VLBA Acquisition Memo # 092

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
HAYSTACK OBSERVATORY
WESTFORD, MASSACHUSETTS 01886

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Area Code 617
692-4765

To: VLBA Recorder Group

From: Hans F. Hinteregger

Subject: Sony visit / D1 Tape for VLBA / MP Tape, MIG Heads?

On 2 April 1987, K. Kobayashi, Director of Technical Operations, and T. Miyao, Manager, Pro Video and Audio Tape Division, of Sony Magnetic Products, Inc., Japan, met with me to discuss near and longer term possibilities for tape for the VLBA recorder.

1) Price of 27,000 feet working length of inch-wide 13-micrometer thick 850 Oersted D1-equivalent tape estimated to be $800 ±20%. (We will not be charged for NRE, unlike "for profit" special customers.)

2) Initial order of around 100 reels early in 1988 with delivery by April is expected.

3) Tape likely to be supplied initially in shorter lengths than 27,500 feet; probably in the form of 13,800 foot (12.5" metal) reels or pancakes (tape on hub without flanges).

4) Haystack is willing, initially, to package the tape to operational VLBA requirements, that is, wind the tape onto separately procured special "self-packing", 16-inch diameter glass reels and splice as necessary. (Although no formal quote from Corning has yet been received, I have been told not to expect a price less than $180 for these reels even in 500-plus quantity; the "standard" 16-inch reel in 500-plus quantity lists for $130 as of June 1986; note the "self-packing" version is a little different but not more difficult to make). Sony will "consider" VLBA tape packaging requirements in the future.

5) 13-micrometer "production" line samples (total at least 27,000 feet) will be made available in September 1987 for evaluation. The new samples will incorporate a tougher binder formulation to optimize the strength and durability of the thinner tape option for D1 (both 13 and 16 micrometer versions are to be standard). This is extremely important for the D1 application, where rotating heads impact the tape at over 2,000 ips, but probably irrelevant for longitudinal recording which is impact-free and an order of magnitude slower.

6) Relatively short, ~1000 meter, 10 micrometer thin experimental samples (total ≥27,000 feet) may be made available to us by July 1987, primarily for mechanical evaluation, that is, to confirm the ability of the transport to reliably handle such thin tape. These samples are not likely to be as perfect (i.e., free of dropouts) as production line samples. Note that with 10-micrometer tape, the desired 27,000 foot working length which yields one hour passes at 90 ips fits on the "traditional" 14-inch reel. If, as I expect, handling is not

a problem, Sony may offer to supply 10-micrometer tape as a more cost-effective alternative to the 13-micrometer D1 equivalent inch-wide tape. Other advanced (slow-speed rotary) applications such as 8mm video and RDAT provide the development driver for 10-micrometer tape thickness, though these applications use 1500 Oersted metal particles in place of 850 Oersted "advanced" Co-doped iron oxide.

7) The defacto standardization of 1500 Oersted metal particle tape in state-of-the-art consumer products (8mm camcorder and now RDAT, Rotary Digital Audio Tape, as well as in professional video, BETACAM and MII, and in digital video, DX) should not be ignored especially in the long run. The consumer systems operate at 75 Kfci and with 1/2 mil trackwidth. This is 3/2 times the transition density and 3 times the track density presently qualified for VLBA with 13-micrometer D1-equivalent tape. With 10-micrometer metal particle tape a six-fold (3/2 x 3 x 4/3 = 6) increase in volume density (hence capacity of a given size reel) can conservatively be projected within the next several years.

Such natural evolution of the VLBA recorder, leading for example to a 12 hour at 1024 Mbit/sec capability on a 16-inch reel, seems now to depend almost solely on adapting one of the new 8mm or RDAT head technologies (required to drive 1500 Oersted tape) to the longitudinal recorder. One of these is the so-called MIG (metal-in-gap) head. The modified ferrite gapped bar from which it is made may be directly compatible with our present process for making headstacks (which uses an unpatterned, 30mm long, VHS-equivalent, single-crystal ferrite bar). The MIG bar incorporates a layer of high-saturation magnetic metal on each side of the gap. Gap length is also shortened from 0.33 (VHS-spec) to 0.22 micrometers to support the higher transition density.

Kobayashi-san suggested contacting A. Kurita, General Manager of Electronic Device Division of Sony Magnetic Products, Inc. to (1) get more complete information on Sony's head technology alternatives, (2) hopefully to obtain sample MIG bars for experimental manufacture into headstacks, and (3) to stimulate interest and cooperation in our attempts to apply the most advanced head and tape technologies to parallel narrow-track longitudinal recorders.

Comment: Such recorders seem uniquely well suited to meeting extreme capacity (1 to 6 terabytes) and/or sustained transfer rate (1/8 to 2 gigabits/sec) requirements such as those of the VLBA. Greater than 10,000 hour MTBF, including headlife, can also be achieved. Reliability, as well as the extreme transfer rate and capacity figures-of-merit suggest that such recorders could also serve as "primary peripherals" of supercomputers, with direct highly parallel access to their multigigabyte solid state memories like the CPUs have. For such a "general purpose" role, each head (channel) would have to be equipped with an integrated "channel modem" which implements a code capable of correcting a (degraded) raw error rate of 10^{-3} to better than 10^{-12}. Such modem chips already exist for RDAT for example, and an efficient, flexible, and user-friendly version should be made part of any new commercial product with "raw" capabilities like those of the VLBA recorder.

Update 21 July 1987: