N87-20680

UTILIZATION OF GLOBAL REFERENCE ATMOSPHERE MODEL (GRAM) FOR SHUTTLE ENTRY

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At high latitudes, dispersions in values of density for the middle atmosphere from the GRAM are observed to be large, particularly in the winter. Trajectories have been run from 28.5^{o} to 98^{o}. The critical part of the atmosphere for re-entry is 250,000 - 270,000 ft. 250,000 ft is the altitude where the shuttle trajectory "levels out". For "ascending" passes (entry trajectories with an ascending nodal crossing at the equator), the critical region occurs near the equator. For "descending" entries the critical region is in northern latitudes. The computed trajectory is input to the GRAM, which computes means and deviations of atmospheric parameters at each point along the trajectory. There is little latitude dispersion for the ascending passes; the strongest source of deviations is seasonal; however, very wide seasonal and latitudinal deviations are exhibited for the descending passes at all orbital inclinations. For shuttle operations the problem is control to maintain the correct entry corridor and avoid either aerodynamic "skipping" or excessive heat loads.

The high dispersions displayed in the model mean that the designers must allow for correspondingly high surface temperatures. S. Bowhill suggested that the time in the re-entry trajectory at which closed-loop control takes over might be taken as a function of season. However, designers want to be able to use a single control program sequence. At present, entry begins with open-loop control. Accuracy of the model is only a factor prior to going to closed-loop where feedback controls take over. (It is not possible to use closed-loop guidance throughout entry because of limitations on closed-loop roll control capability.)

UTILIZATION OF GLOBAL ATMOSPHERE MODEL FOR SHUTTLE ENTRY

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- PRIMARY DRIVER IN GLOBAL MODEL WHICH AFFECTS ENTRY TARGETING IS LATITUDE
  - MODEL SHOWS SIGNIFICANT INCREASE IN DISPERSIONS AT HIGHER LATITUDES
  - MODEL SHOWS SIGNIFICANT INCREASE IN SEASONAL EFFECTS AT HIGHER LATITUDES

- ASCENDING OR DESCENDING DEORBIT PASS IS A MAJOR CONSIDERATION FOR HIGH INCLINATION MISSIONS

- ENTRY TARGETS AND DEORBIT PROP BUDGET ARE DIRECTLY INFLUENCED BY DISPERSIONS PREDICTED BY MODEL

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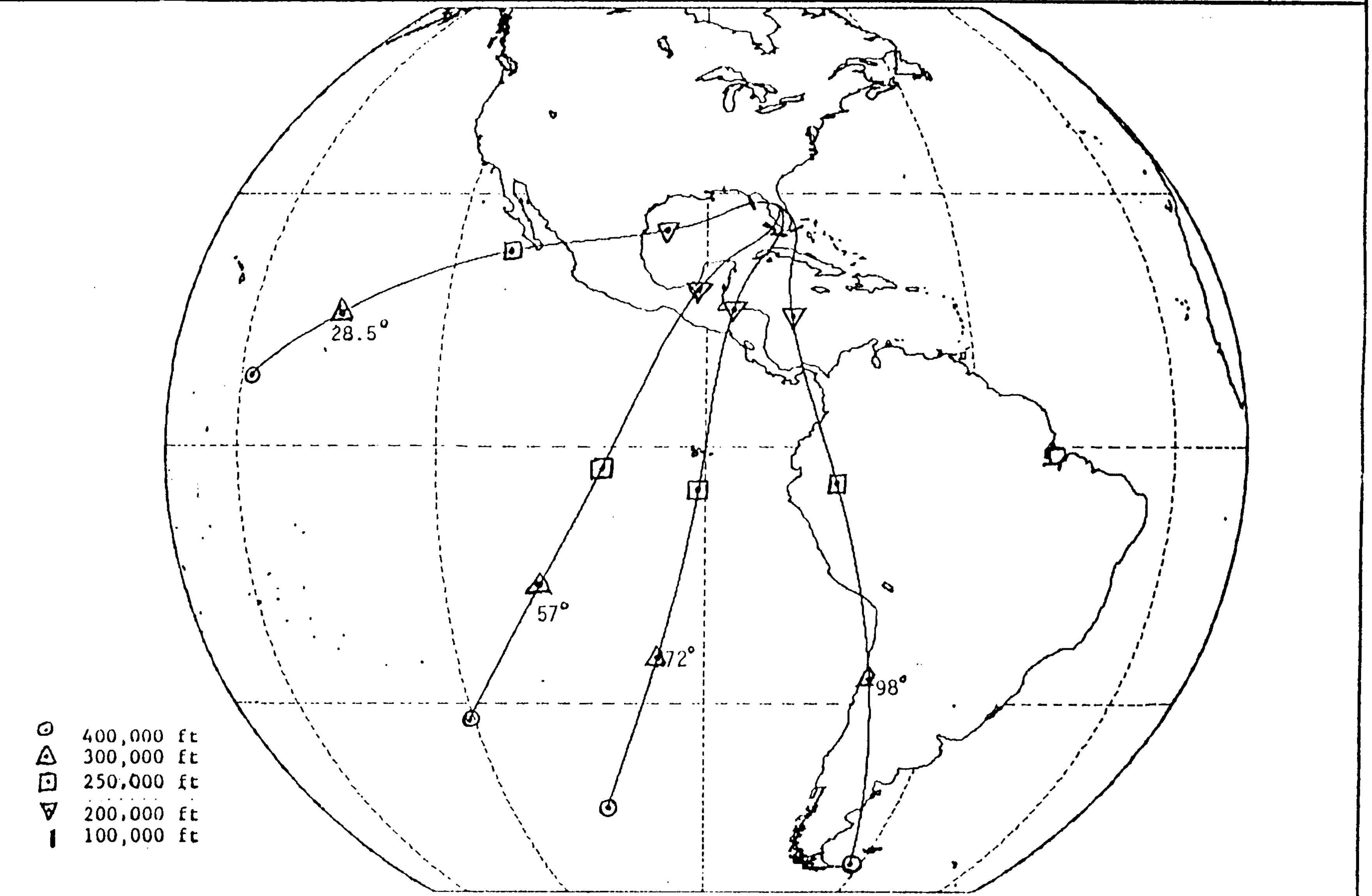

