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SUBJECT: Investigation of the Skylab Rendezvous Profile with Consideration to the VHF Tracking Coverage - Case 610

DATE: April 23, 1970

FROM: C. O. Guffee
R. C. Purkey

MEMORANDUM FOR FILE

(NASA-CR-110576) INVESTIGATION OF THE SKYLAB RENDEZVOUS PROFILE WITH CONSIDERATION TO THE VHF TRACKING COVERAGE (Bellcomm, Inc.) 6 p

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During the Skylab rendezvous, on-board range measurements for navigation updates will be made with the VHF ranging system. This system has not been specified for the Skylab Program; however, for Apollo the VHF system has a maximum unambiguous range of 327 nm. Range measurements can be made only if the range rate does not exceed 1900 ft/sec.* The proposed Skylab rendezvous has been investigated in light of these limits.

The current Skylab rendezvous trajectory was simulated to determine the range, range rate, and total relative velocity which exist under conditions of minimum, maximum, and average phasing requirements. Figure 1 shows a relative motion plot of the final portion of these trajectories beginning at the apsidal crossing prior to the NC2 maneuver. Figures 2, 3, and 4 show plots of range and velocity versus time to go until Terminal Phase Initiation (TPI) for these three phasing situations. The major events as well as the limits on range and range rate are noted on these figures.

The limiting factor on the VHF system in all cases is range and not range rate. Under the 327 nm limit on range measurements, tracking coverage is obtainable for about 1700 seconds prior to NC2 for the minimum phasing requirement case, and 300 and 700 seconds after NC2 for the average and maximum phasing requirement cases. Tracking coverage will be available prior to the NCC maneuver for all cases. An operational limit of 327 nm on range will allow 4700, 2700, and 2220 seconds coverage prior to the NCC maneuver for the minimum, average, and maximum phasing requirement cases respectively.

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*Schmid, K. H., Description of Apollo VHF Ranging System, Bellcomm Memorandum for File, April 5, 1968.

Thus, unless the VHF range is extended, the system will not always provide adequate coverage for on-board navigation prior to NC2. However, a minimum of 2200 seconds of coverage is available prior to NCC if the VHF operational limit is 327 nm.

