VLBA ACQUISITION MEMO #161

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

HAYSTACK OBSERVATORY

WESTFORD, MASSACHUSETTS 01886

17 August 1989

Area Code 508
692-4764

To: VLBA Recorder Group

From: Alan E.E. Rogers
Ken Stetten

Subject: Summary of VLBA Recorder Review Meeting

Summary

A two day meeting was held at Haystack on 15 and 16 August to review the VLBA recorder and discuss in detail proposed mechanical modifications to improve tracking performance.

On the first day (see attached agenda) the VLBA recorder was discussed in detail with several professionals. [A Table comparing the VLBA and D-1 recorders was shown (see attachment).] The primary purpose of the discussion was to get advice, especially from our consultants.

On the second day, Ed Cuddihy of JPL presented an excellent tutorial on the chemical, physical and mechanical properties of tape. Following Ed's presentation, we discussed the recorder production work at Haystack. I now summarize the important comments and conclusions:

If we want mode 2 operation

Jim Eaton of IBM suggested that we might bias the tape into mode 2 (see Acquisition Memo #142) with a sprung guide - like that used on the IBM 3480.

Idler alignment accuracy

Since the idler axis alignment is quite critical, Harry Allen of Honeywell expressed some concern with tolerances. Alan Rogers will review alignment accuracy requirements and discuss them further with Honeywell.

Machining of precision plate

Concern was expressed over machining old precision plates to install the "hard-points". We were advised that significant distortion of the plates might occur. It was generally recommended that a new part be fabricated (hopefully by Honeywell as an option) by doing all the machining before grinding the flat reference surface.

Head clogging

Harry Allen of Honeywell commented that head clogging does occur (although relatively infrequently) on the new rotary recorders and that typically one or two scans are lost before recovery.

Tape testing and head wear

It was generally advised that we should start to select a particular tape for the VLBA use and start operational testing including the head wear. Ed Cuddihy emphasized that head wear is likely to be a function of presence of contaminants as well as humidity. It was also emphasized that we should get as many hours as possible on several machines using the new tape.

Tape dependent forward - reverse offsets

Ed Cuddihy confirmed that the elastic anisotropy is most likely the cause of a tape dependent forward - reverse offset and further pointed out that tracking signatures will get longer and more violent at lower temperatures. Elastic anisotropy was identified as the major cause of tracking wander in the recorders like those on Voyager and other spacecraft and special "center" cuts of PET film were needed for the belt drives of these machines.

Strain limit

Ed Cuddihy emphasized the importance of never subjecting the tape to a strain of more than 1% (the proportional limit). In this respect the longitudinal machine is very gentle - however, large strains can be built up in the tape pack - especially when the tape is subject to environmental changes.

Tape shipment and RH

Ed Cuddihy described the hygroscopic property of tape and suggested that shipping containers should be reasonably well sealed. He was happy to see that our reels cover the pack and probably result in a very long time constant for the absorption of water. He suggested we might consider a band around the circumference to increase the isolation.

Tape binder and RH

If the new tapes have a polyester binder they will be subject to hydrolysis and will "age" if subjected to an unacceptably high humidity/temperature - see attached figure. We need to find out more about the tape we plan to use for the VLBA to see if the newer tapes are also subject to the same storage/shipping limitations.

Implementation of transport modifications

1] I/O rollers

We will send I/O rollers to George Peck for immediate placement in VLBA recorders.

2] Idler roller

Haystack has ordered 20 (some for NASA) new design and larger diameter idler rollers from Honeywell at $700 each and will send idler rollers to George Peck for installation in VLBA recorders as soon as they are available.

3] "Hard points"

Haystack will continue to work out details of this modification with Honeywell who will hopefully make it available as an option on new recorders. Nothing will be done on existing VLBA transports until the precision plates become worn - at which time they will be replaced with a new precision plate capable of accepting hard points.

VLBA tape

A special telecon will be held within a few weeks to discuss the possibility of buying some D-1 tapes if they are available.

