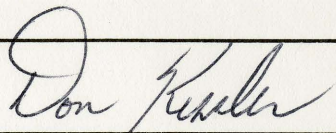


MEMORANDUM

Lyndon B. Johnson Space Center



REFER TO: SN3-84-217	DATE AUG 21 1984	INITIALS SN3/DJ Kessler:mfp:8/20/84:2956	ENCL
TO: SN3/Jim McCoy	CC SN3/B. Cour-Palais		
FROM: SN3/Don Kessler	SIGNATURE Don Kessler 		
SUBJ: Tether Sever Rate from Meteoroids and Debris			

Burt Cour-Palais and I have taken a quick look at the rate a tether would be severed due to meteoroids and orbital debris. Since there is considerable uncertainty in the orbital debris environment, the materials and construction of the tether, and the size particle which would sever the tether under actual stress conditions, these results should be considered, at best, a baseline for further investigations. The actual rate could easily be different by an order of magnitude.

The assumptions used to obtain this rate are as follows: (1) The meteoroid environment is as given in NASA SP 8013; (2) The orbital debris environment is as given in JSC 20001, "Orbital Debris Environment for Space Station."; (3) The relationship between tether thickness and impacting particle which will sever the tether is the same as the relationship between the thickness of a single sheet of aluminum and impacting particle which will just penetrate the sheet of aluminum. This relationship is given in NASA SP 8042.

The attached Figures 1 and 2 give the results of these assumptions. Figure 2 shows, for example, that a tether 20 km long and 5 mm in diameter at 500 km altitude would be severed an average of every 1.4 years. Increasing the tether thickness to 10 mm and lowering to 400 km altitude would increase its lifetime to 29 years. Figure 1 shows that in both cases, orbital debris dominates the sever rate. Uncertainties in the validity of the assumptions could change the respective lifetimes to as short as 0.14 years and as long as 290 years.