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PROJECT APOLLO

PRELAUNCH GO/NO-GO COMPUTATIONS FOR THE APOLLO 10 MISSION

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FIGURES

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SUMMARY

The purpose of this internal note is to present prelaunch measured wind data and predicted command module horizontal velocities for land landings (in the event of a mode I abort) for the Apollo 10 mission. Land landing of the command module (CM) in the event of a near-pad abort is highly probable, and because the horizontal landing velocity is limited to insure structural integrity, the data presented are required by the MSC Flight Director during the prelaunch phase for GO/NO-GO considerations.

The last prelaunch wind measurement at t minus 1.25 hours indicated land landing would occur for a pad abort up to approximately 30 seconds g.e.t. The peak horizontal landing velocity calculated for the Apollo 10 mission was 44 fps, which is less than the spacecraft landing restriction of 54 fps. Therefore, it was not necessary to delay the Apollo 10 launch for this restriction.

INTRODUCTION

The design capability of the Apollo spacecraft indicates that, in the event of a mode I launch escape vehicle (LEV) abort, a land landing is acceptable if the horizontal velocity of the CM at landing does not exceed 54 fps.

These data were provided real time during the Apollo 10 prelaunch countdown to the MSC Flight Director to aid in the GO/NO-GO decision.

PROCEDURE

The procedure for calculation of the horizontal velocities is described briefly as follows.

1. The peak wind velocities in knots are recorded from the 500-foot NASA meteorological tower 703 for altitudes of 162 feet, 200 feet, 300 feet, 400 feet and 500 feet and are plotted against the corresponding altitudes on full logarithmic paper (fig. 1).

2. A value is determined for the wind profile slope P by use of an overlay (fig. 2) which consists of a family of peak wind profile slopes referenced to the 162-foot altitude.

3. The spacecraft's horizontal landing velocity is determined by use of a plot (fig. 3) which represents lines of constant spacecraft horizontal velocities plotted as functions of P versus peak velocity at 162 feet.

RESULTS

The wind profile measurements obtained prior to lift-off from the 500-foot NASA meteorological tower at KSC were recorded on May 18, 1969, at t minus 9.5 hours, at t minus 7.25 hours, at t minus 4.25 hours, at t minus 1.5 hours, and at t minus 0.5 hours. The peak wind velocities were recorded for altitudes of 162 feet, 200 feet, 300 feet, 400 feet, and 500 feet.

These data were recorded and are presented in figure 4. The peak wind velocity, the wind profile slope P, and the predicted horizontal landing velocity for each time prior to lift-off are tabulated and presented in table I. A plot of the prelaunch calculated mode I abort landing points for the final wind measurement is presented in figure 5.

CONCLUDING REMARKS

All of the predicted horizontal velocities were below the spacecraft landing restriction of 54 fps. The maximum horizontal landing velocity calculated for the Apollo 10 mission was 44 fps which is the maximum calculated for Apollo missions. Therefore it was not necessary to delay the Apollo 10 launch for this restriction.

TABLE I.- APOLLO 10 MISSION PRELAUNCH WIND DATA

Time prior to lift-off, t minus hr	Peak velocity, knots					Wind profile slope, P	Predicted horizontal landing velocity, fps
	162-ft altitude	200-ft altitude	300-ft altitude	400-ft altitude	500-ft altitude		
t - 9.5	16	16	20	20	21	0.22	32
t - 7.25	19	18	22	23	23	.199	37
t - 4.25	20	22	23	24	26	.250	41
t - 1.5	24	25	26	26	26	.10	44
t - 0.5	25	24	27	27	26	.06	44

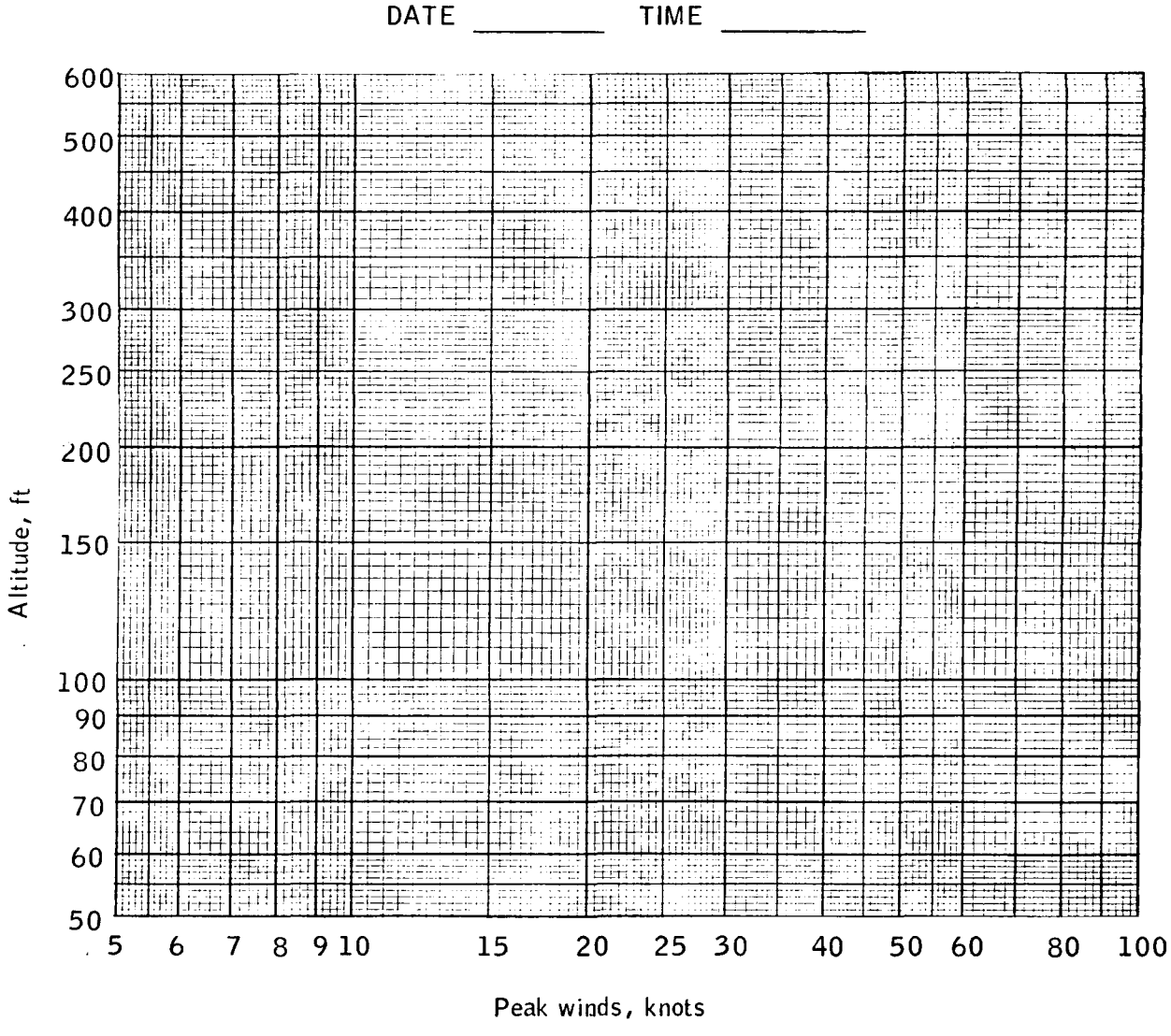


Figure 1.- Plotting chart, peak wind velocity versus altitude.

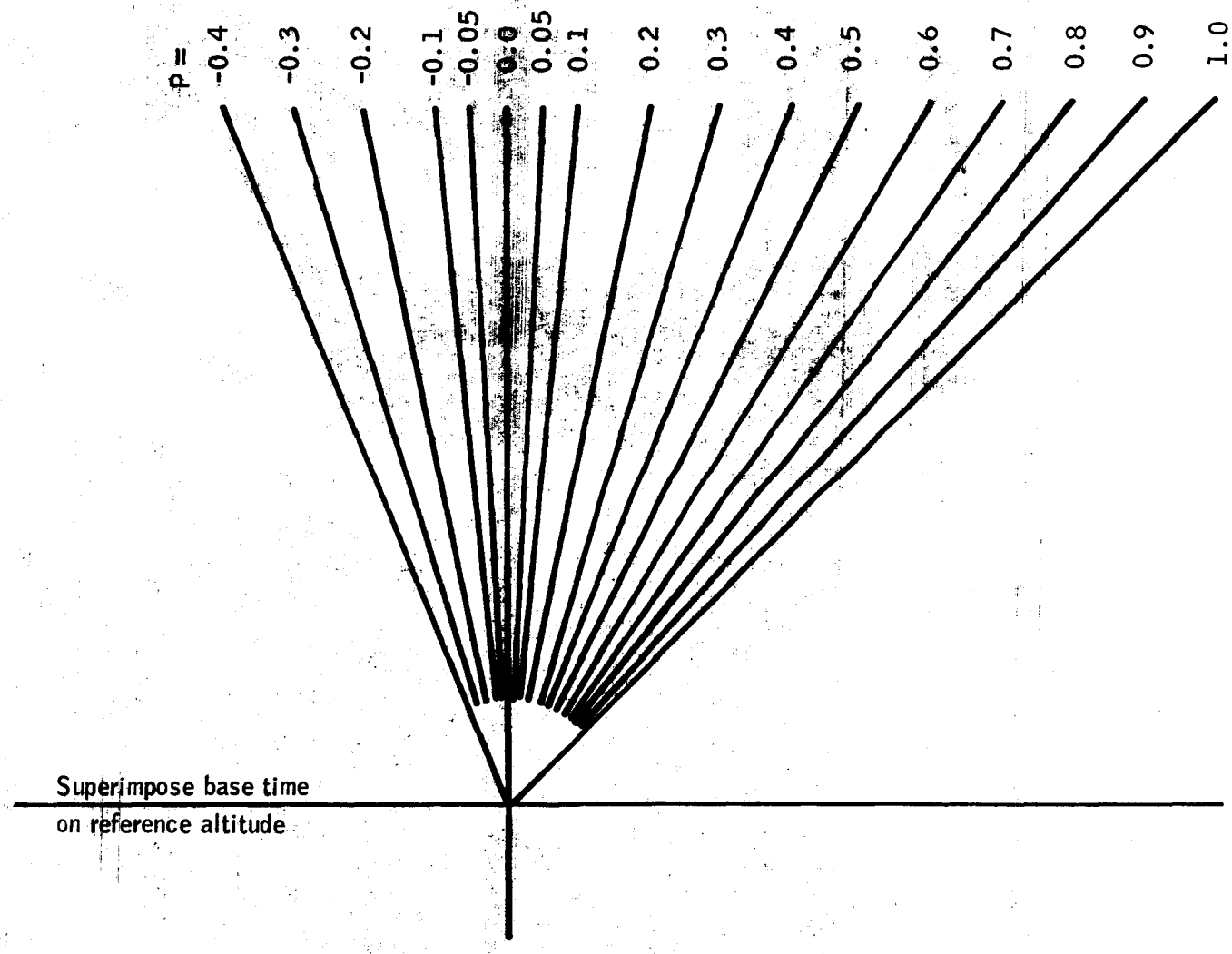


Figure 2.- Family of peak wind profile slopes.

