacks and *Ruf* and *Burgess* answered that the price is about USD 6000.

(Editor's note: *Orfei* emailed me the title of Hans' memo: "Spacing loss vs speed in stepped and triple cap heads", 24-Jun-1997, Mark IV memo #252. The JIVE library has copies of all memos and if you wish you may ask for a copy from Sandra Mellema, "`mellema@jive.nfra.nl`".)

Mujunen asked if "triple cap" headstacks were tested for good operation at 320ips and 18Mbits/s/track, as it is relatively uncertain if thin tape can be used at all at 5 inches of water and 320ips without it starting to "fly". The implications of this are that when we want to start recording 18Mbits/s/track (that is, at 320ips) we either must switch over completely to thin tape (and use standard 10in vacuum) or switch over to using "triple cap" headstacks (with 10in vacuum for both thick and thin tape). *Porcas* commented that the VLBA and the Socorro correlator uses thin tape exclusively and that we need to use vacuum switching only as a short-term solution.

Perea asked how it is possible to use thick tape at all at a station which will be primarily using thin tape. JPL has instructed the Madrid DSN station *not* to use thick tape *ever.* *Ruf* commented that the decision to use mixed thin/thick tape in the EVN was made in the March 1997 EVN Directors' meeting and he also added that we know that vacuum switching both increases head wear and decreases data quality. At the same he noted that we have no chance to completely switch over to using thin tape exclusively because of at least the following reasons:

1. There are not enough thin tapes in existence, readily pre-spooled onto the right kind of glass reels.
2. Because of the previous, VLBA/Socorro cannot loan enough tapes for EVN/Global sessions, they need their own tapes to run the VLBA.
3. Many EVN stations participate in geodesy sessions and many geodesy-only stations can handle thick tape only, thus geodesy sessions are bound to use thick tape, at least for the near future.
4. No fully approved type of thin tape is currently available from any manufacturer.
5. There is not enough money to buy all the tapes we would need even if the tapes were readily available.

Foley asked if DSN/Madrid will be operational and available in EVN September 1997 session. *Perea* asked where he can get advice and tapes for September session. *Ruf* enumerated that for information about the "triple cap" headstack he should contact *Burgess*, for information about thin tape upgrade *Wunderlich*, and for tapes *Ruf*. *Alef* commented that this tape problem is similar to that of EVN stations getting tapes from a variety of sources such as geodesy groups, NRAO, Bonn, Haystack etc. *Porcas* estimated that DSN/Madrid would get thin tapes directly from NRAO/AOC/Socorro. *Ruf* reminded that NRAO expect fast circulation of their tapes and *Alef* added that the amount of tapes DSN/Madrid is likely to need will not probably pose a problem, especially when compared to a station which would typically need 60 tapes or so in a session.

Foley asked what our timescale will be regarding vacuum switching versus "triple cap" headstacks. *Burgess* answered that this depends greatly on money available. *Ruf* commented on timescales that the first batch of EVN thin tapes was ordered in November 1996 and we still (as of June 1997) don't have any thin tapes ready for use. *Wunderlich* added that installing the vacuum switching electronics to a Mark IV drive takes a couple of days per drive. The actual timescale was left open.

3.2.1 Vacuum switching

Wunderlich described the options of adding vacuum switching. We have three kinds of recorders in operation, Mark IIIA, VLBA, and Mark IV. The VLBA recorders already have the necessary electronics for remotely adjusting the vacuum. For both Mark IIIA and Mark IV, a relay switching between two vacuum level adjust potentiometers is the most straightforward solution.

There are two types of vacuum motors in existence, the old model with a variable transformer (AC model) and the new one with a 0–10V control input for controlling the vacuum. Old ones must be replaced with the new type; apparently only *Foley* has one in Westerbork and *Wunderlich* promised to supply him the manufacturer and model of the motor (it doesn't come from Metrum/Honeywell).

Wunderlich continued with showing a schematic of a switcher with a TTL input. *Graham* made a request for the capability to switch vacuum completely off and *Alef* and *Foley* commented that this will require two TTL control bits. *Buiter* asked if vacuum can be controlled only via software and *Himwich* and *Foley* acknowledged that this is the current plan. Selecting the correct vacuum according to tape type (deduced from the tape label) is important to avoid excessive wear of the head stack(s). *Wunderlich* noted that VLBA station software adjusts vacuum automatically according to the bar-coded tape volume label. *Graham* added that it would be possible to deduce tape type from a given schedule.

Mujunen asked if any other parameters such as the head calibration parameters need to be changed when changing vacuum. This question was based on head calibration results obtained after Metsähovi thin tape upgrade where change of vacuum (with thick tape) seemed to affect reverse-forward offset tens of microns. *Graham* noted that 5 inches of water is a relatively low vacuum and even at 160ips tape easily starts to "fly" i.e. lose contact with the headstack, not to mention 320ips at 5in. *Perea* asked if there could be any other parameters than head calibration which may have to be changed simultaneously with vacuum. *Wunderlich* thought these would be enough and added that changes in reverse-forward offset as a function of vacuum at Noto had been of the order of 20μm.

Ruf asked if the (Mark IV) stations want to build the vacuum switch electronics on their own or if they want them to be built centrally. *Wunderlich* added that in addition to the vacuum switch electronics installation, the cut-off vacuum sensor must be adjusted by turning a screw on it. Its default setting is 6in and this must be lowered to 3–4in. (This is the same adjustment which was also made to VLBA recorders when their tape path was upgraded for thin tape.)

Alef told that the Bonn correlator is running thin tape at 5 inches of water. *Ruf* noted the Haystack warning about mixed thin/thick operation (it is easy to accidentally wear a headstack to the wrong contour and get unplayable recordings plus excessive head wear) but assumed that switching between 15in (thick) and 5in (thin) is probably relatively ok.

Ruf asked how we should proceed with vacuum switching electronics. *Burgess* asked where we should get the needed 1/2 bits. *Wunderlich* promised to provide an unpopulated PCB and *Burgess* asked if this board would support the "vacuum off" option. *Mujunen* suggested that a recommendation on which two bits of the Mark IV I/O Board should be used for vacuum switching should be obtained from Dan Smythe (Haystack) and sent to *Wunderlich* for incorporation into his documents.

Alef realized that all tape operations, even prepassing must occur at correct vacuum after vacuum switching is in place. He asked how to prevent 5in to be used with thick tape. *Himwich, Burgess,* and *Ruf* agreed that the FS should decide based on the tape VSN (volume serial number).

Mujunen asked if *Wunderlich* could collect the memo material and distribute it to Mark IV-upgraded EVN observatories. *Ruf* suggested that the memo and the blank PCBs should be ready before end of July.

Action: *Wunderlich* to distribute the vacuum switching memo together with a blank PCB to upgraded EVN observatories before end of July.

Ruf asked how we can handle thin/thick switching with Penny&Giles tape drives (for instance in Torun). *Buiter* said that the JIVE correlator development group runs thin tape at 160ips with standard (mechanical) tension corresponding to 10in. There are some problems with reverse-forward offset and high parity errors. As the tension is adjusted mechanically in P&G drives, *Graham* felt that these drives need the "triple cap" head more urgently than the other stations.

Conway and *Alef* commented that EVN Mark IV drives are untested, uncontoured, and operators "uneducated" with thin tape and that time and resources must be allocated to this as well. *Alef* suggested (initially only for Torun) that that they should get one thin tape (presumably from NRAO), record it according to MPIfR/Bonn instructions and then ship it to Bonn for a playback test.

Alef, Foley, and *Perea* asked if there are operator instructions or a tape handling manual which addresses thin tape handling. *Wunderlich* noted that handling instructions can be found in Haystack VLBA/Mark IV memos. *Perea* asked if there is an EVN-specific tape handling manual somewhere and the answer was no. *Alef* told us that there is a NRAO web page about tape handling `<http://www.nrao.edu/vlba/html/TAPES/tapes.html>`. *Conway* asked if there are any significant differences between handling thick and thin tapes. *Alef* and *Ruf* answered that not really, the tape is just more prone to damages and thus requires even more careful cleaning of the tape drive than thick tape. Prepassing and postpassing (see the above URL) are also more important since shipping causes more uneven packing on reels than what it does with thick tape.

Himwich suggested disabling the Mark IIIA/Mark IV drive "Load/Stop" button so that a tape cannot be manually loaded with (potentially) wrong vacuum. The FS can refuse to load the tape unless the VSN (tape label) has been entered (or scanned in with a bar code reader) and the FS can thus select proper vacuum for this particular tape. *Porcas* added that with thin tape we are always talking about high-density recording (56250bpi with Mark III/Mark IV DR format, 56700bpi for VLBA NDR format, see section 5.2.5).

3.2.2 Thin tape upgrade

Ruf enumerated EVN-affiliated stations which will need the thin tape upgrade, perhaps in conjunction with VIV (VLBA to Mark IV) project:

1. Noto, Metsähovi have already been upgraded.
2. Cambridge (==Jodrell VLBA) will be upgraded shortly.
3. Yebes
4. Shanghai
5. Urumqi

6. DSN/Madrid will be done by JPL (in Aug/Sep; *Altunin* noted that Goldstone and Tidbinbilla are already ready)
7. Simeiz *(Himwich* noted that Goddard has no plans to upgrade this station)
8. Ny-Alesund almost done
9. Wettzell is ready
10. the status of Haartebeesthoek was unknown

Ruf summarized that the ceramic plates have already been shipped to Yebes, they just need the other parts and Leslie Perry (Jodrell) to do the upgrade. *Burgess* promised Les is available for this installation. *Wunderlich* asked whether to ship parts directly to Yebes or to Jodrell. *Ruf* suggested that Les should collect the tools necessary while upgrading Cambridge.

Ruf asked what we should do with the Chinese stations and it was decided that *Wunderlich* sends email to Shanghai and Urumqi to discuss options.

3.2.3 Thin tape usage

Porcas asked how we are going to test the upgrades and *Ruf* suggested that a VLBA-style thin tape be written at every upgraded station and then shipped to Socorro for playback quality analysis. *Mujunen* added that the stations should immediately switch to 15 inches of water for "normal" thick tape operations to let the head recontour to the more pointed shape required by thin tape at 5in. He also asked how much is enough for recontouring the head and *Alef* answered that exact times/tape amounts are not known. Fuji H621 (without the -I suffix) is know to be abrasive and it is also called "lapping tape".

Action: All stations planning to use vacuum switching: adjust your tape recorder now for 15in operation with thick tape.

Action: *Perea* remebered that he had got an email about suitable recontouring tapes and he promised to email it to *Ruf* for distribution.

Action: *Ruf* to ask NRAO for thin tapes for verification of station compatibility with the VLBA correlator. *Porcas* suggested that this can be actually assigned to *Mioduszewski.*

Action: All stations with thin tape upgrade: record (RF/IF) noise on this thin record quality verification tape and send it to Socorro for analysis.

Graham described tests he had done with the Effelsberg VLBA recorder at 5in and 160ips. Some tracks resulted in parity errors as high as 1E-1. This resulted in discussion if the quality test should be made at 80ips only. *Porcas* reminded us that VSOP recordings are to be made at 160ips. *Alef* noted that the VLBA sets up a fake experiment when they do recording quality checks.

Burgess searched and found a more precise price for the "triple cap" headstack by Spin Physics, USD 7627. *Alef* reminded that especially with thin tapes the humidity in the headstack area of the recorder must be kept below 50%. The recommended value is 20–30%. *Himwich* noted that less than 5% is not useful either. *Foley, Buiter,* and *Tuccari* asked about the Urumqi serious head wear experience despite their about 5% relative humidity.

Tuccari explained their experiences at Noto. They have just changed in a new headstack, their third. Their ambient relative humidity is about 40% and inside the recorder, thanks to the dry nitrogen system it is less than 30%. No such system was installed for the duration of their first headstack which lasted for about 1000h. Their second headstack failed after 800h but in a different manner: one track is missing but the headstack is otherwise in good condition. They have just started to use their third headstack and cannot comment much about it yet.

Burgess wondered if the expected lifetime of a given headstack is 4000–5000h and asked if people with dry air/nitrogen kits are experiencing problems with temperature or head failures. Nobody had anything to comment.

3.2.4 Formatter bugs / upgrades

Ruf explained that Arno Freihold (MPIfR/Bonn) has found approximately 16 items in Mark IV formatter firmware which need attention. Arno had described these in an email to Ralph Spencer (Jodrell), explained *Burgess* and the consensus was that local firmware expertise must be developed and that Arno Freihold and *Burgess* could perhaps participate in this.

Foley asked if there are any urgent upgrades necessary before the September session. *Ruf* did not believe this would be likely, although he asked about the time jump problem. *Ruf and Porcas* wondered if the time jump problem could be specific to Westerbork Mark IV formatter, but *Mioduszewski* confirmed that all Mark IV formatters exhibit the same time jump problems.

Ruf summarized that there are problems but we cannot do anything to them within such a short timescale as the September session. Ralph Spencer (Jodrell) is working with Arno to find a solution to the firmware problems. *Ruf* asked if there are any urgent known bugs and this was a natural place for *Mioduszewski* to present the results of Mark IV "all-modes" tests.

3.2.5 All-modes tests

Mioduszewski described the results of "FT1", a test experiment held in April 1997. Five antennas participated:

VLBA DAS:

HN (Hancock), JV (Jodrell Bank VLBA, sometimes known as Cambridge), NT (Noto)

MkIV DAS:

JB (Jodrell Bank Mark IV), MC (Medicina), WB (Westerbork)

"FT1" was observed at 1.6GHz and it tested 42 modes. The tapes were correlated at the VLBA correlator.

The results were encouraging, 34 modes were validated with fringes found and cross-power spectra looking ok. There were problems with poor recording, severe interference, and with 1MHz external filters (this bandwidth shows up as "0" in logs; it did not fringe at JB). There is also a peculiar delay jump associated with every change in speedup factor.

"FT2" will be observed at 5GHz to avoid interference on June 30, with:

VLBA DAS:

HN (Hancock), SC (St Croix)

MkIV DAS:

JB (Jodrell), ON (Onsala), WB (Westerbork)

Graham asked if external 1MHz filters are to be used in "FT2" and *Mioduzsewski* said no. She also explained that whenever the speedup factor changes, the Mark IV to VLBA delay jumps. *Conway* asked if GPS timing data was relied on in correlation and *Mioduzsewski* said no. *Perea* asked if GPS timing data is required and *Altunin* said DSN stations already have the data available. *Porcas* found the "FT1" test results good and *Graham* asked about the bandpasses of 16MHz Mark IV VC filters. *Mioduzsewski* replied that they look as bad as before. *Graham* and *Alef* wanted to know if 16MHz will be used in "FT2" since they have changed some details in the filters at Effelsberg. *Mioduzsewski* said that "FT2" will include 16MHz filters.

Conway asked about relatively poor playback quality performace of stations and whether it is normal. *Mioduzsewski* replied that unfortunately this is the case. *Alef* asked why there are no readback tests in schedules in general. *Ruf* suggested that this item should be moved to tomorrow into section 4.1. *Burgess* asked about high parity error rates of Jodrell VLBA and *Mioduzsewski* told him that whole tracks or BBC IF input data seems to be missing.

Mioduzsewski concluded that "FT2" will be almost identical to "FT1" (with the exception of external 1MHz filters). *Altunin* asked if DSN stations should/could participate in this test and *Conway* noted that this test tries to mainly verify the correct operation of the Mark IV formatter design and firmware in all modes, not particularly the performance of any given antenna.

Porcas asked when "FT2" will be correlated and *Mioduzsewski* expected it to happen within one month of observing. *Ruf* asked if this test is enough, i.e. is this really an "all-modes" test, but nobody actually answered this question. *Gurvits* asked how to notify users of the EVN about the new Mark IV modes available and *Porcas* suggested there is a file about this in Socorro. *Gurvits* asked where PIs can find SCHED setup files and *Porcas* assumed Huib van Langevelde (JIVE) and Craig Walker (NRAO) have been / are designing these. *Mujunen* asked how we can ensure that pointers to these resources can be found in the EVN proposal guide.

Action: *Porcas* to ensure that pointers to EVN station Mark IV capability status table and SCHED setup files for Mark IV observing can be found in the proposal guide.

Conway noted that only 4–7 new Mark IV modes would be enough, i.e. satisfy the needs of most users. *Alef* suggested even a lower number, 2–3, but cancelled this after realizing that spectral line observations may benefit from a couple of additional modes.

Ruf asked what was felt the most important problem in the Mark IV formatter design to be corrected, according to the "all-modes" test observations. *Mioduzsewski* thought that delay jumps is the most serious problem. *Conway* noted that for geodesy observations the setups don't change during a given experiment and thus there is less pressure on the geodesy side to have the problem corrected at all.

3.2.6 VIV upgrade

Burgess introduced (on behalf of Ralph Spencer, Jodrell) the EVN VLBA to Mark IV upgrade project. The team will include Ralph Spencer as the project leader, Arno Freihold (MPIfR/Bonn) and Dan Smythe (Haystack) working on the Mark IV formatter, *Burgess* to work on FS (together with *Himwich), Ritakari* to work on read/write electronics, Huib van Langevelde (JIVE) to work on scheduling and FS support, and *Foley* to work on formatter/FS issues.

Ruf asked about read/write electronics required to upgrade a VLBA recorder to Mark IV. *Ritakari* replied that to increase the bit rate from 9Mbits/s/track to 18Mbits/s/track the existing Write Driver module must be replaced. However, adding a second headstack will require at least the following items:

1. A new headstack.
2. Headstack interface PCB with special AMP connectors (which are unavailable at the moment!).
3. New mechanical mounting fixtures to mount the second PCB.
4. A way to change the delicate Brimflyx wiring into ordinary ribbon cable. (The equivalent of the current Mark IV "Connector Plate".)
5. A new inchworm motor and most probably the mechanical parts into which it is glued with epoxy.

6. Perhaps populating the inchworm controller for a second inchworm motor.
7. Another WRM, Mark IV write module which in turn may require the PWM, power distribution module or special connectors/wirings.
8. Updating RECON firmware to be correctly aware of the second headstack. (There are some provisions for this but it has apparently never been tested.)
9. Update the FS to be able to control upgraded VLBA recorders with two headstacks.

Mujunen added that the only headstack of a VLBA recorder is a read/write head and it is fitted in head position #1. In Mark IV recorders the r/w stack is at position #2. Whether this causes a problem or not has to be determined.

A device similar to the Mark III decoder/data buffer will be eventually required since the data buffer and the DQA (data quality analyzer) of the VLBA formatter will disappear along with the formatter swap.

Ruf and *Burgess* confirmed that the VLBA formatter is really to be removed and replaced with a Mark IV formatter. The precise way of doing this is unclear at the moment, however. *Mujunen* asked who is designing this and *Burgess* was unsure. It was an assumption that Haystack must be doing this but nobody knew anything for sure.

Mujunen reminded that only the two highest-speed Mark IV modes 512Mbits/s and 1GBit/s cannot be attained with the VLBA formatter and one headstack. Replacing the formatter and the existing write module (but not adding a second headstack) brings us the 512MBits/s mode, provided that recording quality at 320ips and 18Mbits/s/track can be managed. (Practical correlation of 18Mbits/s/track modes also requires a correlator and a reliable playback channel which can play back at 18Mbits/s/track. *Graham* noted that Mark IV modes can be correlated at the Bonn correlator in multiple passes and with a slowdown factor of four (18 to 4.5). *Alef* did not particularly like this idea.) Adding a second headstack adds only the 1GBits/s mode (or if 18Mbits/s/track won't work, then a two-stack 512MBits/s mode).

Ruf suggested a planning / "kick-off" meeting to be held in September.

Action: *Burgess* or Ralph Spencer to organize this "VIV kick-off" meeting.

Ritakari commented the upgrade of read/write electronics as follows:

As far as I know, existing Read and Write modules can be used for 9Mbits/s and slower speed recording. The only necessary modification is the addition of a second write module. We have already produced several batches of this module, making some more is relatively straightforward.

Some of the old write-modules use transformers to sample data for decoding. I am not sure if these can be upgraded for 18 Mbit/s operation or if they need to be replaced with new write modules.

Adding another head is more of a problem: We need the headstack, inchworm motor, LVDT transducer and the head electronics, including the hard-to-get headstack connectors.

Some Mark III -style head electronics were left over in the EVN Mark IV upgrade. We should consider the possibility to convert these to Mark IV by the individual observatories.

Ritakari continued to comment on the decoder and data buffer:

These are being developed in Haystack and it is very difficult to estimate the work involved, because no data is available at the moment.

In principle this module should be very simple and inexpensive. Optimal solution would be a IBM PC/AT ISA board with line receivers (connected to Mark IV formatter sampler outputs), synchronisation logic (fits in one seven-dollar MACH 211 PLD chip), and 64 megabytes of 10ns SDRAM (one DIMM module, available at the nearest computer shop) and of course ISA bus interface logic. This is completely adequate to collect 8 megasamples of data on all tracks and the PC main processor would be used for data quality checks and/or correlation.

3.3 Operational Matters

3.3.1 The transitional period of mixed thick/thin tape operation

Ruf explained that we are now facing a transitional period of mixed thin/thick tape operation and requested suggestions as how to minimize the problems associated with this. *Foley* suggested minimizing the number of changes within a given session but *Conway* and *Porcas* felt this was a nightmare for the scheduler. *Ruf* commented that an ideal arrangement would be separate thin/thick parts within each frequency. *Alef* wished for automatic vacuum changes and *Himwich* reminded that every change wears the head a little. *Alef* suggested using "triple cap" heads as the final solution. *Ruf* suggested scheduling around VSOP observations. *Gurvits* asked how much thick tape is expected in September and November sessions. *Porcas* noted that all VSOP observations will be done on thin tape as they are destined to Socorro for correlation. *Gurvits* added that this will happen to most global observations, too, so that leaves us with EVN-only observations. *Porcas* commented that the Program Committee will discuss these, but that some multi-epoch proposals will surely appear in both sessions. *Gurvits* noted that the less we have thick tape observations, the less we will have backlog in Bonn correlator.

