

# VLBA ACQUISITION MEMO #341

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To: VLBA Data Acquisition Group

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Subject: Failure of Ampex tape under low humidity conditions

Following the discovery of the influence of humidity on tape failure (see VLBA Acquisition Memos 323, 327) we decided that it would be worthwhile to try shuttling a new Ampex tape under low humidity conditions. After shuttling at 320 IPS, 10 inches vacuum, and 30% RH for 48 hours, the tape failed despite our hope that avoiding moderate to high humidity would prevent failure.

Upon close examination of the edge guiding surfaces, one of the contact points was found to be coated with a hard to remove layer, of about 1 micron thick. Based on the analysis method of VLBA Acquisition Memo 266, the expected temperature rise across the deposited layer is

$$\Delta = \frac{f\mu Vd}{KLt} \approx 130^\circ C$$

where

$f$  = edge force (0.04N - see VLBA Acquisition Memo 124)

$\mu$  = coefficient of friction (assume  $\approx 0.5$ )

$V$  = velocity (8 m/s)

$t$  = thickness of edge contact (16  $\mu\text{m}$ )

$d$  = thickness of layer (1  $\mu\text{m}$ )

$L$  = length of edge contact (500  $\mu\text{m}$ )

$K$  = thermal conductivity of layer (assume  $\approx 0.15$  watt/m/ $^\circ\text{C}$  typ. for plastic)

which is high enough to explain the "melt-down". We plan to have the deposit analyzed for composition.