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DESCENDING PASSES	K. JOOSTEN	
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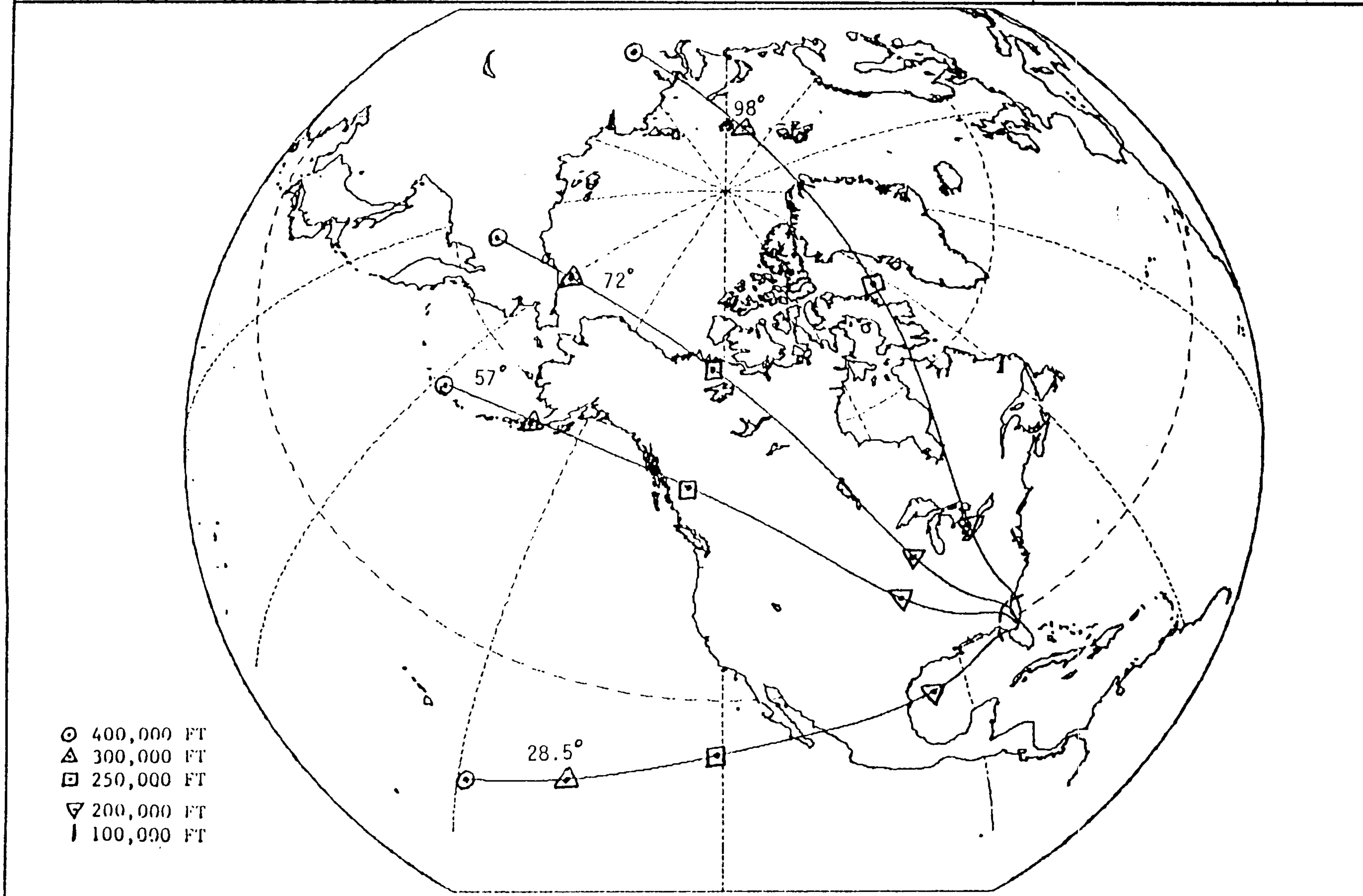