Hase asked how many thin tapes can be made available. *Porcas* stated that they will have to come from NRAO. *Conway* asked if we have to manually adjust the vacuum in September session. *Porcas* and *Foley* claimed this would be dangerous. *Ruf* asked how certain is the VSOP schedule and *Gurvits* answered that it depends on the progress of in-orbit checkout. The VSOG has most probably created an optimistic schedule and some experiments will most probably be cancelled, but nobody knows for sure.

Porcas asked if we could preallocate the "right tapes for right experiments", properly prepassed *(Alef)*. *Ruf* asked if the tapes could be prelabeled and if thin tapes purchased by *Hase's* institute have shown any signs of damages. *Altunin* reiterated that DSN stations will use only thin tapes and that no operator training can be provided for handling thin/thick switching. *Ruf* concluded that no real conclusion on thin/thick tape operation can be found since the requirements are conflicting.

The meeting had a lunch break.

After lunch *Ruf* asked if there was anything to add to thin/thick operation. *Porcas* asked what needs to be informed to PIs about thin/thick tapes and *Ruf* noted that all VSOP and global experiments will be recorded on thin tape (and correlated in Socorro) and that all EVN-only experiments will be recorded on thick tape for the transition period and correlated in Bonn. *Graham* and *Alef* reminded that at least the DSN stations are thin-only. *Mujunen* asked who will collect information about thin tape capability and make it available to PIs.

Action: All stations: Send updates of station information (especially including when thin tape is available on your station) to *Porcas* (`porcas@mpifr-bonn.mpg.de`).

Alef requested updating of LOs and IF patching information at the same time. *Ruf* noted that DSN/Madrid must be listed as thin-only in the status table and that soon all other EVN stations can be listed mixed thin/thick.

Action: *Porcas* to contact Mike Garrett (JIVE) to arrange for station status table updates in JIVE WWW and PI information.

Porcas asked for a deadline for completing testing thin/thick switching and thin tape recording quality test. *Ruf* suggested before start of September session. *Mioduzsewski* told us that an engineer will look into the data quality on test tapes at AOC and this will not require VLBA correlator time.

3.3.2 Thin tape purchase

Ruf described how efforts to buy thin tapes for EVN started in 1995 but how regardless of an early start we are still somewhat "stuck". A new (slightly cheaper) supplier Quantige(sp?) (former Ampex) has been found and their tape quality is being assessed by Haystack and NRAO. NRAO/AOC (Socorro) has promised to help in repacking future tapes onto glass reels.

Hase noted that the geodesy community needs thin tapes for its CORE program. This would mean about 350 thin tapes, acquired by US Naval Office, NASA, and geodetic institutes all around the world. *Hase* suggested the possibility to investigate a consolidated buy. *Alef* told that in the latest teleconference with recorder folks of Haystack and NRAO, Hans Hinteregger (Haystack) told that Haystack is coordinating the purchase. *Porcas* asked what is the timescale for the geodesy community to start using thin tape. *Himwich* commented that (due to correlation in Socorro) some stations can become thin-only and that among EVN stations, the participation of Onsala, Noto, and Medicina would be appreciated. NASA is upgrading Fairbanks and Kokee Park in September 1997.

Buiter was concerned about the availability of thin tapes in the future since in the video market there is zero demand for this kind of tape. *Ruf* replied that this is why we need to buy all the tapes we will eventually need now while this tape type is still available. *Buiter* asked what are the (supposedly "extra tight") tolerance specifications for the glass reels and *Ruf* assumed reliance on NRAO specifications.

Porcas reiterated the question about geodesy timescales concerning thin tape and *Himwich* replied that he wasn't sure. The CORE program starts before either JIVE or Haystack Mark IV correlator is in production use, so this necessitates correlation at Socorro and this implies thin tapes. Thin tapes probably won't be introduced in 1997. The geodesy community has acquired some thin tapes and Arthur Niell (Haystack) knows the details. *Ruf* asked how many tapes there were, 100?, and *Himwich* answered "perhaps". *Himwich* also stressed that for geodesy-only stations they are not willing to risk mixed-tape operation and that their "own" stations will switch over to thin tape once they have to start using it.

Ruf concluded that due to practical necessity EVN has to bear with a (hopefully short) transitional period of mixed thin/thick operation. He also recommended that EVN should take advantage of the NRAO offer to repack new thin tapes.

Action: Ruf contacts Arthur Niell (Haystack) to get details of the thin tape purchase plans of the geodetic community and to discuss the possibility of combining purchases.

Conway asked how many thin tapes will be needed. *Ruf* explained that roughly a thousand tapes would cover a year of correlator backlog. *Alef* noted that we must stop observing more than what we can correlate. *Porcas* estimated that EVN would require typically about 200 tapes for each session.

Altunin reminded us that the "Caltech" correlator still exists and that there is a relatively low demand for it. It is a four playback drive correlator and it will be upgraded to thin tape operation in 1998. He expects this "availability offer" to be valid at least to the end of 1998.

Ruf asked if Wettzell could join EVN thin tape purchase and *Hase* suggested that as *Ruf* contacts Arthur Niell, *Hase* contacts his coordinators.

Burgess asked about the expected life of a given thin tape and *Porcas* explained that this far NRAO has lost about 50 of their roughly 1000 tapes.

3.3.3 Thin tape repacking

Wunderlich explained the repacking procedures needed to transfer new thin tapes from their metal shipping reels to "self-packing" glass reels. This process started at Bonn roughly in June 1996.

The Acrometal self-packing reels are actually narrower than 1in tape. Empty reels are usually 0.984" (25.0mm) and with a properly packed tape, the tape widens the reel up to 0.996" (25.3mm). A phenomenon called “flange forcing” has happened if the tape has forced the flanges of a given reel wider than 1.000" (25.4mm). These changes in reel dimensions are possible because the glass flanges are made of “security glass” and they are actually flexible.

The procedure for repacking goes like this:

1. The tape is wound onto a regular, non-self-packing “blue hub” glass reel with high vacuum (15in) and low speed, 80ips. This is the moment when first problems seem to appear, the tape will often pack “bumpy”.
2. The standard glass take-up reel is swapped to the top reel position and another empty glass reel is put into the lower reel position. Tape is wound at high speed (330ips) and low vacuum (7.5in). At this stage the “spokes” problem occasionally appears, the tape touches the other flange very hard.
3. The tape is finally wound onto a self-packing reel. (Editor’s note: I forgot to take notes of the speed, vacuum, and direction of this step.)

After these steps approximately 2–3 tapes were removed due to persistent bumps and spokes.

Thin tapes repacked with these procedures were used in VLBA/Effelsberg experiments, together with tapes from NRAO. The Socorro correlator complained that EVN tapes were “not in perfect condition” whereas VLBA tapes were ok. The tape reels of Effelsberg VLBA recorder were adjusted to be aligned in the same plane but still in another VLBA/Effelsberg experiment the same degradation happened to EVN thin tapes and not to VLBA thin tapes. Repacking of further EVN tapes was stopped at Bonn.

Wunderlich continued to explain that the reasons for “forced flanges” usually lies in the tape path: tape is pushing towards one flange due to a misalignment. The fact that adjusting the Effelsberg recorder didn’t help meant that another cause had to be found. The 3M/Scotch tapes EVN got were inspected and measured against Sony tapes which NRAO usually uses. EVN tapes seemed to be approximately 30μm wider and the tape edges were not symmetrically cut, i.e. the cross-section of tape edge showed a non-perpendicular tilt. Six tapes were shipped to Hans Hinteregger (Haystack) for inspection and *Wunderlich* continues discussions with him.

Editor’s note: At the time of the meeting the cause for tape damage was unclear. It was suspected that either the difference in tape edges of 3M vs Sony or any improper handling could be the cause. Later 3M admitted that the tapes were defective and they agreed to take them back and refund the price. (3M doesn’t make any new tapes of this type, thus the refund and not a replacement with new tapes.)

Buiter asked what kind of take-up reel was used in Effelsberg recorder and *Wunderlich* replied that a standard blue non-self-packing one. *Buiter* continued that JIVE has similar packing problems with P&G drives but that P&G recommends using a self-packing glass reel as the take-up reel. *Buiter* also asked if the manufacturer (3M) has been contacted and *Wunderlich* explained that this will be done after Hans Hinteregger has had a chance to inspect damaged tapes. *Mujunen* asked if unrepacked tapes were also sent for inspection to NRAO and/or Haystack and *Wunderlich* confirmed this was the case, NRAO got six tapes and Hinteregger one “good” and one “bad”.

Alef asked what are NRAO’s experiences with 3M since they also have 3M tapes. *Ruf* also noted that they keep statistics of failed tapes and that they had said that there “may be a tendency” that 3M tapes fail more often. *Wunderlich* added that the tendency had been observed by “cut batch by batch” basis.

Buiter confirmed that there were similar problems with P&G drives in JIVE and that he had heard that George Peck (NRAO) has widened self-packing reel width specifications. *Alef* commented that Hans Hinteregger (Haystack) considered this wider specification unsafe for tape shipment. He also noted that it is possible that self-packing reels used in Bonn repacking may have been of the wider specification but that this should only influence transporting tapes.

Ruf concluded that tape experts are currently working on the problem and that EVN should consider and prefer NRAO help in future repacking of new tapes.

3.3.4 Tape logistics

Alef described the current status of EVN tape logistics as "improved". WWW-based "Track" is being used by almost all stations (see red "TRACK" button on page `<http://www.nrao.edu/vlba/html/VLBA.html>`, password requests to "`vlbatape@nrao.edu`"). Tape transit times have shortened and are usually a few days, less than a week except for Shanghai which takes usually one week. Also station bar code labelling is improving as "`drudg`" can now generate PostScript bar code labels and matrix printers with faint ink ribbons have all but fallen into disuse.

Foley complained that in the past Web-based Track didn't accept all tapes, but *Alef* ensured that this is not the case anymore. He added that geodetic stations are also using Track. *Wiik* asked if CMVA (Coordinated mm-VLBI Array) tapes are to be entered into Track and *Alef* thought there should be no exceptions. He also recommended that:

Action: *Himwich* to encourage geodetic stations to use Track, either the Web or the terminal version. (Contact "`vlbatape@nrao.edu`" for new station arrangements and passwords.)

Foley asked *Mioduzsewski* if there were any comments from the VLBA correlator regarding tapes and she answered that tapes arrive usually in time and that "most stations" use Track.

