

VLBA ACQUISITION MEMO #396
MARK IV MEMO #244

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To: VLBA Data Acquisition Group, Mark IV Development Group
From: Hans Hinteregger, Sinan Müftü
Subject: Minutes of Telecon held November 7th, 1996, 10:05-11:30 am (EST).

Attendees:

Jean Casse, Tony Foley from NFRA
Bill Brundage, George Peck and Ron Weimer from NRAO
John Webber from NRAO
Kerry Kingham from USNO
Hans Hinteregger, and Sinan Müftü from Haystack

Six items were on the agenda, and two additional items were discussed during the telecon. These are as follows;

1) Review of write performance checks, maintenance:

Hans Hinteregger indicated the importance of insuring a good head-tape contact before setting the record current. He also indicated that this should be a part of the standard operating procedure.

2) Flat-top head progress:

Hans Hinteregger (HFH) indicated that Haystack has been testing a flat-top version of the current VLBI headstack and that it performs well with thin 3M and SONY tape. The head used in the experiment is a ferrite construction conventional VLBI head. The length of the head step is 2 mm (compare to 300 um for the current VLBI head-stack). The wrap angle is 5 deg. on each side which is the standard wrap angle used in VLBI recorders. The performance of this headstack was comparable to the triple-cap head which exhibits best bandedge SNRs of 26 and 23 dB with 3M 5345 and Sony DIK thin tape respectively. On the other hand thick (Fuji H621) tape performance was not initially good. In order to remedy this situation the flat contour was worn to a relatively large ~20 mm radius with a contouring tape. This improved thick performance at 1.5 um wavelength and increased bandedge SNR to 25 dB, but about 5dB excess spacing loss remains.

Questions were asked about whether this work and the flat-top head idea as a whole has been put into VLBA and Mark IV memos. John Webber, George Peck indicated that they have not received any memos recently and asked Haystack to put them on the memo distribution list.

A question was asked about why this flat top would not eventually wear down to a regular circular contour.

Sinan Müftü indicated that in a regular circular contour the contact pressure is mainly determined by the ratio of the tension to the radius (T/R). However in a flat contour, where a self-acting air-bearing produces suction under the tape, contact pressure can be lower. This leads to lower wear for the same amount of tape running over the head. If contact pressure is sufficiently low and the bearing material sufficiently hard wear can cease altogether.

Question was asked which tapes have rough surfaces.

HFH indicated that thin SONY DIK is rougher than 3M 5345 which is exceptionally smooth. The thick Sony V16 is quite rough and Fuji H621 is less so; 3M5198 and Fuji H621 E are the smoothest thick tapes. Sony VIK has not been evaluated.

3) Simple flange forcing check for tape damage & shippability: (Mandate check before unloading or shipping for all acquisition and processor operations?)

HFH indicated that he has recently seen reels whose flanges have been forced. When a flange is forced the self packing function of the reel is defeated and permits scatter wind. If scatter wind occurs it will be crushed when a "clamping" reel band is put on and/or when the tape is shipped. He indicated that excessive flange forcing should always be looked for before shipping. The use of a .997 inch gauge block together with color coded plastic shims is recommended to measure flange separation with error less than .001 inch. HFH indicated that he will study the problem at Haystack. He reminded that the VLBA spec. for a properly packed reel, is to have less than 1.001 inch flange separation at the tightest reel azimuth indicated by the narrow green reel (not tape) label. At this point a .004 inch shim should slightly resist insertion between the .997 inch block placed on top of the pack and the flange.

Q. A question was asked why flange forcing occurs, and whether it may be related to servo problems.

HFH indicated that start-stop in the middle of the tape and change in the operating tension are the main "reversible" causes of the flange forcing. Irreversible excessive flange forcing (that can't be removed by running the tape from end-to-end at 320 ips maximum speed 10" H₂O max vacuum (2.2 N tension) indicates permanent edge damage and should disqualify for the tape for operational VLBI reuse. Flange forcing generally increases with speed and tension.