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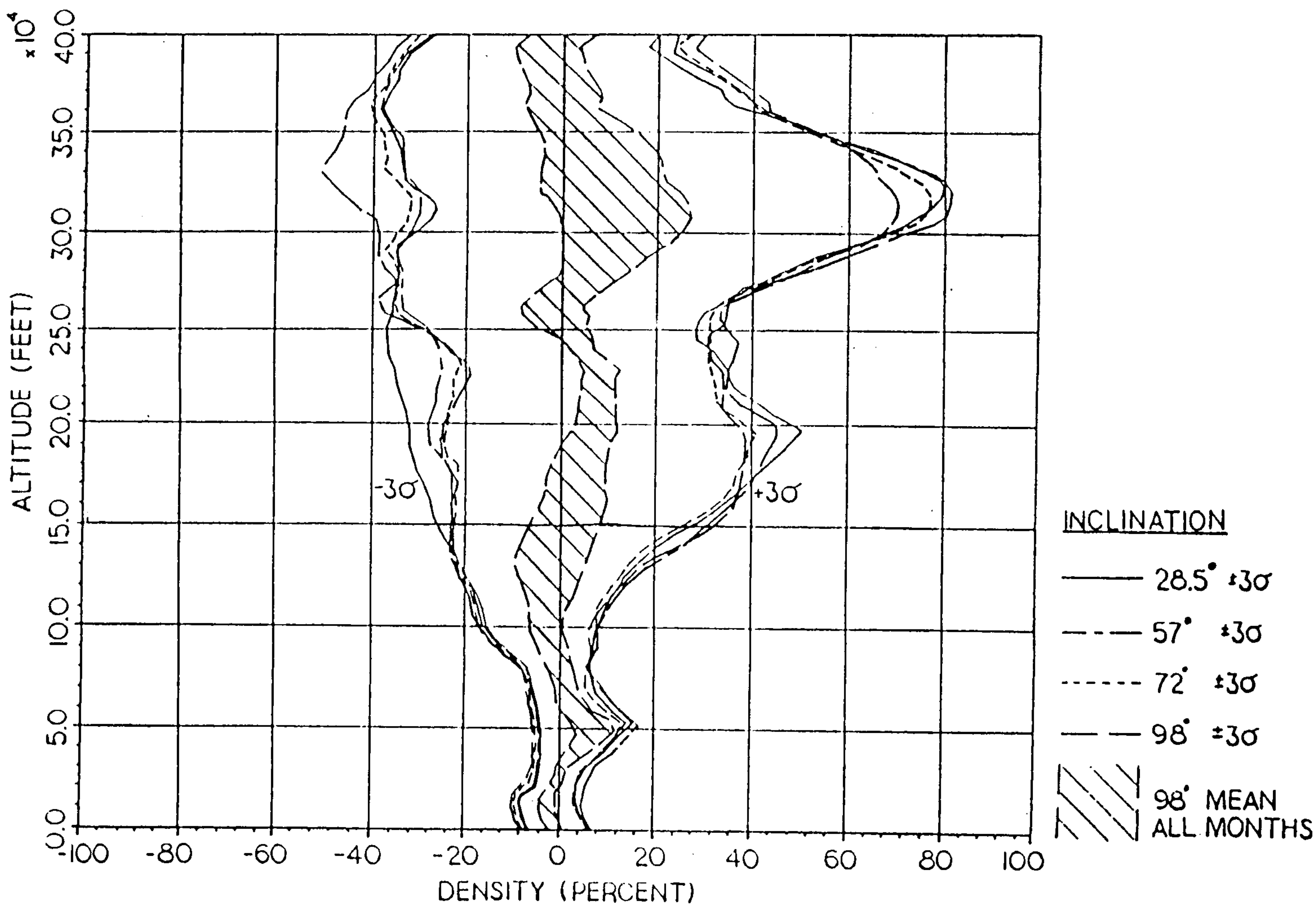

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SUBJECT:	NAME:	
DESCENDING ATMOSPHERES	K. JOOSTEN	
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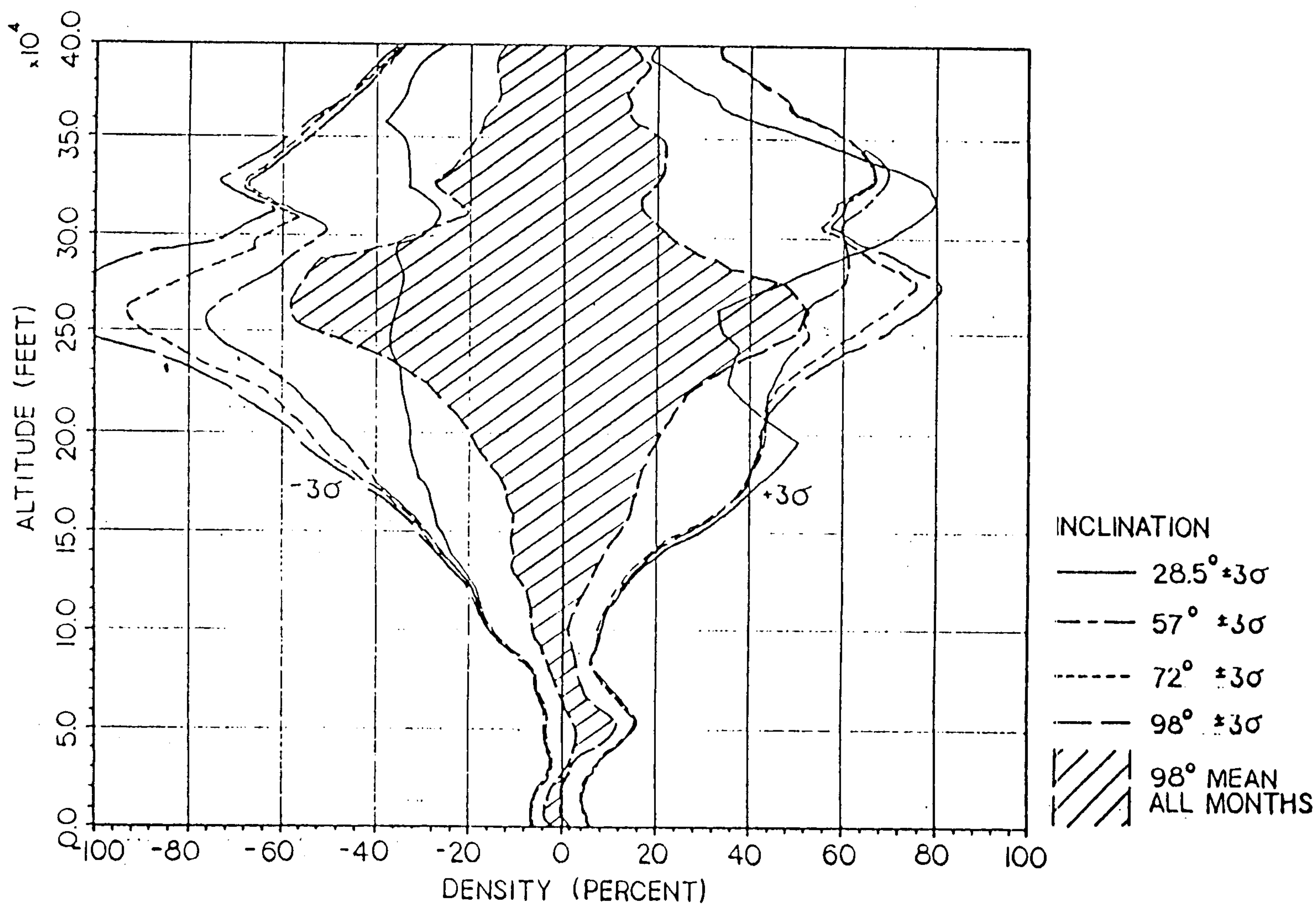