Alef stressed the importance to attach bar code station labels to every tape which gets shipped to the correlator. *Polatidis* commented about getting "FedEx" tracking labels "for free". *Buiter* asked if thin tapes should be bound in bundles or cardboard boxes for shipping and *Alef* and *Mioduzsewski* agreed that the best way is to ship tapes separately in their own (2in thick foam-filled) plastic transportation boxes. NRAO has been successfully shipping thin tapes individually.

There was some discussion about tape labelling, *Himwich* asked if anyone is still using "Epson" matrix printers for bar code labels and *Alef* discouraged this. *Polatidis* complained that since green base labels are reused multiple times (although they originally were designed to be replaced at the correlator when tapes are degaussed), they tend to peel off.

The meeting had a coffee break and decided to handle a couple of items from Saturday's agenda.

3.3.5 Target of opportunity proposals

Porcas presented the concept of "target of opportunity" proposals. These observations are only carried out if/when a precondition, a predicted astronomical event actually happens. The typical delay from a given event to the corresponding observation would be of order of 4 months. A question posed by *Porcas* was if the EVN can react much faster, would it be possible to react, say, within 4 days?

The consensus of the meeting was that "TOO" proposals can be included in the EVN block schedule and that under a relatively short notice observatories can omit them from the session, i.e. not observe them if the corresponding event has not occurred. However, the preparatory work, schedule files etc. must appear according to the usual EVN deadlines for "TOO" experiments to be included in sessions.

Action: All stations: list the boundary conditions and timescales for reaction to target of opportunity proposals.

Porcas continued to depict the EVN "Call for Proposals" which gets sent one month before the proposal deadline. It includes the EVN station status/capability table ("`evn.sts`" in "`astbo1.bo.cnr.it`"). It is the responsibility of stations to send updates whenever their receiver availability, Tsys (Jy), and recording system capabilities change. At the moment *Porcas* will collect this information at "`porcas@mpifr-bonn.mpg.de`" and make sure it gets updated in the tables which gets distributed to PIs.

After the PC has selected proposals to be observed and after the block schedule has been created by the EVN scheduler Rolf Schwarz (MPIfR/Bonn), the prospective PIs get additional “PI instructions” sent to them. This information includes pointers to scheduling software (PC-SCHED and SCHED) and setup files. Any changes to station LOs, IF patching etc should also be sent to *Porcas* who will collect this information at “`porcas@mpifr-bonn.mpg.de`” and make sure it gets updated in FTP servers accessed by PIs.

Burgess asked why so few experiments properly use the “cover letter” anymore and *Mujunen* and *Gunn* requested that at least phase cal on/off and LCP/RCP usage should appear on the cover letter as PC-SCHED/“`.drg`” formats don’t support indicating these—eventually the new VEX schedule format will include pcal and polarization. *Polatidis* also complained that schedules often arrive late at “`astbo1.bo.cnr.it`”. *Mujunen* asked if there are any circumstances when EVN stations should look at files found on “`aspen.aoc.nrao.edu`” and *Foley, Mioduzsewski, Graham,* and *Porcas* all agreed that all schedules intended for EVN stations will appear on “`astbo1`” and that they can deposit the corresponding log files and GPS data also there.

Mujunen asked about unified IF patching for both Mark IV and VLBA racks. *Alef* reminded the meeting about the automated IF switchbox which was a topic in the previous TWG. The stations which would benefit most of such a box are those regularly participating in both geodesy and astronomy (Medicina, DSN/Madrid, Onsala, Wettzell), since astronomical dual polarization IF patching is very different from geodesy patching. *Perea* noted that JPL has created an automated box for IF patching for DSN stations. *Hase* asked if the box was commercially available and *Altunin* answered that he is not sure.

Action: *Perea* to send JPL IF switchbox capabilities documentation to *Ruf*. *Altunin* to email possible Web references about the box to *Ruf*.

3.3.6 Calibration experiments and reports

Alef presented a preliminary May/June 1997 CAL report. The full report can be obtained at `<ftp://ftp.nfra.nl/jive/monitor/cal may97.ps>`.

A worrying problem was that at 6cm half of the stations got LCP and RCP interchanged. At 1.3cm the calibration sources were quite weak. *Graham* noted that the usual CAL team has left us and this has put the extra burden of creating CAL schedules on *Conway* and *Polatidis*. *Gurvits* suggested using another source at 1.3cm as the fringe search candidate. *Alef* requested long enough gaps in the CAL schedules to allow for readback tests to be inserted by “`drudg`”. *Himwich* added that this requires only 70 seconds after a given pass.

Altunin asked how often EVN arranges CAL observations and expressed their interest in participating them. *Ruf* replied that CAL observations are included in every session, that is every 2–3 months. *Porcas* added that a CAL run usually lasts for a day or slightly less per each observing frequency and that the schedule should be known 6 weeks before the observation.

Action: *Ruf* to send the block schedule to DSN/Madrid as early as possible indicating especially the CAL observation.

Himwich noted that automated tests in FS/“`drudg`” have been tested to work with Mark III mode C only and that it is possible that they require further development to be generally applicable to any VLBA and/or Mark IV mode.

Porcas asked if the stations felt that cover sheet information in the distributed block schedule would be helpful and at least *Gunn* acknowledged yes.

Action: *Gurvits* to ask Rolf Schwarz (MPIfR/Bonn) for an ASCII version of the block schedule and to arrange that it gets updated to JIVE Web pages.

4 On Saturday, 27.06.1997

Ruf opened the meeting at 09:06. *Alef* told us some latest news about correlation of the May/June 1997 CAL experiment.

4.1 EVN Network Operation

Gurvits presented a status report of EVN operations. The report was distributed in the meeting. General performance of the EVN shows signs of improvement, but problems remain. Major problems to be addressed include pre-session setup and checks, near-real-time diagnostics, switch to thin tape, and site-specific problems (particularly for new network telescopes).

Action: *Gurvits* contacts Richard Schilizzi (JIVE) to enforce the EVN Board of Directors' meeting decision in March 1997 to provide 24 hours before the beginning of a given session for system checkout, plus an additional 12 hours before each frequency change.

Porcas argued that a permanent physical setup would require less system checkout time, but *Foley* answered that for example for Westerbork a permanent setup was impossible. *Tuccari* suggested to minimize points that need to be changed/reconfigured for VLBI.

Perea described how schedules reach DSN/Madrid via JPL and how many times details are missing. He asked where he should ask for clarifications. *Porcas* answered that if proposal information doesn't reach a given station then the station may contact the PI directly—contact information (email) should be present on the cover sheet and schedule files. *Foley* confirmed that this is what he has been doing whenever there is something unclear as to what the PI wants the station to do in a particular experiment. *Porcas* warned that many PIs are "amateurs" in the VLBI technical sense and that they may be relying on JIVE experiment support, and in this case it may be appropriate to send the question to the PI and at the same time "`CC:`" it to "`jive@jive.nfra.nl`".

Gurvits asked if the "`.drg`" contains enough information and *Wiik* replied that unfortunately not. *Polatidis* stated that a standard cover letter would usually be enough, but *Wiik* complained that recently the only standard thing in cover letters has been that they have been empty.

Ruf reminded that the schedule files should be available two weeks before the session start and this should leave enough time to get clarifications from PIs—but this deadline seems to be slipping.

Action: *Porcas* to "publicize" on the "`evntech@nfra.nl`" mailing list the email addresses of the PIs of a given session at the moment when the schedule files should be frozen on "`astbo1`". This enables station technical friends to easily contact PIs for clarifications. (Editor's note: Actually why couldn't this email message be the aforementioned "block schedule with cover sheet information"? The appearance of this message could also signify that the schedule files are frozen...)

Gurvits asked about the usefulness of the station checklist. *Ruf* commented that since we encounter wrong polarization how the checklist can help. *Altunin* explained that DSN schedules pre-calibration time 1.5h before each session and he would like to know if there is a recommended procedure for checking dual-pol 1.3cm, maybe with W3OH. *Porcas* thought that each station should do its own station checks and *Alef* added that we could compare this to how GPS was implemented in EVN.

Tuccari described how they add extra noise to only one IF at the receiver and check the IF with a spectrum analyzer at the IF distributor in the rack. *Ruf* was skeptical since this wouldn't have resolved the recent problem at Jodrell when a primary focus receiver was accidentally mounted at secondary focus and polarization was thus reversed. *Foley* suggested irradiating the whole dish. *Conway* suggested that a check of the cables is necessary in the checklist but not a guarantee that polarization will be correct. *Pazderski* told us that Torun uses a helical antenna to irradiate the disk. *Conway* summarized that 1) cables, 2) polarizer, 3) reflectors can be wrong and this induced *Burgess* to suggest and favor an end-to-end test for checking polarization. The discussion continued to ponder pros and cons of an irradiating end-to-end test. *Alef* asked what has changed recently which could explain recent problems with polarization. *Burgess* told he had changed his working location at Jodrell, it is not anymore next to the receiver guys. *Conway* commented that usually something gets touched which has not been touched for 20 years.

Ruf proposed a test tape one week before session start, *Gunn* told that this wasn't possible for instance at Jodrell. *Gurvits* asked if we will organize polarization check observations for those who can participate. *Tuccari* commented that this test would ensure the first part only, since any changes such as a frequency change will invalidate the results of the "week before" test. *Alef* stated that the TWG came to the same conclusion years ago. *Gurvits* recommended trying W3OH at 18cm.

Alef requested recording quality checks to be made at stations. *Ruf* concluded that we should stick with the checklist, especially regarding to recording quality issues.

4.1.1 Scheduling software

Gurvits noted that upgraded Mark IV would be fully utilizable only after we have new features in scheduling software. We have lack of manpower here, since Huib van Langevelde (JIVE) (who has been enhancing SCHED together with Craig Walker, NRAO) should be working on JIVE correlator software. Also NRAO/VLBA is not directly interested in adding Mark IV-specific features into SCHED.

Action: *Gurvits:* to recommend to the EVN Board of Directors (BD) that manpower to scheduling software should be allocated.

Porcas noted that in the past scheduling software emerged from the user community. *Ruf* suggested that this issue should be brought up in the next BD meeting in October in Onsala (held together with EVN Users' meeting).

4.1.2 EVN Network Operation (continued)

Gurvits asked if it has been easy to access "`astbo1.bo.cnr.it`" for experiment feedback and depositing logs and GPS information. *Venturi* stated that the VAX machine may be eventually replaced and the communications line improved. *Gurvits* encouraged all stations to report access problems to JIVE and they'll try to find a way to help. He further told that a QASP (Quality Assurance Program) team is on its way to the Chinese stations Shanghai and Urumqi in summer 1997, 1+5 people.

Gurvits reminded that tape shipments are to occur weekly *during* sessions on Mondays to Socorro and on Tuesdays to Bonn. He also promised to take care of the action item on him to have the EVN block schedule in ASCII format on JIVE Web pages. *Gunn* liked to know if we can rely that this will be the master copy which will be absolutely up-to-date. *Gurvits* also reminded stations to post a dummy log onto "`astbo1`" whenever they did not observe although they had been scheduled.