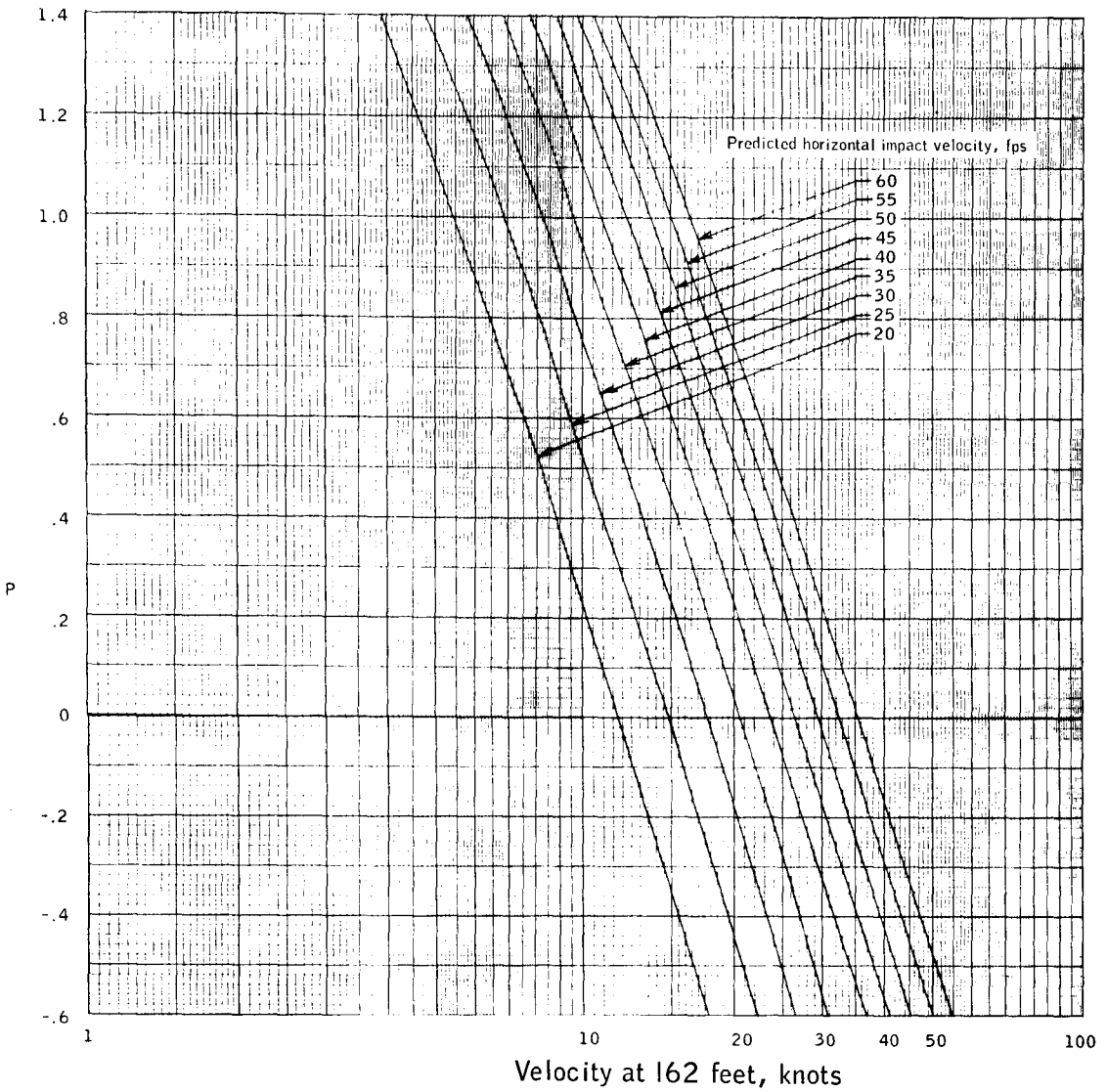
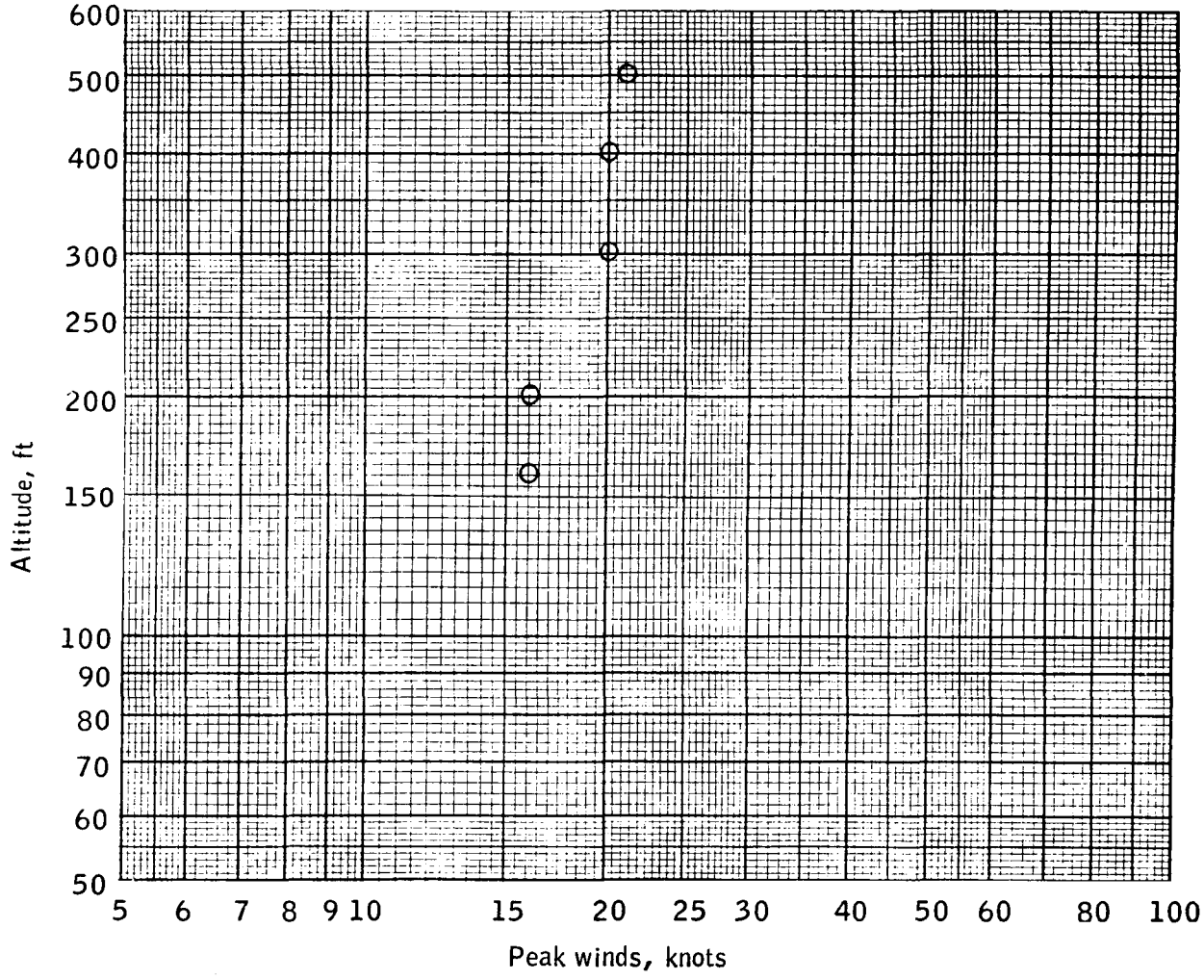