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SUBJECT: SEASONAL EFFECTS

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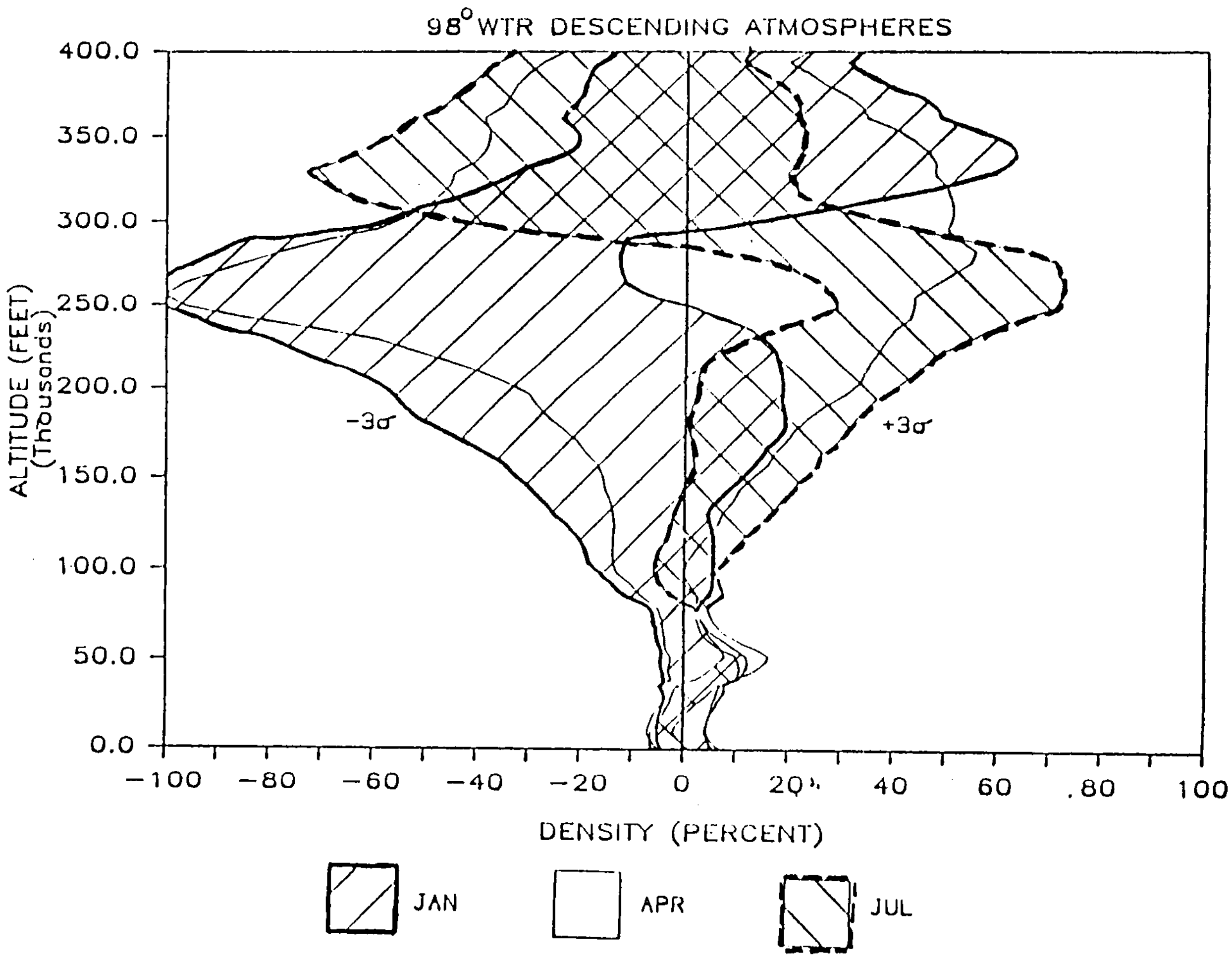