Gurvits asked if it is clear which subdirectory of "`astbo1`" to use and *Venturi* answered that the starting day of a given experiment dictates the subdirectory name, if it is, say, "`EVN.MAY97`" or "`EVN.JUN97`". *Porcas* noted that this is said on the PI instruction sheet. *Conway* asked about the leading zeros in experiment codes and *Alef* suggested that they should be eliminated, i.e. "EL20" instead of "`EL020`".

4.1.3 The Field System

Burgess presented the key ares in which FS developments are desirable. These are:

1. Thin tape handling, vacuum autoswitching according to tape VSN label.

2. Linux kernel update to support newer PC hardware.

3. Support for TAC (Totally Accurate Clock, a GPS receiver).
4. Support for continuous tape motion. (This applies mainly to "`drudg`".)
5. Logging extensions, especially off-source flagging and amplitude calibration related logging.

Mujunen described shortly that a Linux kernel and distribution update is necessary to support the latest PC hardware, to avoid certain network security problems with the old distribution, and to enhance interoperability in a larger network of other Linux computers. *Foley* asked if this upgrade should be used in November session and *Porcas* reminded that three stations are not yet using FS9. *Hase* commented that Wettzell will start using FS9 before end of 1997. *Himwich* stated that Urumqi may be upgraded in conjunction with the QASP visit and that Simeiz may get a loaner disk which is currently in Brazil.

Perea wanted to know if a single VEX/"`.drg`" is at the moment sufficient for FS9 observing and *Himwich* stated yes—if this doesn't seem to work, he and Nancy Vandenberg (NVI/GSFC, "`nrv@gemini.gsfc.nasa.gov`") would like to know about the problem with "`drudg`".

Mujunen added that although the Linux upgrade will most probably be available in November 1997 it will not be necessary to upgrade to run the November session. At some later date the FS may refuse to compile/run on the old 1.2.12 Linux platform and require the new Debian 1.3.1.r3-based kernel version 2.0.30. *Altunin* commented that it will be difficult for DSN to keep up with these upgrades as the people responsible for setting up the stations will be leaving in September 1997 and no software changes were anticipated after that.

Porcas asked about FS support for frequency agility and receiver changes. *Himwich* felt controlling station-specific receiver change hardware was best left to station-specific FS software. *Mujunen* complained that many of the apparent "FS enhancements" would actually require no modifications to the Field System but that they would require massive revisions in the ways in which information flows in the VLBI observing process as a whole. This would have to cover the whole chain of PIs, stations, correlators, and PIs again in the data post-processing step. One step towards this direction is the adoption of VEX which is designed to convey information from the scheduling stage all the way thru correlation and back to the PI.

Himwich noted that there is new support for continuous tape motion in "`drudg`" but that due to lack of such schedules these features are mostly untested. *Alef* noted that continuous tape motion works with the VLBA, but since SCHED VEX-to-`drudg` support is under development, FS9 users can test it only later. *Porcas* commented that one can get continuous tape motion with PC-SCHED and some hand-editing and *Mujunen* used the opportunity to clarify what he meant with the main "FS" problems being actually problems in getting the whole chain of scheduling software–FS–correlator to agree on the same concept such as "continuous tape motion". This is a perfect example because as far as the FS goes, "continuous tape motion" is nothing but making sure the schedule will not contain certain "`et`" stop tape commands which would normally be there—no changes to the FS are actually required.

Porcas reminded us that Huib van Langevelde cannot be much involved in enhancing SCHED, but nevertheless *Himwich* estimated that VEX support will most probably become available in September 1997. *Porcas* summarized that having VEX support and thus SCHED support together with continuous tape motion brings Mark IV and EVN VLBA stations much closer to true VLBA compatibility. *Gurvits* asked how this new capability can best be explained to prospective PIs and:

Action: *Porcas* promised to make sure that next call for proposals will include enough pointers that the PIs can understand the new features available with SCHED+VEX+Mark IV.

Himwich wanted to know what exactly is meant by flagging and it was explained that the VLBA uses this term to mark in the logs the time ranges during which no good data is to be expected. The most frequently asked "flagging information" is "offsource", the periods during which the antenna was not pointing to the source. *Himwich* noted that if this feature is to be included in the base FS it will make it even more important that the "silent" status query mode of "`antcn`" be implemented correctly at every station.

Himwich explained that a few NASA stations would like to run the FS standalone all the time and log information such as GPS offset using the FS. *Conway* suggested using multiple logs for different purposes, but it was felt that one log file is simpler to manage and whenever subset information is required, "`grep`"-style filters can be used.

Himwich warned that the next (September 1997) version of the FS will use new ''`now()`" routines to calculate the apparent coordinates with 10 milliarcsec accuracy, compared to the old 10 arcsec accurary. These routines are also more independent of 1950/2000 epoch.

4.1.4 Recent TAC developments

Burgess expressed the wish to have the correct time directly transferred from TAC into the FS computer, perhaps with a manually invoked setup program along the lines of the existing "`fmset`". *Himwich* described Tom Clark's (NASA/GSFC) goal to setup TAC as a Stratum 0 NTP network time protocol daemon reference with Linux "`xntpd`". *Ritakari* mentioned that Metsähovi has developed a simple and inexpensive PLD-based digital time difference counter with 10–20ns resolution which can be connected to a LPT port of the FS computer and which can monitor the time difference between formatter 1pps and GPS 1pps.

4.1.5 Progress on phase calibration units

Gurvits asked about the status of pcal extractor units. *Burgess* answered that they do have one "Onsala extractor" at Jodrell but that it only has DOS-based software. *Conway* and *Burgess* pleaded for manpower to convert the software into a "FS-friendly" Linux version. *Burgess* noted that there are rumors about a new Mark IV decoder being developed at Haystack and *Porcas* added that the JIVE correlator will be able to extract the phase calibration tones as it correlates. *Conway, Alef,* and practically everybody agreed on the usefulness of extracted phase cal information after a long discussion. No immediate action could be resolved, however. *Burgess* could not commit to providing the software driver for the Onsala device.

Conway stated that all units have been built and that they are waiting shipment to stations. Hardware has been verified to be functional with DOS-based software.

Action: *Burgess* will talk to Ralph Spencer (Jodrell) about a possible candidate for writing Linux/FS-compatible control software and asks Ralph to add this to the EMU/VIV meeting agenda in September.

4.1.6 IF Patching

Himwich noted that if automated IF patching at Mark III/IV stations is required, then the JPL switchbox may be the best solution as it already has software written for the FS and integrated into a station-specific "`patch=`" command. *Conway* and *Orfei* volunteered to accept such switchboxes for testing. *Foley* asked if Westerbork would badly need it for geodesy observations. *Ruf* confirmed that not absolutely but that manually patching between geodesy IF setup and astronomy dual-pol setup is very inconvenient. *Burgess* suggested a larger patch panel with high-quality connectors that are really intended for continuous use. *Himwich* and *Alef* favored the automated solution and *Hase* confirmed that it is useful for switching between geodesy and astronomy IF patching.

Porcas asked about IF patching with VLBA racks with only eight baseband converters. "`drudg`" currently supposedly can generate SNAP for these racks for modes that require less than 8 BBCs. IF patching is actually easier for these racks if they have space for only 8 converters: in this case the rack is a genuine VLBA rack and every BBC has access to every of the four IFs, be it A, B, C, or D. The so-called "geodetic" VLBA racks have limitations and the easiest way to get over them is to connect LCP with a power splitter to both A and B, and RCP to both C and D. Now every converter can access both LCP and RCP, BBC01–07 use A(LCP) and C(RCP) and BBC08–14 use B(LCP) and D(RCP).

4.1.7 Amplitude calibration

Conway gave a talk about EVN amplitude calibration. The main objective is to get amplitude calibration data to PIs in a format which is directly useful to them—at the moment this is the AIPS "`ANTAB`" file. Fredrik Rantakyrö runs his "`log2ant`" script on log files found on "`astbo1`" and produces a single ANTAB file per each experiment, "`expt.antab`". The script is on "`astbo1`" in subdirectory "`[EVN.CAP]`" and the stations can also run the scripts themselves to check how well the Tsys lines of their logs get translated.

At the moment the first priority is to improve overall gain scale factors. Information has been collected and testing its quality with long runs is being conducted.

Action: Whenever the amplitude calibration of a given station is off by more than 5%, *Conway* feeds this back to station(s) involved.

In many cases the Tcal stability of the calibration source is not ideal (for example in Onsala one source was discovered to vary at 10% level). Another source of errors is the variability of the cal source across the band.

The actions for each station were summarized by *Conway* as follows:

1. If you have gain curves we don't know about, send them to *Conway.*
2. Measure your gain curves regularly and check pointing, give rough estimate of true Tcal(K) at each frequency.
3. Measure frequency dependence of Tcal or—even better—fix it so that it is flat vs frequency.
4. Need stable noise cal injection, try to stabilize temperature? Need a network-wide solution to this.

There were some suggestions as how to calibrate amplitude with >8GHz receivers. No real solution was found but 1) accurate absolute Trec, 2) hot load switching, 3) tipping scans, or 4) forgetting about the whole thing may be applicable.

Conway and *Foley* suggested using a stable phase cal injector in conjunction with the Onsala phase cal device, since it can extract the phase cal amplitude and thus this could be used for continuous Tsys monitoring. *Mujunen* commented that it is possible to get continuous TPI readings during scans from the FS to support interpolating Tsys changes during scans. The discussion continued to stress that every experiment must include a few known good calibrators and:

Action: *Conway* to make sure that all JIVE support scientists know about good calibrators and will recommend putting them into schedules.

4.1.8 Polarization

Alef reported on the EVN polarization performance in February 1997 session. Polarization purity of 2–3% is considered ok but in the EVN percentages such as 5–10–15% are common. These degrade seriously the dynamic range of polarization maps. "If all EVN receivers achieved 2–3% polarization purity Maria Massi (IRA) could stop her work on correcting instrumental polarization effects", said *Alef*.

The meeting broke for lunch and continued 14:05.

4.1.9 Target of opportunity proposals (revisited)

Ruf asked for opinions regarding "TOO", target-of-opportunity proposals. *Foley* commented that Westerbork has a comparable system in place which requires predefined setups. *Ruf* anticipated that EVN-wide support for "TOO" would be difficult to arrange. *Porcas* used the latest session as an example: there could have been schedules created for the gaps in the block schedule and if the source were bright enough it would have been observed. *Ruf* asked if "TOO"s are to be conducted outside EVN sessions and *Porcas* said no. *Mujunen* thought that it would be possible to schedule "TOO"s in the normal way and that they would simply be omitted if so instructed in advance. *Porcas* asked if 2 days would be enough for advance notification and this was thought to be enough as long as the experiments always stay within sessions.