REC #3

It was decided that REC #3 should stay at Haystack (at least for the next two years) so that it can continue work as a test bed for the latest tape, modules, heads, etc. VLBA recorder (probably the AOC recorder) should also be maintained with the latest versions of the hardware.

VLBA Recorder Review Meeting

Tuesday, 15 August 1989

at

Haystack Observatory
Westford, Massachusetts

Agenda

08:00-08:30	--	Coffee, Welcome Comments
08:30-08:50	--	Brief Review of VLBA Recorder Specifications
09:30-10:00	--	Demonstration of VLBA REC #3
10:00-10:30	--	Mechanical Studies of VLBA recorder related to tracking and head to tape contact
10:30-10:45	--	Break
10:45-11:00	--	Proposed Modifications of transport: a) Return to the use of an idler roller. b) Installation of "hard points". c) Return to I/O rollers.
11:00-11:45	--	Discussion and advice from participants
11:45-12:30	--	Lunch (Provided in Meeting Room)
12:30-12:45	--	Tests of transport performance using thin tapes
12:45-01:15	--	Can we eliminate the prepass?
01:15-01:30	--	Discussion and Recommendations.
01:30-02:00	--	Packaging and handling of thin tapes.
02:00-02:30	--	What tape should the VLBA procure?
02:30-03:00	--	Discussion and recommendations.

Participants:

Harry Allen, Honeywell
Thomas Buretta, Haystack
Roger Cappallo, Haystack
Ed Cuddihy, JPL
Hans Hinteregger, Haystack
Peter Napier, NRAO
George Peck, NRAO
Jim Eaton, IBM
Alan Rogers, Haystack
Jon Romney, NRAO
Ken Stetten, NRAO
Dan Smythe, Haystack
Prof. Frank Talke
John Webber, Interferometrics
Dick Thompson, NRAO
Skip Thacker, Interferometrics

Attachment 1.

