

VLBA ACQUISITION MEMO #268

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To: VLBA Data Acquisition Group

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Subject: Slipping Capstans

The capstan will slip when the flying height¹

$$h = 0.6R \left(\frac{12\mu U}{T} \right)^{2/3} \approx 8 \text{ microns}$$

where

R = capstan radius (0.6")
 μ = viscosity (2.6×10^{-9} lb. sec/sq")
 U = tape velocity (320 IPS)
 T = tape tension (0.4 lbs. for 10")

exceeds the combined surface roughness of the tape backcoat and capstan. Some added grip is provided by the grooves which promote the collapse of the air bearing by leakage. However, it was found experimentally in experiments on the idler (see VLBA Acquisition Memos 140, 144, and 156) that 500 sq. mils of area per groove is needed for satisfactory air relief at 360 IPS. The current capstan design has 8 grooves (compared with 15 on the idler) of about 160 sq. mils each. From the idler test results we would not expect the present small cross-section grooves to be sufficient especially if they become clogged with dirt. Older capstans (worn and smooth) may have to have the grooves filed deeper to restore their effectiveness. Deeper grooves help compensate for lack of roughness in the surface and may be used to extend the lifetime of older capstans. [With care, the grooves can be cut deeper by using a 15 mil thick jeweler's saw blade held against a rotating capstan.]

¹Fluid Film Lubrication, W. Gross Editor, John Wiley & Sons, Inc., 1980, Page 493.