Porcas asked if it would be necessary to provide schedules for the "gaps" and *Foley* commented that this would be much better than to get schedules in email one day before the observation. *Venturi* commented that for Medicina omitting observations would be okay, and Westerbork, Onsala, and Metsähovi all agreed as these stations do not have any assigned operators and the station personnel must be flexible anyway. *Perea* noted that last-minute changes do not work well at DSN station but *Altunin* revealed that DSN has committed to react to VSOP changes presented 3 days in advance. *Altunin* envisaged that also DSN can accommodate changes provided that 3 days is enough for JPL to re-process the schedules.

Action: *Porcas* to distribute guidelines to proposers as how to propose a "TOO" to the EVN.

4.2 Reports

4.2.1 DSN status and EVN relations to DSN

Altunin presented the facilities of DSN Radio Observatories and the cooperation possibilities with the EVN. DSN will be soon "privatized" to a company (Lockheed/Boeing?) and it would make sense to ensure the status of radio astronomy by establish a few separate DSN-EVN projects.

Interestingly enough, all DSN stations are equipped with sensitive high-frequency receivers, for instance DSS13 (Goldstone) offers 43GHz and all 70 meter dishes will get a new K-band (22GHz) dual polarization receiver by the end of 1997. 80–100GHz will become available in Goldstone in 1998. EVN-DSN projects can be run at all three stations, not only Madrid. (All three are Goldstone, Tidbinbilla, and Madrid, and each of these locations has one 70m and possibly several 34m antennas.) All stations will only run thin tapes and accept VEX format schedules which get centrally processed in JPL before shipping to stations.

Mujunen asked how these new possibilities get communicated to the prospective PIs and *Porcas* promised to take care of this in the form of the status table. *Altunin* told that he would like to get an "all-modes" verification at the VLBA correlator much like the EVN "FT1" test.

It was asked how the schedules shall be sent to DSN and *Altunin* answered that VEX format schedules should be sent to the JPL/DSN schedule processor, and since VEX schedules will be generated with SCHED and SCHED doesn't directly support Mark III modes, it will be natural to use Mark IV/VLBA modes supported by Mark IV formatter. *Porcas* asked what happens to the schedules in JPL and *Altunin* answered that JPL probably thought they could save money by running "`drudg`" centrally.

Altunin continued to describe the availability of DSN stations. It is envisaged that DSN could participate three times a year, 2x 18h blocks at (at least) L/S/X/Ku bands. In addition to this each period could contain 3–4h of joint CAL sessions, and Goldstone could participate EVN 43GHz sessions. *Altunin* was not sure where the thin tapes required for these observations would come from nor he wasn't sure about amplitude cal and pcal tone compatibility.

Action: *Altunin* to send DSN scheduling and station contact information to "`jive@jive.nfra.nl`" for inclusion in JIVE/EVN Web pages `<http://www.nfra.nl/jive/evn/network/members.html>`. Much of this information can be found on DSN Web page `<http://dsnra.jpl.nasa.gov>`.

Porcas suggested putting at least Madrid in EVN status table. *Alef* commented that these antennas are very attractive to any VLBI user and that 3x 2x 18h is the only bad point... *Mujunen* requested that the different-sized antennas at each location be put as separate entries in the EVN status table and *Porcas* replied that they already are listed in this way. *Porcas* also asked if the 3x 2x 18h applies to using the 70m antenna and *Perea* acknowledged yes. He also noted that if requested, we could perhaps get more, especially 34m time. *Porcas* also asked if it is okay to require Madrid and/or Goldstone without (or with only) VLBA participation. *Altunin* commented that they do not have any direct arrangement with the VLBA but EVN/Global experiments would be okay. *Porcas* also suggested that DSN should send a representative to the Board of Directors' meeting at Onsala in October.

Hase asked if it would be important for geodesy people to get active to attain Madrid involved in Euro-Geo projects. *Altunin* suggested that a "special project" would be a good approach.

4.2.2 PC Chairman's report

Porcas (the new Program Committee chairman) presented the PC report. After Alcala users' meeting and advertising conducted there on EVN special abilities (5cm methanol, joint EVN-Merlin, Mark IV modes) the number of proposals is again up, in February 1997 42 proposals, a threefold increase. In June 1997 EVN got only 14 proposals and this proves EVN is suffering from "competition" from the VLBA.

Gurvits asked if there were any 50cm proposals and *Porcas* commented that a few were there but that EVN frequency sequences are now somewhat "VSOP-dictated". He also commented that he was afraid to endorse a technically "difficult" spectral line project as the like had resulted in bad schedules in the past. *Ruf* noted that experiments like this are something to worry about in the future.

4.2.3 Correlator reports

JIVE *Gurvits* presented the status of the JIVE correlator project. Active development concentrates on the Station Unit (SU) which interfaces the playback drives to the correlator proper. The correlator boards are functional and "first fringes" test is about to be executed with a Jodrell–Cambridge baseline and a simplified delay model.

The Station Unit and the playback drive (both of which come from P&G) are on the critical path of the project plan. At the moment there are two playback drives at JIVE but these units have not yet passed the Factory Acceptance Tests (FAT). The SU has software and firmware problems due to complexity. *Porcas* asked how good is the correlator online software and *Gurvits* had to answer that nobody really knows. *Porcas* added that online software was found to be on the critical path when the VLBA correlator was built.

VLBA *Mioduzsewski* was mostly happy with EVN stations regarding to how they interact with the VLBA correlator: tapes arrive mostly soon enough, Track is being used, logs and GPS files are okay. There are occasional truncated log files and often recording quality is significantly poorer than with "native" VLBA stations.

When testing correlation of Mark III data versus VLBA data the tests showed that cross-spectrum was identical but that autocorrelation showed bumps which are due to Mark III DR headers. A fix was developed which blanks out headers at the correlator but it is not yet determined when (and if) this fix will be taken into use.

The correlator has found fringes between the baseline Effelsberg–HALCA.

Graham requested station by station recording quality information. *Alef* and *Mujunen* asked if there was a way stations could look up the files via FTP or Web.

Action: *Mioduzsewski* to look up this information, i.e. how to arrange access to "weight plots" and send the results of this to "`evntech@nfra.nl`".

Porcas asked what modes were uncorrelable at the moment and *Mioduzsewski* replied that Mark III dual-pol was. *Himwich* asked about typical problems with tape drives and *Alef* commented that outdated head calibration, wear of equipment, and introduction of 14 passes (vs the conventional 12) were the foremost problem causes. He noted that first VLBA recordings were worse in these regards but that VLBA recording quality has steadily improved and that 14 passes at the VLBA is now better than 12 at the EVN.

Conway asked what would be an appropriate way to close the recording quality feedback loop. *Alef* reminded that there is a plenty of information on checks and tests in the FS documentation. *Himwich* suggested tape drive experts visiting EVN stations and *Ruf* commented that all EVN stations are bound to have tape drive experts for operation at all. *Foley* and *Conway* stated that expertise is needed to teach operators, especially for handing thin tape. *Alef* estimated that it may be cheaper to have expert visitors at stations than it will be to fail with the introduction of thin tape but *Ruf* hesitated to "centralize" the responsibility. *Himwich* recommended a "tape drive workshop" to be arranged where tape drive expertise can be spread. *Alef* complained that so few experts are actually available in the EVN to arrange workshops like this and *Foley* agreed describing the situation bad and even worse with the introduction of thin tape. *Porcas* concluded by suggesting that stations which do not qualify in the VLBA thin tape test should arrange a visit to their station to check the recorder.

Bonn *Ruf* told the meeting that the prototype P&G playback drive at Bonn sometimes had reliability problems and *Graham* commented that in particular the capstan motor needed regular maintenance. *Ruf* continued by explaining that the Bonn correlator prepares to switch over to using "`M3TAR`" (/"`MK4IN`"?) as its output media format, that is, Unix "`tar`" archives. *Gurvits* asked when this would happen and *Alef* said that part of February data may be in the new format and it can be recognized by a new naming convention.

The correlator received the largest EVN session ever in 1/97 and when 2/97 tapes started to come in the correlation of the first 1/97 experiments had begun. Thus, the correlator struggles with about a year of backlog.

The meeting had a coffee break and continued at 16:15.

4.2.4 Station reports

Each of the station representatives conducted a short verbal report.

Wettzell *Hase* reported that no significant changes have occurred apart from a K4 recording system being installed.

Yebes *Vicente* reported about a new antenna control computer and a new 22GHz receiver coming up in 1998.

Medicina *Orfei* reported that the track and wheels substitution and phase 2 of the frequency agility project have been successfully completed. This allows switching between primary focus receivers in seconds and between primary and secondary focus in minutes by remote control. A second version of this design is in progress for Noto antenna.

The final step of this project is to permanently keep mounted all secondary focus receivers and point to each of them with the subreflector. This step has already started at Medicina.

The IF band of the 8GHz receiver has been widened at 800MHz to join the request of geodetic projects and an IF3 module was bought for this purpose.

Noto VLBA terminal is now complete with 14 base band converters and the ground unit for the cable length measurement between the acquisition terminal and the receiver.

Formatter has been sent to Interferometrics laboratories in order to be repaired. Indeed no possibility was to use the digital switch board. Such a board presented a problem and was repaired in warranty, but the operation took about two months.

It's started a project that will bring to have in the Noto antenna the automatic subreflector positioning as developed for the Medicina antenna. The system is expected to be operative in the summer 1998. In the same period a new cooled S/X/L/92cm receiver should be operative in primary focus.

Reduced efficiency has been found at 22 GHz. The problem is due to the subreflector mirror that has been placed not in proper way during the use of the primary focus receiver. Such a way not to keep suspended the mirror produced a deformation able to affect the performances at 1.3 cm. The mirror will be replaced in the new subreflector positioning system.

Field System now used is 9.3.9 for VLBA, MKIII, S2 recording terminals.

Receiver status: 22GHz has been repaired and Tsys disuniformity in the band was eliminated. The isolators to optimise the polarisation performances have not yet been inserted. Such components have been placed in the C band receiver, but during the operation the front- end of the right channel was damaged. L band receiver was modified in order to have uniformity in the Tsys in the full band and in both polarisation; Cal signals have been added.

A Canadian S2 recording system has been installed and this system will be used to observe in the VSOP program. The terminal has been tested and fringes have been detected in L band with Tidbinbilla and Hobart stations.

A new GPS receiver system is going to be acquired in order to optimise the performances in terms of rms for the time offset. The TAC receiver indeed cannot be synchronised with an external reference and the internal clock is not very stable. It's then necessary to integrate for long time (1000 s) in order to mediate the variation due to the internal clock. A receiver with external synchronisation possibility will then be chosen.

Thin tape upgrade has been performed by Michael Wunderlich and now Noto recording system is able to run both kinds of tapes.

Porcas and *Alef* asked if there was a 2cm receiver at Noto and *Tuccari* replied not yet. The 6cm receiver is also still the old one and a new one will be available by the end of 1998.