Comments were made about, a) start-stop in the middle of the tape are common in practice, b) every time a tape is taken off a drive a reel band is put on the tape, c) rewinding every tape would increase machine time requirements.

HFH replied that full automatic rewind can be worked into procedures in most situations.

Casse: How serious is this in the life time of a tape?

HFH: Visible scatter wind leads to damage in shipment due to crushing. Excessive flange forcing at 320 ips usually indicates that a bumpy pack will be formed at 80 ips, which in turn indicates that permanent edge damage (significant edge thickening) has occurred. A tape which becomes bumpy under any operational conditions should be disqualified for VLBI reuse.

4) Urgency of Tape-path humidity reduction (the Kokee fiasco!) with present head design:

HFH: In crisis proportions for geodetic users. Kokee has worn out 2 heads in 2 months. If the humidity in the tape path is not kept below 20-30 % too rapid wear occurs.

Kerry Kingham (KAK): Indicated that their wear rate used to be 1 head in 2 years. Since they moved the tape drives to a new correlator area this rate has increased to two to four times that. The difference between the old and the new rooms is higher relative humidity (RH). Even though RH was specified to be below 40%, the actual RH is now 50% in the room.

HFH: indicated that it is necessary to implement dry (40° C warm) air kits to force tape path humidity to less than 20% as well as to guarantee humidity \leq 50% in the room with ordinary AC.

KAK: indicated that Dave Fields told him that he would send a kit. but he has not received anything.

HFH and KAK decided to talk on this issue off-line.

HFH indicated that a kit was sent to Kokee. This kit includes a second blower motor to generate warm air. HFH indicated that the cost of the extra blower is low compared to the head costs. These brushless blowers are rated for continuous operation at full power and are protected against over heating.

George Peck: Indicated that his hopes for finding a low cost vacuum motor supplier were not met. He found out that the cost is \$450-\$500, in line with catalog prices.

5) Change Reel Spec. or Fix 'too tight' reels:

HFH: The subject is the reel spec change that George Peck has proposed: .982 to .992 inch minimum flange separation (original spec .977 to .987). The 'tight' reels that HFH tested were within the lower 5 mils of the original spec excluded by the new spec. A good fix for tight reels that bind -- as do a fraction of the newer reels with minimum flange separation less than .982 inch and high .005-.006 inch runout-- is to insert three small .005 inch shims between the inner flange and the hub at 120° intervals.

He cautioned that if the upper end of the reel spec. is increased too much it will destroy the scatter wind suppression "self packing" characteristic of the reel. More tests should be performed, to determine whether reels near the .992 inch upper end of the proposed new spec consistently meet the <1.001 flange forcing spec with tapes that meet this spec when using \leq .987 reels. 'Not tight' reels with exceptionally low, up to .002 inch, runout are suspected of being prone to fail the FF spec.

RW: Doesn't like subjective descriptions of too-tight reels like operators reporting on whistling sounds etc.

HFH: The 'binding' phenomenon is a matter of degree. The tape pack must 'engage' the flanges of a SP reel at some pack radius. The effect is exacerbated by high speed and low tension. Thus when a tape is first mated to a new reel it should be observed during a full 320 ips, 4-5" vac wind, not just at the beginning and end. A good tool (binding probe) is a (6" x ½" x .020") steel shim allowed by the operator to ride lightly on the accumulating tape pack. The probe will start to bounce slightly when the flanges engage the tape pack. Excessive bouncing of this probe in mid-pack may be the only evidence of too tight behavior short of dropping vacuum. Too tight reels begin to engage violently at about ¾ inch pack thickness, while good self packing reels engage gently at about 1.5 inch pack thickness.