C. O. Guffee

R. C. Purkey

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Attachments

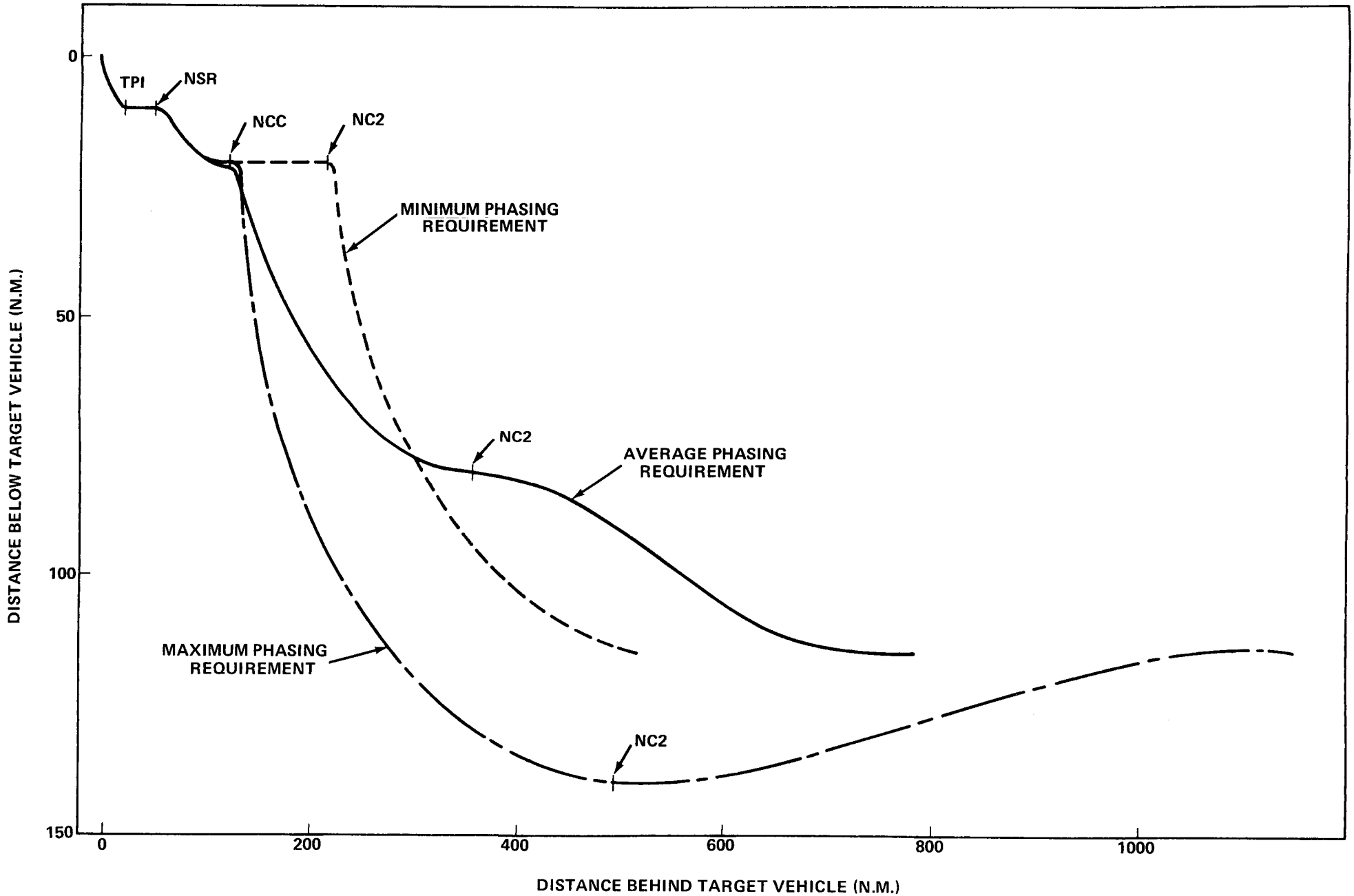

FIGURE 1 - RELATIVE MOTION PLOT OF FINAL PORTION OF SKYLAB RENDEVOUS TRAJECTORY