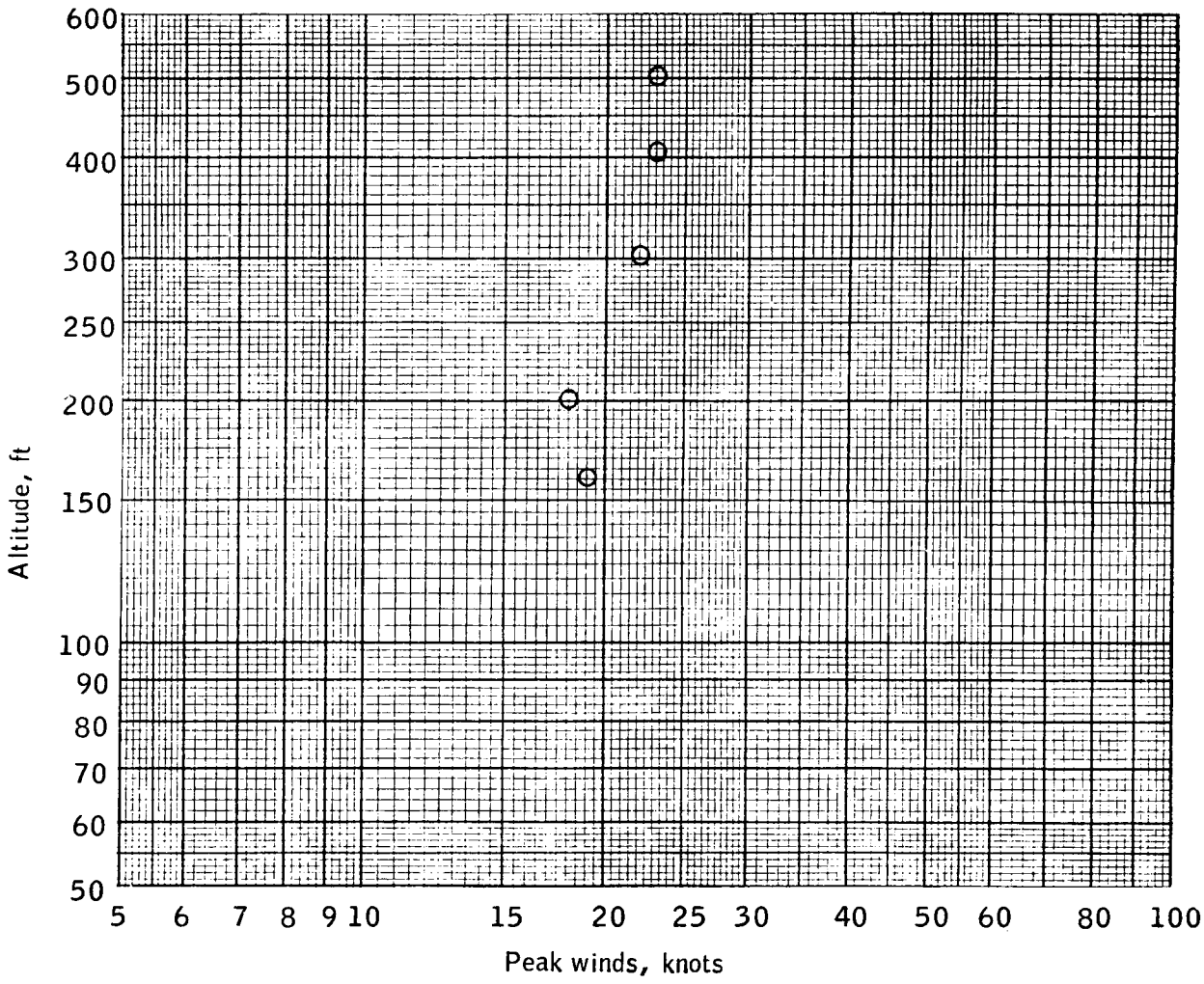