6) Caution: Fully worn-in head contour is needed to prevent flying (good initial test performance doesn't check this):

HFH: When a new head with shorter-than-equilibrium contour radius is installed it will initially work well. But as the wear pattern grows the positive air bearing near the leading edge will defeat contact pressure and some flying will take place. Therefore the head spec should be changed so that the initial radius of curvature is close to, if anything a little larger than, the equilibrium radius. (Currently the specified radius of curvature is 0.1". This results in a 4.5 um contour height of the gap with respect to the step corners. New heads should be checked for meeting contour specs with a microscope and the manufacturer should provide contour measurement data.

HFH: Shall we change the spec?

Q: Is there a number that works

HFH: Some thing like 2.5 um for the thick tape should work.

The participants decided to wait before they change the head radius spec.

7. Is there a need to increase the SNR spec. of the heads?

Ron Weimer (RW): The SNR spec. for the high density thin tape is not sufficient. Should this head spec. be raised?

HFH: Best performance we have for thick FUJI tape is 30 dB at 33 Kfci and for the thin SONY tape is 23 dB at 56 Kfci. The reason for having a low SNR can be some non-intrinsic factor such as not having full contact.

RW: The current spec. is for thick FUJI tape and it is 24 dB? Can we change this to 30 dB?

HFH: A new spec. should be set for thin SONY tape and 18 dB should be OK for that. With greater care in test setup, perhaps 27 dB for Fuji and 21 dB for thin Sony might become realistic new worst-case specs.

RW indicated that an 18 dB spec is not acceptable. HFH and RW decided to talk on this off-line.

8. RW: Where are we going with the heads?

a) In about two years we are going to have heads made with the thin film technology.

b) For now, sites using thin tape only could use a flat top version of the standard VLBI head for increased head life. Quotes are forthcoming from Metrum and Spin Physics. Processors, which for an extended interim period must use both thin and thick tapes, may soon be able to use a cheaper version of the triple cap with its excellent thick/thin tape interchange capability.

Next Mtg: Postponed to Thurs 13 Feb 97 for special topic. George Peck will moderate and write-up.

SPECIAL TOPIC: WORLD-WIDE VLBI THIN TAPE PROCUREMENT PROJECTIONS

addendum: Copy of 8 Jan e-mail to AEN.

Return-Path: <hfh@newton.haystack.edu>
Subject: thin tape for Mk4 (fwd)
To: hnj@newton.haystack.edu
Date: Thu, 09 Jan 1997 13:30:55 EST
X-Mailer: Elm [revision: 109.18]

Arthur --

Quantegy [formerly Ampex] recently provided 3 tape samples that have now all passed the 2-week shuttle [at 320 ips, 10" vacuum, between SP and NSP glass reels] mechanical durability test that qualifies them for VLBI use. There was no sign of degradation [increase of SP-reel flange separation (forcing) or the concomitant low-speed bumpy pack syndrome]. All earlier Ampex/Quantegy samples failed this test. The new version of the tape, still called '741', has a reformulated 'kneaded' high Tg binder, 'bimodal' backcoat, and is 'preshrunk' for dimensional stability according to Quantegy's Bob Parham, tel# (334)742-7923. The new version had already been shown to cure an edge-damage [bumpy pack] problem encountered in Bosch helical scan recorders with earlier versions of the tape.

Quantegy now represents a new potential second source for thin VLBI tape. Sony now will not accept orders for less than 500 reels. Quantegy will accept individual 20 piece minimum orders but needs to have assurance that the aggregate VLBI tape procurements exceed some threshold of probably about 200 per year in order justify production startup. Quantegy is willing to supply the tapes packaged, on VHS-spec Acrometal SP glass reels. If competitively priced, this should make their product attractive to individual geodetic VLBI observatories that will need to procure their own fraction of the thin tape supply.

NRAO will soon stop processing thick tape according to G. Peck. This and Mk4 implementation will put pressure on non-VLBA sites to procure thin tapes. An effort should now be made to put together a realistic world-wide VLBI thin-tape procurement projection for the next few years. We have postponed the next international VLBI recording telecon till 13 Feb so that the various resource managers can prepare to address this issue quantitatively at that time.

-- Hans