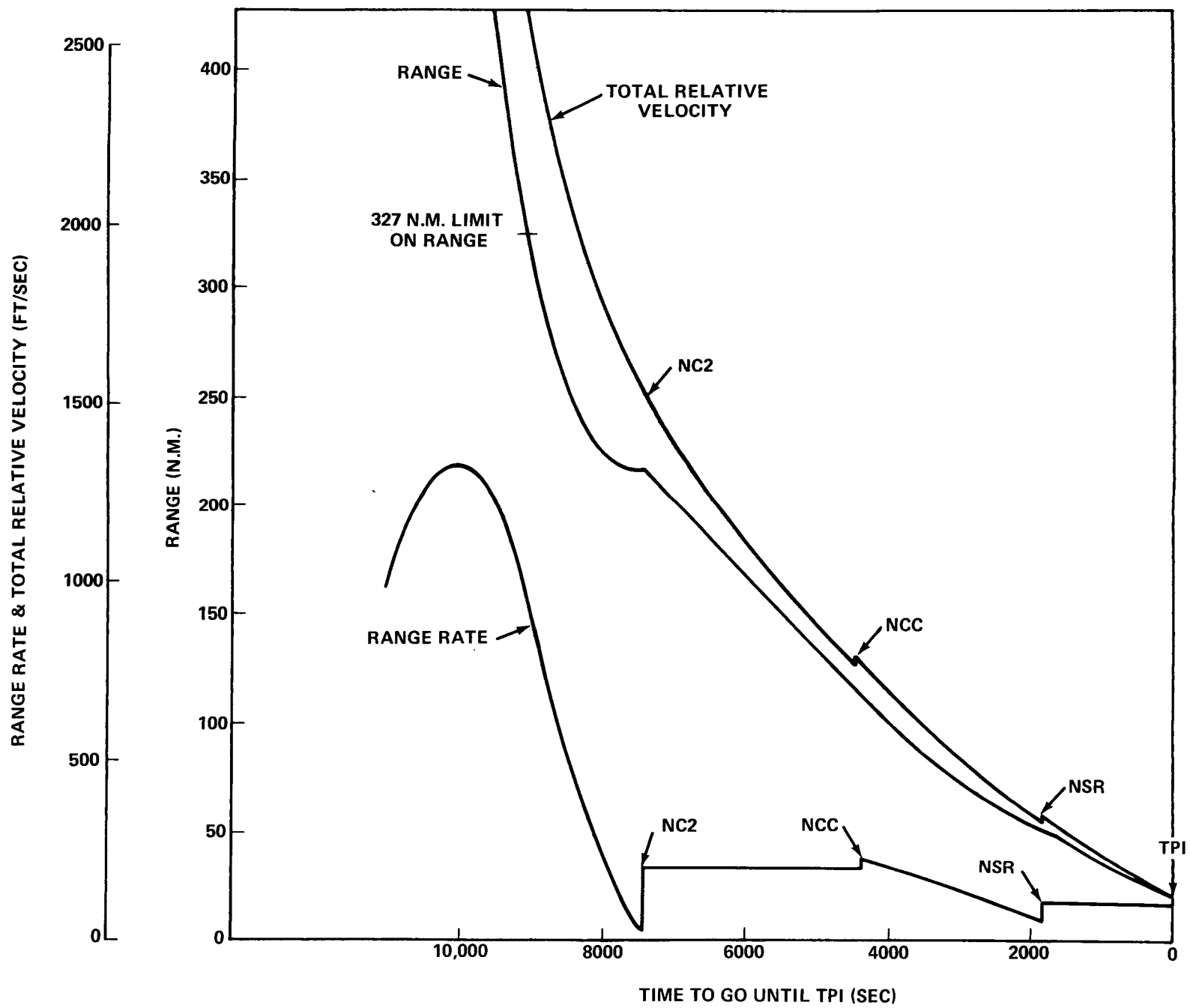

FIGURE 2 - THE RANGE AND RANGE RATE FOR THE MINIMUM PHASING SKYLAB RENDEZVOUS

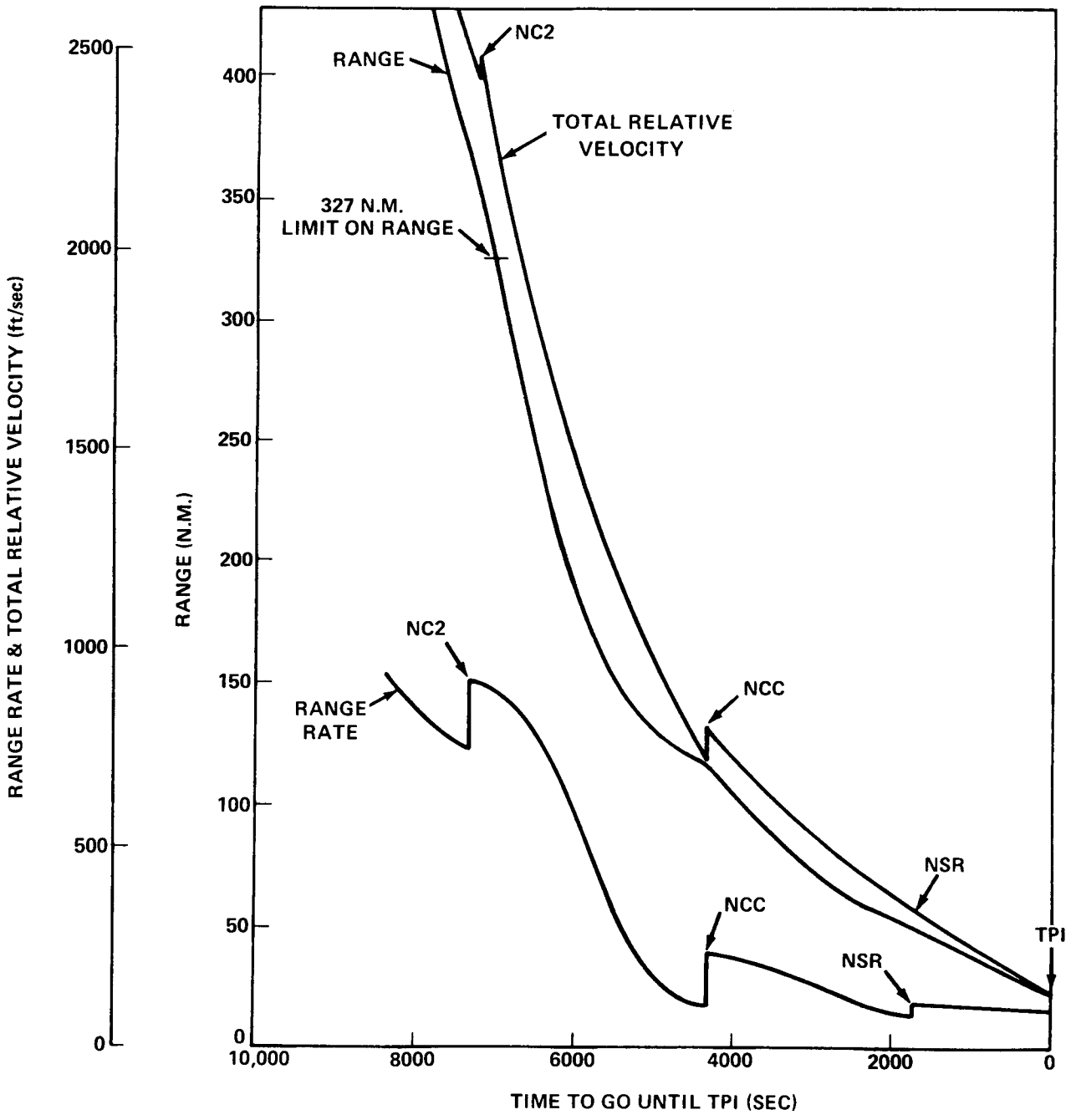