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SUBJECT: SHUTTLE AEROCAPTURE

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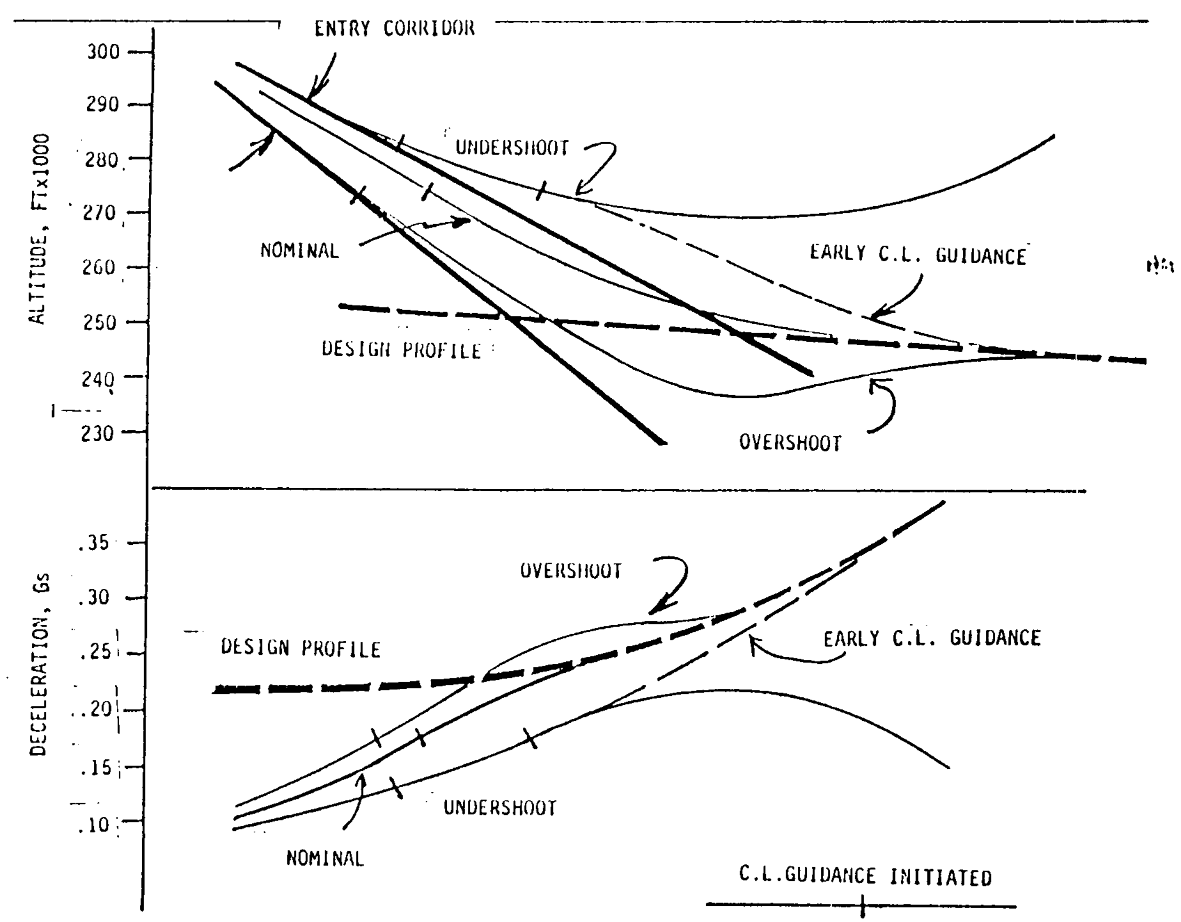