Figure 3.- Constant horizontal impact velocities plotted as functions of P versus $(V_H)_0$ (162-ft reference altitude, gust duration 10 seconds or more).



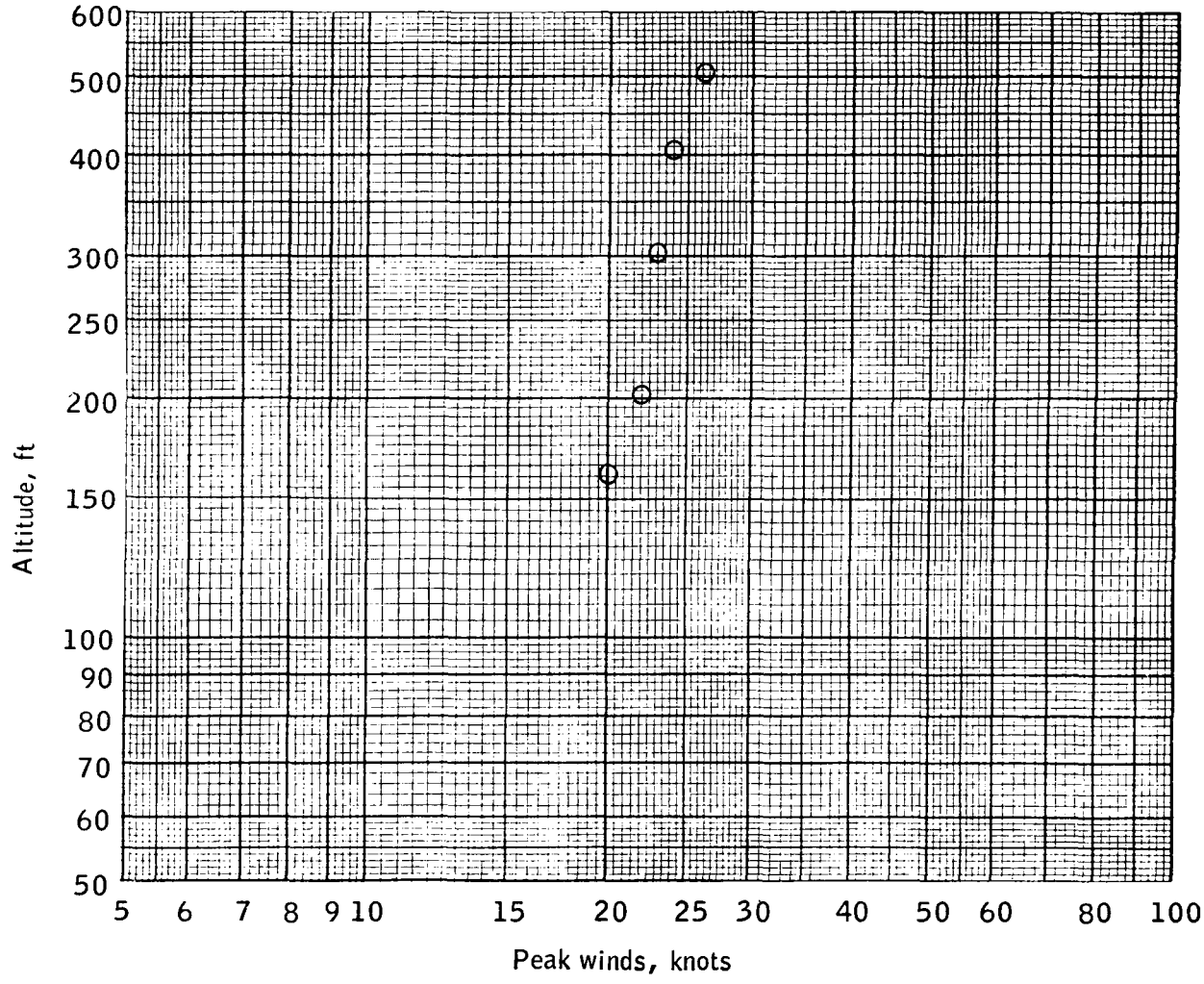
(a) t minus 9.5 hours.

Figure 4.- Peak wind velocity versus altitude.



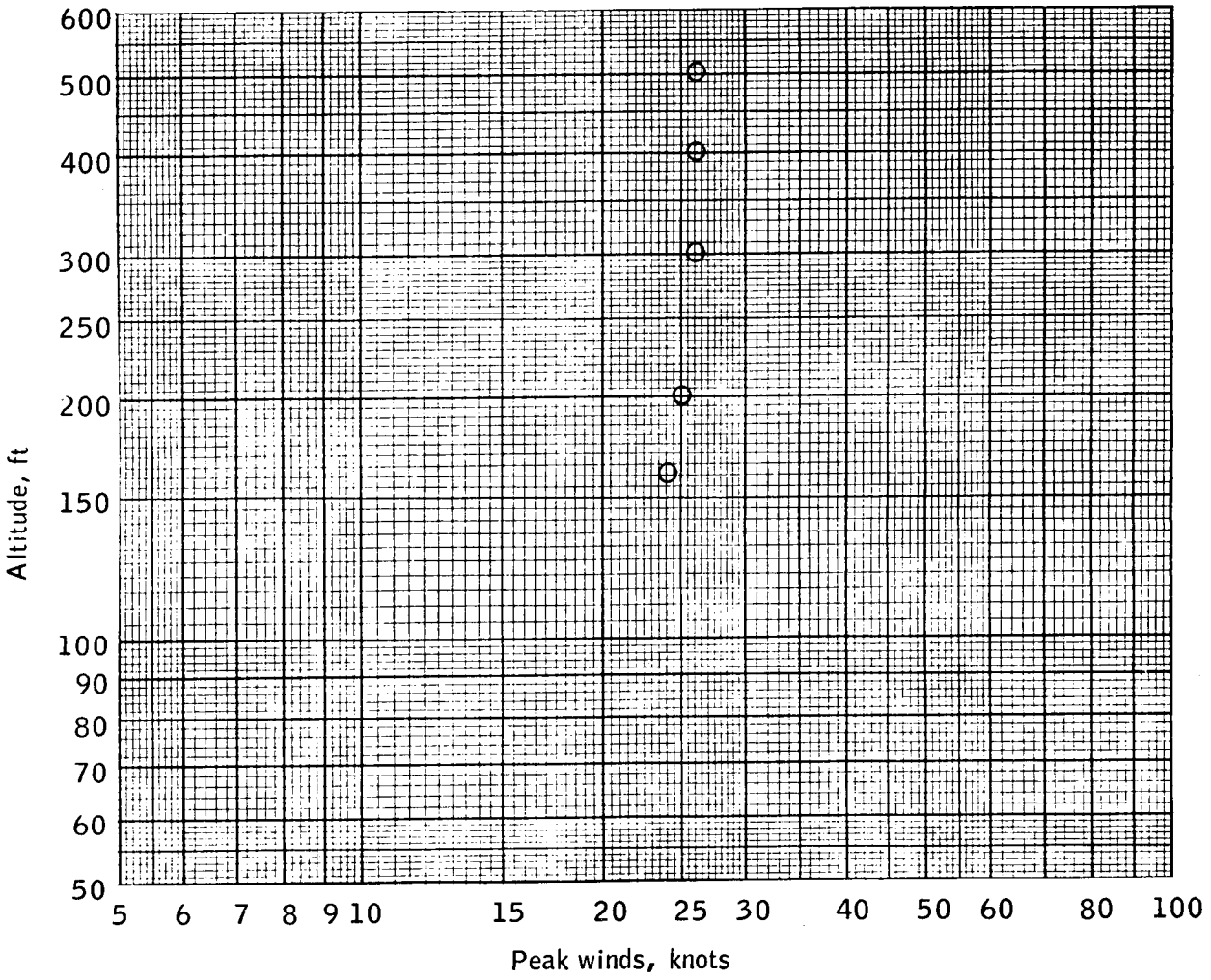
(b) t minus 7.25 hours.

