

VLBA ACQUISITION MEMO #395

MARK IV MEMO #233

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
HAYSTACK OBSERVATORY
WESTFORD, MASSACHUSETTS 01886
28 February 1996

Telephone: 508-692-4764
Fax: 617-981-0590

To: VLBA Acquisition Group, MK4 Recording Group
Coordinated Millimeter VLBI Array,
European VLBI Network

From: Hans F. Hinteregger

Subject: Minutes of 1st International telecon on VLBI Recording held on 8 February 1996,
10:00 A.M. EST [15:00 UT]

Attendees: EVN - Jean Casse - NFRA-JIVE
Klaus Ruf - MPIFR-BONN
VLBA - George Peck, Ron Weimer - NRAO
Bill Brundage, Jon Romney
CMVA/MK4 - Hans Hinteregger - HAYSTACK
Dave Fields, Tom Buretta, Dan Smythe, Sinan Muftu
Russ Ruhl - METRUM

The purpose of expanding these telecons to international participation by all interested parties [users of compatible longitudinal VLBI tape recording subsystems] is to ensure continued compatibility, improved operational reliability, and a coordinated growth/development path.

I want to encourage the active participation in these telecons of 'hands-on' people from field sites and processors, for first-hand feedback on problems, suggestions, questions etc..

Agenda:

1. FIXED EQUALIZER CHANGEBACK AT VLBA PROCESSOR - GEORGE PECK
NRAO plans soon to convert the modified equalizers in the parallel read path of its VLBA processor drives back to their original design.

George will issue a VLBA memo that documents in full detail the VLBA processor parallel read signal path as actually implemented. Haystack will highlight the configuration differences [not just the equalizer] for 4.5 Mb/s operation of VLBA-style upgraded drives on Haystack, Washington, and Bonn? processors.

The VLBA processor configuration will support reading -

- a) at 160 ips only, VLBA-qualified high resolution thin tapes recorded at 56 Kfci only, or
- b) at 270 ips only, Mk3A-qualified lower resolution 'thick' tapes recorded at 33 Kfci only.

Reliable playback of THIN tape recorded at the LOW density will NOT be possible at the VLBA processor. VLBA will cease to record thin tape at the low density.

All Haystack and Washington? processor drives, on the other hand, now operate reliably [with VLBA-style upgraded or thin-tape upgraded Mk3A drives]

- a) at 80 or 135 ips with hi-or-lo density recorded thin tape at 5"H2O vacuum [1.1 N tension],

or

b) at 135 ips with lo-density-only recorded thick tape at 15" [3.3 N].

With the standard [single CAP] VLBI head, it is imperative that tension is switched [actually 1:3, ideally 1:8] to compensate for [almost] 1:2 tape thickness change in order to maintain a sufficiently compatible contour radius.

2. TRIPLE CAP HEAD - IMPLEMENT OR IMPROVE? - H.F.HINTEREGGER, RUSS RUHL

The triple CAP [Constant Area Profile] prototype built by Metrum to Haystack specifications [purchased by NRAO] has seen 9 months of problem-free operational service in a VLBA-style upgraded Haystack processor drive.

The triple CAP prototype has:

A. a relatively large radius of curvature [worn from about 6 to 7.6 mm compared to our standard 2.5 mm radius single CAP],

B. outriggers [which multiply the contact area by 167% reducing contact pressure, and provide built-in inner wrap-angle control that makes head placement and orientation accuracy less critical], and,

C. triangular shaped grooves between outrigger and central [head-array] tape bearing surfaces with a shallow about 9 deg angle on the outrigger side to provide aerodynamic pull-down at high speed as the tape moves from outrigger to the central bearing.

The chief proven advantage of the triple CAP prototype is insensitivity to tape thickness interchange. Good contact has been maintained at a fixed vacuum of 10"H2O [2.2 N tension] regardless of tape thickness.

Though initial lab testing did not indicate flying at high speed as expected, no long-term tests at the 8 m/s Mk4 speed, with or without tape thickness interchange, have yet been done to unambiguously demonstrate the benefit of feature C.

Russ Ruhl mentioned that the price of replicating the existing triple CAP prototype can be expected to be 60% higher than the present VLBI standard, which he attributed to the complexity of the new contour defining operations. A quote has since been received: The triple CAP is part #00001357-001 and will sell for \$13,650. The high price and the possibility of a simpler-than-standard flat contour with integral wrap guides [similar in principle to what was demonstrated with a thin-film disk-head row-bar] produced no enthusiasm for replicating the prototype but rather for prototyping and evaluating a new version which is both better [more tape thickness interchange, speed, tension, and wrap geometry variation tolerant] and easier to manufacture [cheaper] than the standard VLBI head.

The expected lower wear rate of the triple CAP is also not proven. After 1200 hours of running 6 um of wear has been measured. It is likely that most of this wear occurred in the first 600 hours during which the tape path humidity was not controlled and often went into the 40-50% RH range known to cause rapid wear. Under these conditions the head would probably have worn out in 3000 hours. After the first 600 hours the vacuum exhaust, warmed to a stable 40 C by forcing it through a relatively small diameter tube, was ported into the tape path. This continues to guarantee a tape path humidity of 10 to 20% RH [measured by an accurate meter]. There have been no performance maintenance problems in this configuration. We will try to put an upper bound on the dry wear rate by looking for incremental wear after another 600 hours of running.

3. DRY TAPE PATH KIT - PROGRESS - H.F.HINTEREGGER

A kit is being developed to provide a dry, stable temperature environment in the tape path which uses the brushless vacuum motor or an identical independent motor as the relatively high rate [CFM] source of warmed [therefore low RH] air. In order to warm the air sufficiently to about 40 C [without a servo stabilized heating element in the exhaust air path -- a complexity initially to be avoided until/if very much narrower tracks are implemented without reducing the multichannel span so that very accurate system-wide tape temperature control becomes necessary] the motor must be run in the upper half of its rated rpm range. This makes the motor as presently mounted too noisy for human comfort -- our correlator operators complain with good cause. A 2-piece sheet metal housing [7x7x9" box] has been designed into which the motor is placed surrounded by foam which serves primarily as a good muffler. With the motor running full bore the residual noise with the package inside the recorder cabinet is barely noticeable. Though the box becomes warm the thermally protected motor has never shut itself down in over two months of continuous all-out running so I consider this configuration adequately tested with margin to spare. We are looking for a reasonable quote for the sheet metal work.

Independent control of vacuum and exhaust air temperature is easily achieved. The air temperature is controlled primarily and quite gradually by a relatively high motor rpm [the control voltage]. The corresponding vacuum can be adjusted arbitrarily downward by introducing an adjustable muffled vacuum leak where the vacuum hose couples into the precision plate. This was done by drilling diametrically through the plastic fitting attached to the precision plate, sliding the hose end onto the fitting and adjusting it so as to partially cover the vacuum leak holes until approximately the desired vacuum is achieved at a given motor speed. The hose end pierces a small piece of porous foam which also surrounds the leak holes and serves to muffle that additional source of noise.

Since a large fraction of the airflow comes from the leak, neither the volume of airflow nor the exhaust air temperature depend much on whether or not a tape is loaded. To keep the tape path environment at a stable slightly elevated temperature and sufficiently dry the vacuum motor should NOT be shut off when a tape is unloaded as is done now in VLBA-style drives.

4. EXPERIENCE AT 18 MB/S WITH 2 STACKS - JEAN CASSE, DAN SMYTHE

In response to Jean's question and concerns regarding the Mk4 performance specification of P&G tape drives and heads, Dan pointed out that very little experience at 18 Mb/s exists except with one channel at a time in the lab. While demonstrations of parallel recording with 64 channels at 18 Mb/s per channel have been successful, playback on even only a single channel in the lab has only approached [not reached] 18 Mb/s due to limitations of the test electronics. There is as yet no prototype of Mk4 18Mb/s parallel playback electronics!

We do expect with the Metrum drive and the current head design to achieve consistent bidirectional contact performance [no significant increase in spacing loss to 8 m/s] on all channels. Analog tests with a spectrum analyzer are the most sensitive and unambiguously direct way of checking the reality of this expectation.

5. NEXT TELECON:

I'll schedule the last Thursday in March or the first in April(?). Please e-mail your preference to hfh@newton.haystack.edu.

Topics already suggested for next time:

- 1] Consolidated updated configuration/performance specifications; installation, maintenance, test instructions.
- 2] Review of thin-tape repackaging and test procedure.
- 3] Please e-mail me your priority concerns for next agenda.