Jodrell Bank Reported by *Burgess.*

Personnel Derek McKay has arrived and commenced work on the Cambridge phase stabilising system. Overall we now have enough people to have a good chance of maintaining a stable operation.

Recent cutbacks have resulted in a substantial reduction in the activities of the maintenance staff being likely as of September this year. This may result in limits on telescope availability in the future.

Current Ops Our previous difficulties due to the loss of the HP and the addition of the Cambridge station are for the most part resolved. The only major area causing us problems is that of correct polarisation. A project has been initiated with the RF lab to set up feeds at 5 and 22GHz aimed at the MK2 telescope, allowing a check to be performed as easily as possible. We have targeted the MK2 at present but the Lovell telescope will be included as resources permit.

Station Hardware There have been no major problems with either terminal or the software. Most difficulties are to do with recording and bad tapes. The gain curve and calibration (local) systems have been restored but we have not yet implemented FS9 'aquir' logging.

We have ordered a triple-cap headstack form Spin Physics to replace the P&G one which fell to bits. We plan to order a second stack in October. It is suggested in a recent Email for Alan Whitney that vacuum switching will not be required with these heads.

Timing and GPS Remains as-is for the present. In the future we intend to move timing and phasecal data to a Linux machine in the VLBI room for automated transfer. The VLBA timing point was wrong by 8uS due to triggering on the 'wrong' pulse edge: we have corrected this and intend no further changes in this area.

Effelsberg *Graham* reported that Rainer Boesel (`rboesel@mpifr-bonn.mpg.de`) is now working permanently at Effelsberg on the VLBI terminals.

The new azimuth track and new elevation encoders have improved performance in general.

This summer the wire outer panels of the antenna from 80–100m will be replaced by perforated aluminium panels. This will improve gain at wavelengths 4cm to 1cm and reduce ground noise, but increase wind loading.

Work on frequency agility for VLBA operation in the range 13cm–7mm is complete. Efforts are being made to improve performance at 1.3cm and 7mm.

The VLBA terminal is used with thin tape provided by AOC at the moment, Mk4 runs with thick tape.

We now have many VLBI observations outside sessions, these have shown a need for improved operator training.

Onsala *Conway* reported on new 6cm dual-pol system, new 6cm and 18cm receivers, new 5cm system and 25m autocorrelator (for single-dish spectra), new 25m antenna control system completion, new Russian CH1-75 spare maser, and SEST 3mm fringes with the P&G VLBA terminal. (Editor's note: I couldn't find a machine-readable version of this station report.)

DSN/Madrid *Perea* apologized that he didn't know a station report would be appreciated in the meeting and he promised to produce one for future meetings.

Metsähovi By Kaj Wiik, Metsähovi Radio Research Station, Finland, "`vlbi@hut.fi`" (email address for VLBI-group)

VLBA terminal Some of the BBCs are not working mainly due to VCO problems.

The thin tape upgrade was installed in May and seems to be working well when used at high vacuum.

mm-VLBI 3 mm fringes were found to Metsähovi in the April CMVA session. Starting from the June session Metsähovi will participate routinely to the CMVA experiments at 3 mm.

Maser and timing A new HP-58503A GPS receiver has been installed (GPSMH2) and it shows about 13 ns RMS noise in the daily averages compared with the 40 ns of our old Magnavox (GPSMH1). GPSMH2 shows currently about 150 ns lower offsets than GPSMH1 due to different cable lengths.

Personnel Kirsi Karlamaa (kirsu@kurp.hut.fi) is joining the VLBI group, gradually shifting from receiver design to FOV. Jan Engelberg (jen@kurp.hut.fi) is our new contact person in the maser and timing issues.

Torun *Pazderski* presented Torun progress on their antennas (15m and 32m), their receivers (21/18cm, 6cm, 5cm; 22GHz is being designed), their P&G VLBA terminal, phase cal, and interference problems. (Editor's note: I couldn't find a machine-readable version of this station report.)

Westerbork *Foley* presented the latest developments of the Westerbork frequency-agile MFFE (Multi-Frequency Front End). It has linear feed except for S/X and circular polarizations are generated in IF. Full specification receivers are being manufactured approximately one per month. Replacing the MFFEs will mean that there will be no tied-array in 1997. The current 8x 10MHz tied-array bandwidth will be available in March 1998 and the new array processor with 160MHz bandwidth is planned 1999. The new "DZB" 8x 20MHz correlator will get its first crate in August 1997.

The antenna dishes will be constantly renovated and this means that 2–3 antennas will be out of operation for the foreseeable future. Phase cal injection from apex of one dish is being considered, as well as single disk wideband.

Porcas asked if sessions 3 and 4 of 1997 will be single-dish at Westerbork and *Foley* confirmed this. S/X will be also done. Session 1/1998 will also most probably be single-dish but 2/1998 may get the tied-array.

Action: *Foley* to send these Westerbork updates to *Porcas* for inclusion to the EVN status table.

Shanghai June 1997 by Liang Shiguang.

Antenna A new PC586 replaced old 8-bit computer to control the antenna in May. Pointing has been improved to be better than 20 arcseconds (r.m.s). This improvement of pointing will be continued to meet higher frequency observations.

VLBA Terminal The problem of vacuum loss, that occasionally happened in past years, has been solved by dropping down the value of vacuum around 25 percent, from 10 to 7.5. This action is of no effect on parity error rate of tape reverse pass, but it reduces the parity error rate of forward pass by 1 to 3 order. It is also expected to benefit the longer life of headstacks. We found out that after recording the headstacks are much cleaner than before.

Spectrums of LO of BBCs have been cleaned up to be 30-35 dB stronger than phase noise by introducing a amplifier buffer located at terminal room, which gains and filters the reference 5 MHz signal from hydrogen maser.

There is possible to get funds to buy some thin tapes this year.

Receivers Three cooled receivers, 1.3 cm, 3.6 cm and 6 cm bands, are in operation this year. These are single polarisation receivers except for 1.3 cm receiver. The Tsys for 1.3, 3.6 cm and 6 cm are about 100, 50 and 40 K repeatedly.

Urumqi No report was received from Urumqi.

4.2.5 VSOP report

Gurvits reported on the VSOP program, now that the satellite itself has been renamed to "HALCA" after its successful launch.

There had been a long period without fringes but on the 16th of May the Mitaka correlator found fringes on the baseline Usuda–Halca with the source 1055+018. This recording was done with the K4 system, a descendant of video recording technology. Later fringes to DSN (Tidbinbilla on 11.06.1997 with the

S2 correlator), Greenbank, and VLBA (SC, 06.06.1997 with the VLBA correlator) have been also found. 15.06.1997 resulted in the first image of 1519-273 and on 03.07.1997 1156+95 will be released.

What happens next? There has been only one experiment which has fringed with an EVN antenna (Effelsberg) and VT801 has been cancelled. The next task is to prove that EVN L band is fully operable with Halca, and the assumption is that C band will most probably also be useful, but that the K band is unlikely to work at all. Due to an unknown reason (but a loose waveguide is suspected) there is 10dB of extra attenuation between the feed and the LNA, and a decrease this substantial is bound to affect K band observation programs.

Porcas asked if there were any fringes from tapes translated from one recording system to another. *Gurvits* explained that not yet, but that the VSOP–VLBA copying machine is about to be ready. *Conway* asked if there were any thermal problems with Halca but *Gurvits* couldn't say. *Foley* asked if there will be any 1.3cm VSOP in September and *Porcas* answered that the session will have a couple of multi-epoch EVN-only spectral line projects. *Wiik* asked if Halca had detected any astronomy objects at 22GHz and *Gurvits* told that Earth was detected but Moon was undetectable. *Conway* queried if the pointing was good enough for 6cm and *Gurvits* explained that only center of galaxy could be observed on L band this far.

4.3 AOB

Ruf drew some conclusions of this meeting as follows:

- Migration to thin tape seems ok.
- We need to explain the problems with polarization to the Board of Directors.

Foley suggested that the polarization check problem should be resolved at 6cm first. *Porcas* suggested making polarization checks an issue at the Directors' meeting but *Ruf* noted that it will held too late (in October) to benefit the September session. *Ruf* asked if it would make sense to create a TWG subgroup devoted to polarization but *Porcas* thought that each station has the responsibility to check it.

4.3.1 Date of next meeting

Ruf asked if the TWG should be held more often and the consensus was that perhaps January 1998 would be appropriate for the next meeting. January 16th–17th 1998 (Friday–Saturday) was suggested and *Vicente* from Yebes kindly offered to host the meeting. *Ruf* left it to the consideration of Yebes whether to actually have the meeting in Alcala. (Editor's note: *Gurvits* has later suggested if the meeting could be held on January 19th–20th (Monday–Tuesday). Please indicate to "`kruf@mpifr-bonn.mpg.de`" if this is *not* possible for you.)

4.3.2 Production note

This document was written using the `linuxdoc-sgml` DTD. SGML stands for "Structured Generalized Markup Language" and I chose SGML for this document because SGML is made specifically for translation to other formats. SGML allows you to specify the *structure* of a document—that is, what kinds of things make up the document. You specify the structure of a document with a DTD (Document Type Definition). `linuxdoc-sgml` is one DTD that specifies the structure for Linux HOWTOs and other docs. QWERTZ is another DTD; the SGML standard provides DTD's for books, articles, and other generic document types.

For further information about software used to process this document, the `linuxdoc-sgml` package by Matt Welsh, please refer to the text file `<ftp://kurp-ftp.hut.fi/pub/emu/linuxdoc-guide.txt>`.

5 Appendixes

5.1 Useful Email Addresses

For contacting JIVE support scientists (for instance for help with schedule files etc): "`jive@jive.nfra.nl`".

For distributing a message to other technical friends in the EVN (also followed by hw/sw developers): "`evntech@jive.nfra.nl`". To subscribe to this list send a message to "`evntech-request@jive.nfra.nl`" with the word "`subscribe`" in both the "`Subject:`" line and the message body.

For worldwide distribution of FS-related issues: "`pcfs@gemini.gsfc.nasa.gov`". To subscribe, send an informal message to Nancy Vandenberg "`nrv@gemini.gsfc.nasa.gov`".

For issues related to the EVN Mark III-to-Mark IV upgrade: "`emu@jb.man.ac.uk`". For corresponding EVN VLBA-to-Mark IV upgrade: "`viv@jb.man.ac.uk`". To subscribe to either of these please send an informal message to Ralph Spencer "`res@jb.man.ac.uk`".

The JIVE WWW home page is located at `<http://www.nfra.nl/jive>`.

5.2 A Description of Thin/Thick Tape Switching Effects

Alessandro Orfei from Medicina asked me *(Mujunen)* about a couple of details of thin tape usage. I answered him and the message resulted in additional comments from *Himwich* and George Peck (NRAO) which I have consolidated below.