Figure 4.- Continued.



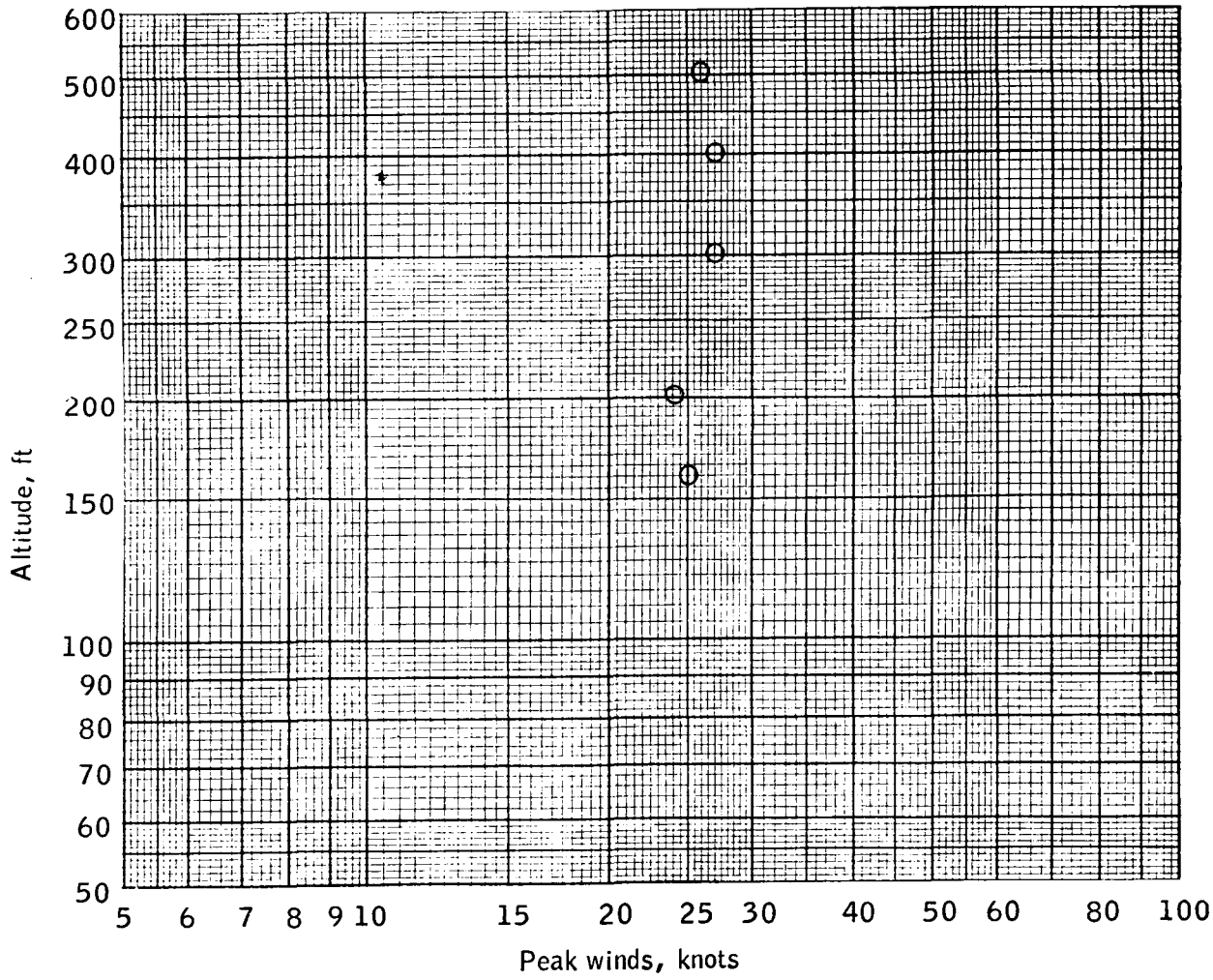
(c) t minus 4.25 hours.