FIGURE 3 - THE RANGE AND RANGE RATE FOR THE AVERAGE PHASE SKYLAB RENDEZVOUS

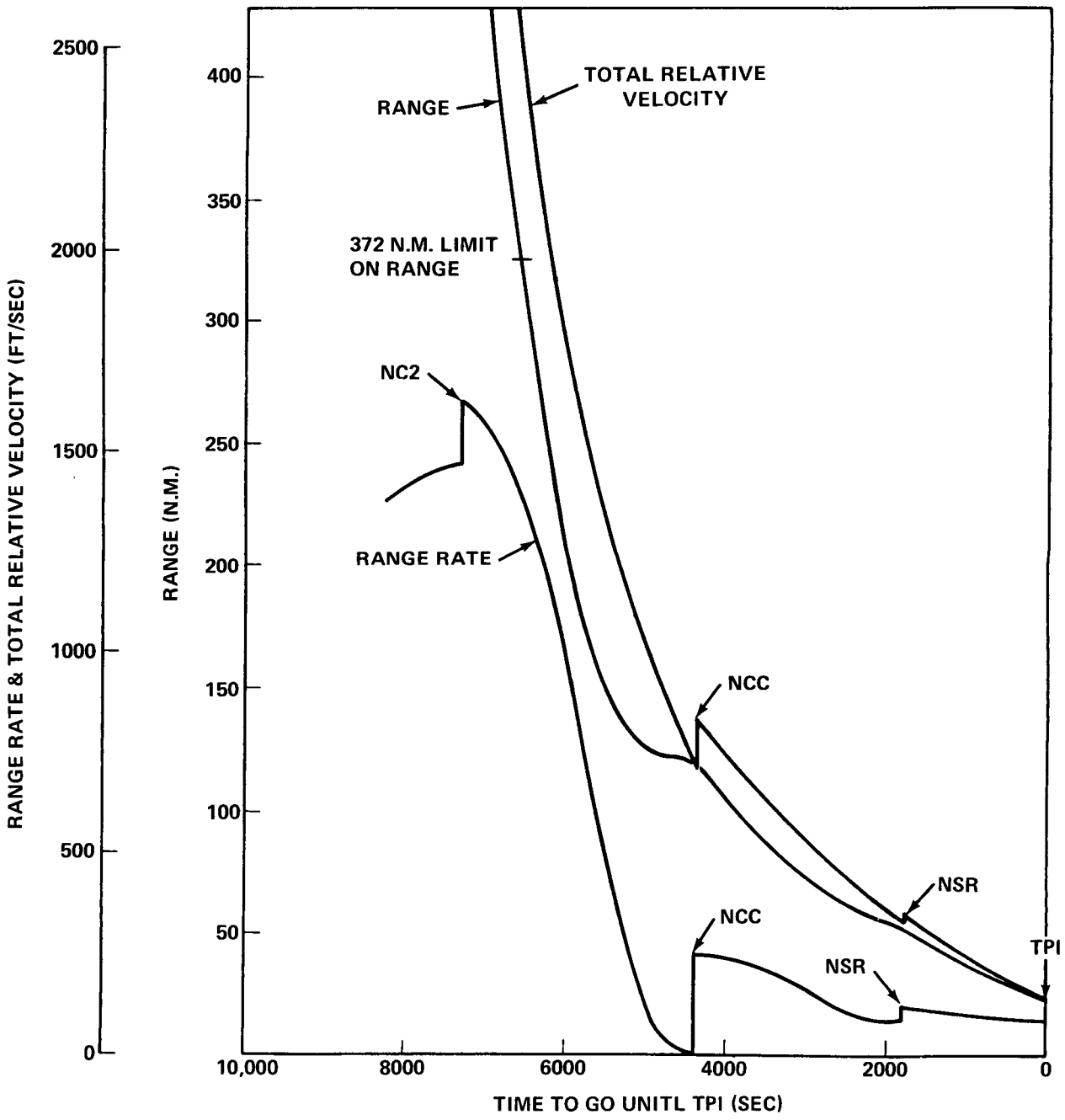

FIGURE 4 - THE RANGE AND RANGE RATE FOR THE MAXIMUM PHASE SKYLAB RENDEZVOUS