5.2.1 Does prepassing thin tape differ from prepassing thick tape?

I have understood that prepassing is done just like for thick tape, running at high speed (270–330ips?) in forward, releasing vacuum and cleaning the recorder, and then running back in reverse. However, from reading thin tape development memos I get the feeling that initially melting of thin tape edges at high speeds was a problem. So perhaps it is safer to run the prepassing of the first thin tape compatibility test at 160ips only, and only after getting a verification from Socorro that no tape edge damage has occurred, only then switch over to using 270/320/330ips.

Please note that before we need recording a MkIV mode with 18Mbits/s/track, it will be highly unlikely that 320ips will be used in an experiment. VLBA/MkIV modes that use 9Mbits/s/track are recorded at 160ips and 4.5Mbits/s/track at 80ips. These are the modes the VLBA is using all the time, thus the VLBA thin tape "success story" does not really apply to 320ips recording, that is, nobody knows yet how well the tapes perform when routinely used at 320ips.

Himwich added: I talked to Dan Smythe and he said that the thin tape upgrade is supposed to have solved the edge melting problems (a good thing I guess because Mark IV requires that it work). I also talked to George Peck and he felt that there was no need to for a speed limit on postpasses (and therefore I assume on prepasses as well). He was worried about flange forcing at high speed, but checked and did not find a problem. So I think this means that pre- and post-passes can be done at 330 ips ("`sff`"/"`srw`").

Mujunen adds: Please note that the VLBA also postpasses tapes after experiments. The goal is to smooth out any uneven packing caused by tape starting and stopping during the last tape pass. Unevenly packed tape is more prone to damage during shipment. Apparently postpassing is not required if the schedule didn't stop tape in the middle of the last tape pass.

5.2.2 Is the write voltage different for thin and thick?

We didn't adjust ours, but write voltage has always been a tricky thing. In principle flux cells at 56000 bits/transitions per inch are smaller and less write current (voltage) is required. (The same applies when the head wears out and tape comes closer to write coils and the air gap becomes larger.)

I have always wanted to get a nice table/range of voltages to use, but apparently the "right" way to adjust the voltage is to search for the maximum SNR in playback spectrum / minimum number of parity errors in playback. (Playback spectrum can be seen by connecting a low-frequency spectrum analyzer to the same connector you use for checking the eye pattern. When a good eye pattern is played pack, you'll see the signal level of range of 0..(bit rate / 2) rise.) I couldn't quickly find what SNR is considered "good", >23dB? (Can anybody confirm this?)

Please note that the same write voltage results in different write currents and thus different recording behavior in MkIII, VLBA, and MkIV. (That is, the write resistors in series of the write coils are slightly different in each of MkIII, VLBA, and MkIV.)

To search for the maximum SNR / minimum parity errors maybe the most straightforward way is to set the voltage to quite a low value and make a test recording where the voltage is increased gradually, for example:

```
 1000--2000 feet  8V  (MkIV, maybe VLBA)
 2000--3000 feet  9V
 3                10V
 4                11V
 5                12V
 6                13V
 7                14V
(8                15V)
```

The adjust range of PWM goes up to about 19V but I haven't heard of anybody using write voltages this high.

Then play back the tape and watch for the footage counter and changes in SNR in spectrum analyzer and parity error counters in MkIII decoder display. (Use MkIII mode A at 4 or 8 MHz and tape speed of 80ips or 160ips, correspondingly.) Use the voltage which gives best SNR and lowest parity errors.

Himwich added: One refinement on this, and it may not be an improvement, is that we have been encouraging the geodetic stations to use the lowest write voltage that gives the minimum parity errors. The error rate is sort of a "bath-tub" like profile against write voltage. It starts high, drops toward a low/minimum value, stays at that value a while and then rises again. Since the write voltages needs to be dropped as the heads wear, starting at the low voltage end of the bath-tub bottom gives the longest time between adjustments (and most safety I suppose).

George Peck (NRAO) added: We have found that the write voltage does differ between thick and thin. If the write voltage is too high, it especially effects recordings where just half of the tracks are written during a pass, and the other half of the tracks are written later. Crosstalk between heads can cause the first pass to be partially overwritten by the latter pass. For this reason, we usually check for crosstalk when we have chosen our write voltage. We do this by recording just the even or odd tracks, checking the error rates, and then recording the rest of the tracks in the same head position. Then, an error rate check is made on all tracks to be sure that there was no crosstalk to overwrite the first set of tracks which were written.

Mujunen concludes that by judging these messages it seems appropriate to set the write voltage to the lowest value which produces good parity errors on playback. This will minimize crosstalk and give the longest time before the voltage needs to be adjusted again due to head wear.

5.2.3 What are dangers of using wrong vacuum?

I find it easy to remember how thin and thick tape behave with respect to vacuum when I think of a wedge (the head) on top of which I'm stretching the tape with my hands. In this arrangement the vacuum level is represented by the force I'm exerting with my hands—higher vacuum corresponds to more force being used to stretching the tape which then tries to wrap more closely around the "wedge" of the head. Another "mental image" is to think that the tape is more like sandpaper and then see what would happen to the "wedge" (head).

If the tape is thin and thus flexible, it can follow the contours of the wedge/head more closely and thus the head gets a "sharp" countour. This is like grinding with flexible sandpaper.

If tape is thick and thus more rigid, it acts more like a flat grinding stone. It flattens out the countour of the head. There is more contact area with the head, i.e. a pointed, "sharp" head makes contact with the head mostly with the recording air gap area whereas a "flattened" head makes unnecessary contact with "useless" head area and SNR is reduced.

However, if you exert more force on the less flexible thick tape, you can make it embrace the "wedge" in a sharper angle. This is what we are after with 15in of vacuum for thick tape.

Now it is easy to see what happens with wrong settings.

First, if you forget 5in for thick tape, there is not enough tension to force the tape in pointed manner over the head, the tape makes contact only with the center of head, wears it out quickly (because the contact area is very narrow) and thus flattens the head again, much like if the tape were a flat grinding stone.

Second, if you accidentally use 15in for thin tape, the increased tension wraps the tape more pointedly over the head and the tape starts to slowly wear the sides of the head until there is a prominently high "peak" in the middle of the head in the recording air gap area. This actually makes the head better for thin tape recording as the head becomes more pointed. I don't know if this is outward dangerous (say, for the tapes?) but apparently the wear of head sides is faster than wear when the head has reached the "natural" contour for a particular thickness/vacuum combination.

From the above you can also deduce why Haystack and NRAO are concerned about head wear with vacuum switching: when you switch from 5in to 15in, apparently thick tape starts to form a slightly less pointed contour, wearing the center of the head. When you switch back from 15in to 5in, thin tape wears a little the sides of the head to get back the "natural", more pointed contour. To get precisely the same contour with thick tape as what one gets with thin tape at 5in, apparently more than 15in of vacuum would be required which then would wear the headstack more, as George Peck points out next.

George Peck (NRAO) added: The worst thing to do is to use the wrong thick tape vacuum, because the thick tape apparently changes the headstack contour more quickly than thin tape. We believe that it is also bad to run the thin tape at high vacuum. As Ari pointed out, this would cause a more pointed contour on the headstack. We have been receiving some brand new headstacks which are contoured in this way, and they might work well for a short time, but after the thin tape starts to flatten out the pointed contour, they do not work well until a new contour is established.

I don't know what vacuum all of you are planning to use for the thick tape. Our attempt at switching between thick and thin used 15 inches of water for thick, and 5 inches of water for thin. You might have better results than we did if you use a higher vacuum for thick tape. The disadvantage, of course, is that the high vacuum surely wears the headstack much more quickly.

5.2.4 Is there a schedule for thin tape head calibration like that one for thick?

Himwich: The existing *hdcal.snp schedules should work with thin tape, but I think this has already been discovered.

5.2.5 Is 80ips the usual speed for thin tape like 120ips is for thick?

Yes, if you calculate (135ips / 80ips * 33333bpi) = 56250bpi which is (about? does anybody remember the nominal value which would be the "right" one to use in FS "`bit_density`" command...?) the required bit density on thin tape, then you can see that (56250bpi * 80ips) = 4.5Mbits/s. (The 120ips figure is a historical misnomer: the button '120' on the MkIII recorder has actually always delivered 135ips, as the internal tacho generator was adjusted a little higher.)

Himwich added: 56250 for Mark III/IV format is correct. For VLBA format the density is 56700. The difference is due to the fact that the VLBA format is NDR and splices header bits in without losing data bits. The "`bit_density`" command thinks in units of total bits on the tape including parity and headers as opposed to only data bits. The speeds for both Mark III and VLBA formats on thin tape are 80ips and 160ips. This is big improvement over thick tape where not only were the bit densities different, but the speeds were as well.

A note though: some correlators, but not the VLBA, can handle low density on thin tape, but this is used rarely and I would it expect to all but disappear.

5.2.6 Is necessary to set a new kA value in the `equip.ctl` file for thin tape?

I'm not sure which parts of the system use this value, I vaguely remember that the VME control computer of the VLBA drive uses it to estimate the position on tape by comparing the relative speeds of reels. We changed it from 268 kA (thick) to 160 kA (thin), can anyone verify if 160 is the correct nominal value?

Himwich added: We are advertising 152 as the value, but this only needs to be set for VLBA drives (in `equip.ctl`). Mark IV drives don't care.

George Peck (NRAO) added: The VLBA uses 153 for thin tape. It probably wouldn't matter if the VLBA uses 153 and everyone else uses 152. This value is used by the firmware to calculate the values for the takeup and supply pack detectors. I'm not sure, but it may affect the low tape point.

5.2.7 Which versions of the FS support automatic vacuum switching?

FS provides vacuum switching support starting from release 9.3.13. The recommended version is 9.3.15 or later, since the "`drudg`" component of FS9.3.13 had a bug potentially affecting collecting Tsys data.

5.2.8 Vacuum behavior

Orfei wrote: A note about our cut-out threshold: it is not possible to set below 4" H2O and when a switching is done from high to low a slight different vacuum level respect to 5" is set unless the vacuum door is open and closed again.

And *Mujunen* added: Yes, we experience similar effects. The cut-out threshold depends on fine-tuning the pressure switch as described in thin tape upgrade documents and I believe Michael set ours too to about 3.5–4in. This far the switch hasn't activated falsely at 5in, so I think 4in is probably ok. (I'd expect that at 3–4in the tape hardly will run at all.)

Our vacuum motor also likes some "warm-up" time at low vacuums, that is, after loading the tape at 5in vacuum gradually increases from about 4.4 to 5.3in during 2–3 minutes. (The vacuum gauge isn't apparently any real precision instrument either, try tapping it slightly with a finger... :-)

Himwich added: The tape drives should be warmed up for a few hours before use anyway, but maybe now we should include a suggestion to let them warm up with a tape mounted (and preferably at the vacuum that will be used for drives that switch).

George Peck (NRAO) added: We also have noticed that the vacuum pressure rises during the first few minutes after the tape is loaded. For this reason, we try to set our levels when the motor is warm, but we haven't ever had any problem with loading the tape and moving tape immediately after the load.