Figure 4.- Continued.



(d) t minus 1.5 hours.

Figure 4.- Continued.



(e) t minus 0.5 hour.

Figure 4.- Concluded.

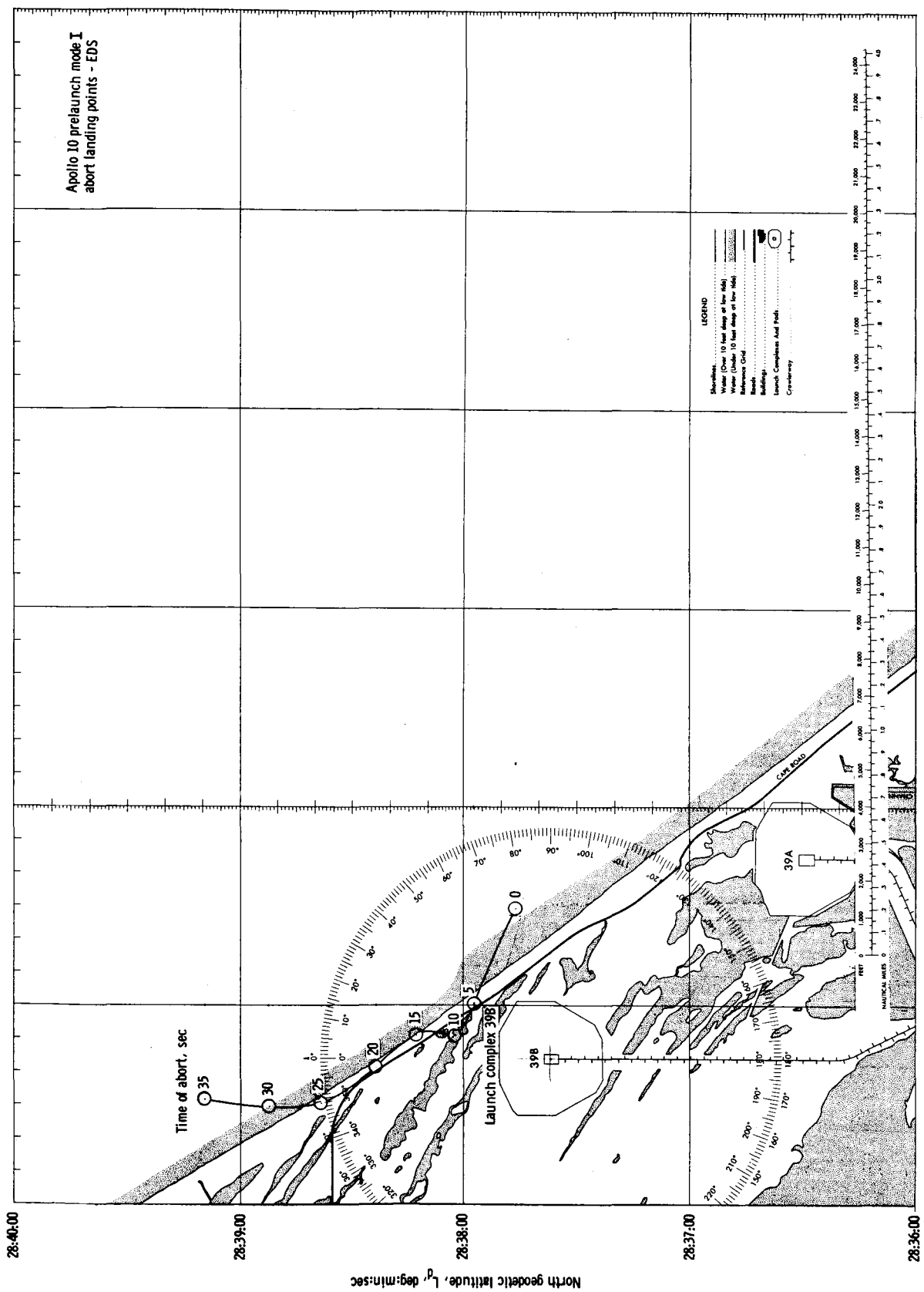


Figure 5.- Mode I abort landing points for the t minus 1.25 hour winds.

REFERENCE

1. Newman, Samuel R.; and Ives, Dallas G.: Predicted Horizontal Velocity for Spacecraft Land Landings Calculated During the Apollo 8 Countdown Demonstration Test. MSC IN 69-FM-2, January 7, 1969.