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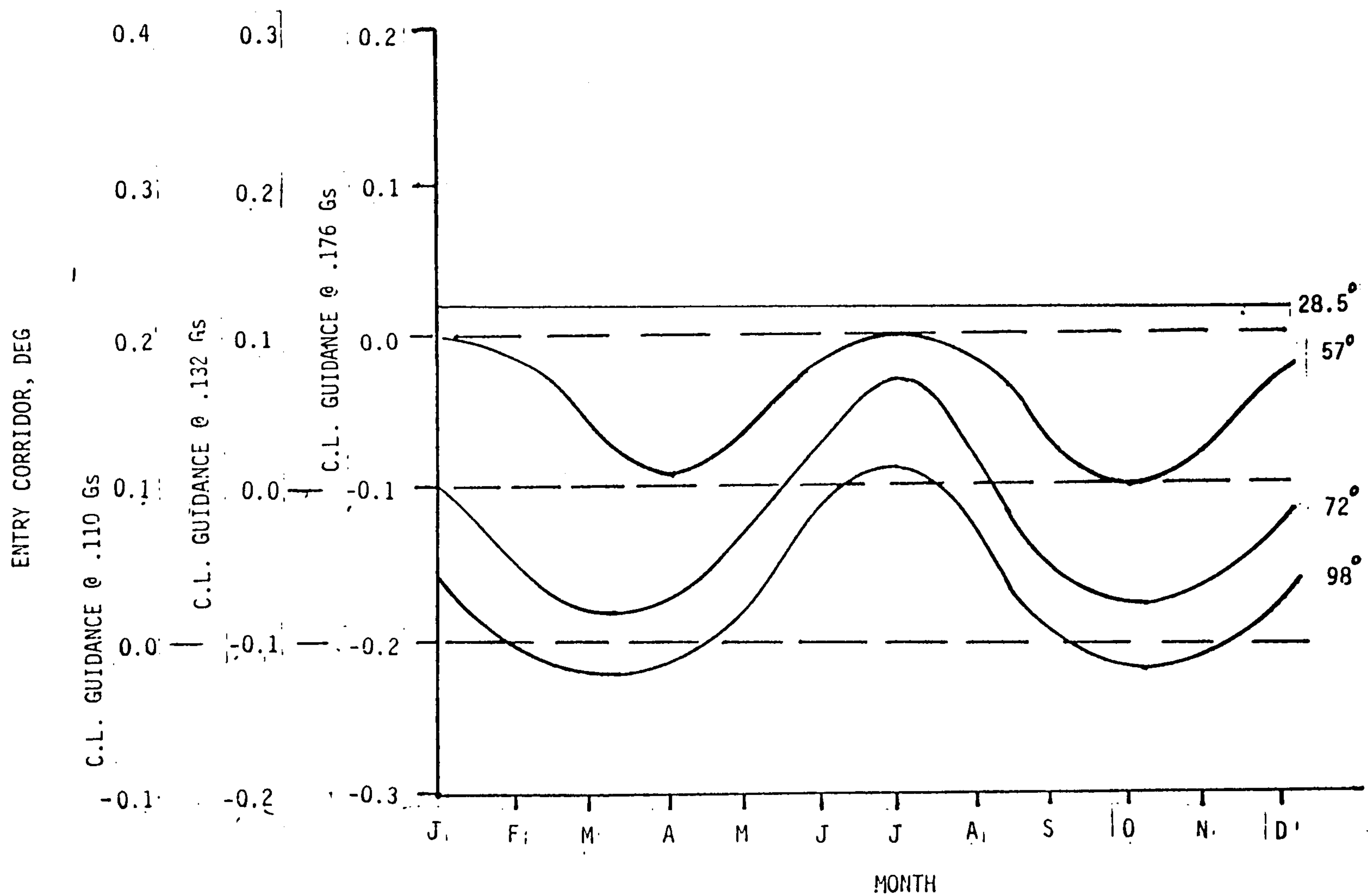

- MODEL'S "DENSITY SHEARS" CAN CAUSE SURFACE TEMPERATURE TRANSIENTS
  - DUE TO CLOSED LOOP PITCH RESPONSE TO DRAG ERRORS
- WTR HEAT RATES AND LOADS ARE HIGH ANYWAY DUE TO HIGH RELATIVE VELOCITY AND LONG RANGE
- MONTE CARLO ANALYSIS USED TO DEFINE STEEP CORRIDOR LIMIT

SURFACE	28.5°	57° (ASC)	57° (DSC)	90° (DSC)
NOSE	81°F	79°F	173°F	172°
WING L.E.	88°	112°	216°	299°
CHINE	70°	71°	141°	180°