VLBA ACQUISITION MEMO #138

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

HAYSTACK OBSERVATORY

WESTFORD, MASSACHUSETTS 01886

12 April 1989

Area Code 508
692-4764

To: VLBA Data Recording Group

From: Alan E.E. Rogers

Subject: Idler Bearing Friction

History

It is now thought likely that the problem that resulted in John Webber and Hans discarding the idler was the result of bearing friction. The original tests of tracking made by Hans at Honeywell showed good performance with the idler but when the first narrow track system was tested poor non-reproducible tracking was observed. The poor tracking was shown to be associated with the idler and it was replaced by a fixed post. The reason for the idler problem was never fully investigated by was thought to be the result of beats between the idler and capstan eccentricities. It is now thought that the real cause may have been slippage. Recent tests show that very good tracking performance on REC #3 using the idler. However, when an old idler was tested in REC #3 it was noticed that at speeds greater than about 60 IPS the idler would loose its grip on the tape and start to effect the tracking in a non-reproducible manner. Apparent beats also became apparent but these are the result of a cyclic tape slitting signature that is present on most tapes possibly associated with the rotations of slitting blades. When the idler slips it acts more like a fixed post and the machine operating mode changes. Tapes recorded with an idler and played back with a fixed post will show slitting signatures as will tapes recorded forwards and played back in reverse.

Idler friction

The idler uses 2 Barden SFR6SS bearings. In good condition, these bearings should each have 20 gm cm viscous torque with 100 centistoke oil at 5000 r.p.m. (derived form Barden catalog and confirmed by Harold Berglund of Barden). The 2 bearings should need only about 35% of the available torque from the tape. The tape torque is given by

$$2 R T w f \approx 110 \text{ gm cm}$$

where

T	=	Tension ($\approx$0.5 lbs)
w	=	Wrap angle ($\approx 10^{\circ}$)
f	=	Coefficient of friction ($\approx$1)
R	=	Radius of idler ($\approx$0.55")

but is probably considerable reduced by air entrapment at high tape speeds. It has been empirically determined that the new idler looses grip at about 330 IPS. The old idlers probably have a lot of viscous friction because the lubricant has evaporated over the years.

Honeywell is aware that the idler can slip at high speed and has recently redesigned the idler with smaller lower friction bearings (about 9 gm cm at 6000 r.p.m.). If we use an idler we should use the new design and we have ordered one for testing. We also need to study the air entrapment problem and determine if the relief grooves are deep enough.