COMPARISON OF THE K4 AND VLBA RECORDERS

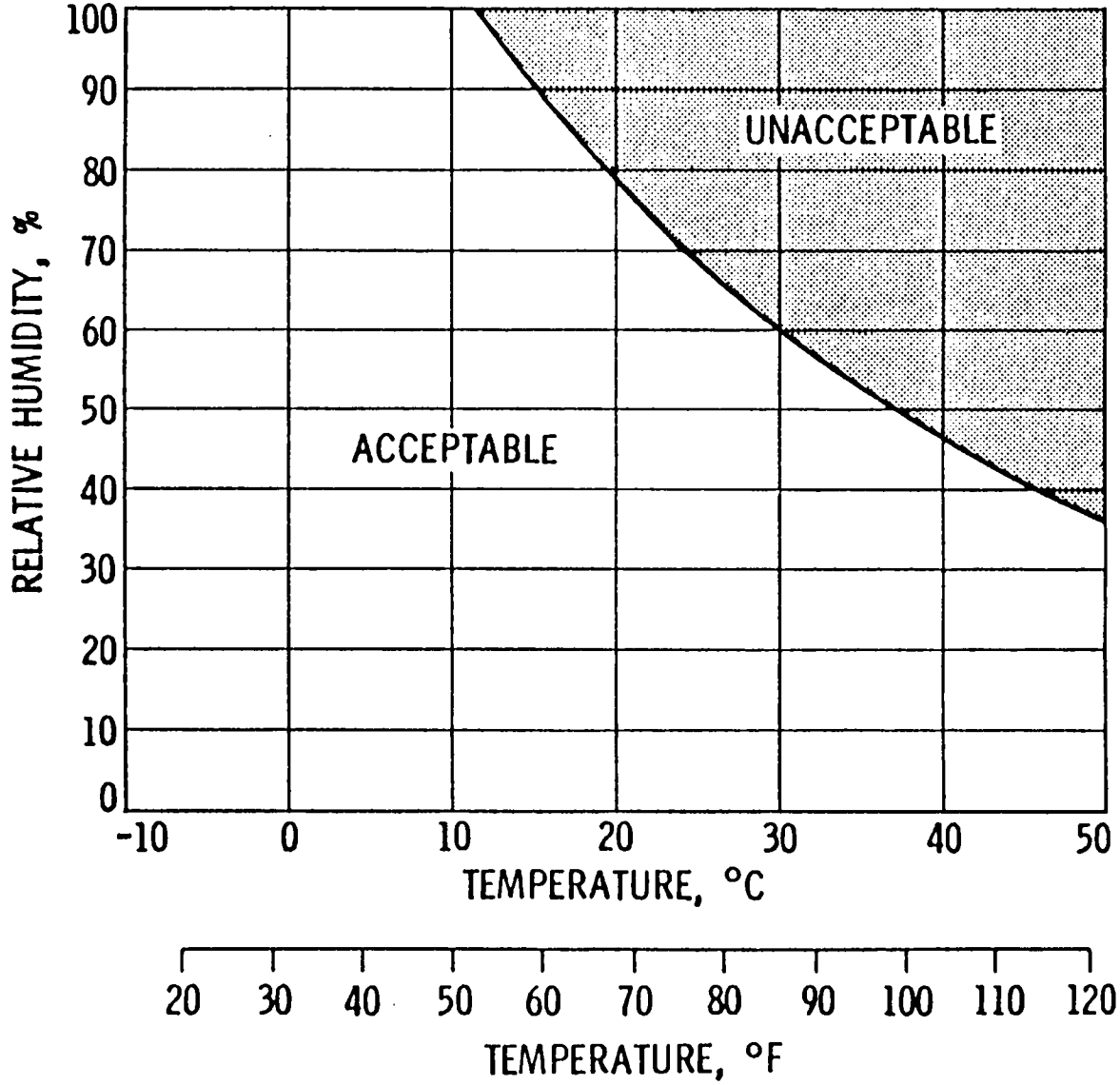
	K4 SONY ID-1	HAYSTACK VLBA
RECORDER TYPE	Helical	Longitudinal
LINEAR DATA DENSITY (bits/μm)	1.4	2.0
TRANSVERSE DATA DENSITY (tracks/mm)	22.2	17.6
SCAN SPEED AT 256 Mbits/s (m/s)	50.2	4.1
CURRENT MAX.RECORDING RATE (Mbits/s)	256	256
MAX. DESIGN RECORDING RATE (Mbits/s)	256	1024 (160 ips) 2048 (320 ips)
BIT ERROR RATE SPEC	$< 10^{-10}$ ###	$< 3x10^{-4}$ w/o ECC
TAPE PACKAGE	D1-L cassette	14" reel
VOLUME (CM^{-3})	2490	2917
DATA VOLUME DENSITY PKG'D (Gb/cm^{-3})	0.4	1.9
FILLED PACKAGE WEIGHT (kg)	2.7	4.7
SHIP.WEIGHT:24 hrs at 128 Mb/s (kg)	42.6	11.4 ##
CURRENT TAPE THICKNESS (μm)	16	28
PLANNED TAPE THICKNESS (μm)	13	13
CAPACITY WITH 13 μm TAPE (Tbits)	0.92	5.5
RECORDING TIME AT 128 Mb/s (hours)	2	12
COST (K$)	250 *	160+ 117#

* For a single unit, without multiple cassette loader.
\+ Industrial cost.
\# Haystack cost.
VLBA Ship Weight assumes 4 tapes in MKIII cardboard shipping box
With ID-1 Std. ECC tape (raw) - BER $<10^{-4}$ and burst shorter 3000 bytes
Attachment 2.

HFH 8/89

TAPE AGING

PREDICTED ACCEPTABLE AND UNACCEPTABLE AMBIENT ENVIRONMENTS FOR UNPROTECTED TAPE USE AND STORAGE



Attachment 3.

E.F.C.