



AD614673

EXPERIMENTAL MODEL STUDIES OF THE DYNAMIC VELOCITY
FLUCTUATIONS EXISTING IN THE AIR WAKE
OF AN AIRCRAFT CARRIER

Part II: APPENDIX (GRAPHS OF EXPERIMENTAL DATA)

by
August F. Lehman
and
Paul Kaplan

Prepared For:

Office of Naval Research
Department of the Navy
Washington, D. C. 20360

COPY	2	OF	3	by
HARD COPY		\$.	3.00	
MICROFICHE		\$.	0.75	

638

Report No. 65-21
Part II

March, 1965



ARCHIVE COPY

Technical Industrial Park / Plainview, N. Y.

APPENDIX (GRAPHS OF EXPERIMENTAL DATA) TO
EXPERIMENTAL MODEL STUDIES OF THE DYNAMIC VELOCITY
FLUCTUATIONS EXISTING IN THE AIR WAKE
OF AN AIRCRAFT CARRIER

by

August F. Lehman

and

Paul Kaplan

Prepared For:

Office of Naval Research
Department of the Navy
Washington, D. C. 20360

Under Contract No. Nonr-4186(00)

Reproduction in whole or in part is permitted
for any purpose of the United States Government

Report No. 65-21

March, 1965

Part II

APPENDIX MATERIAL

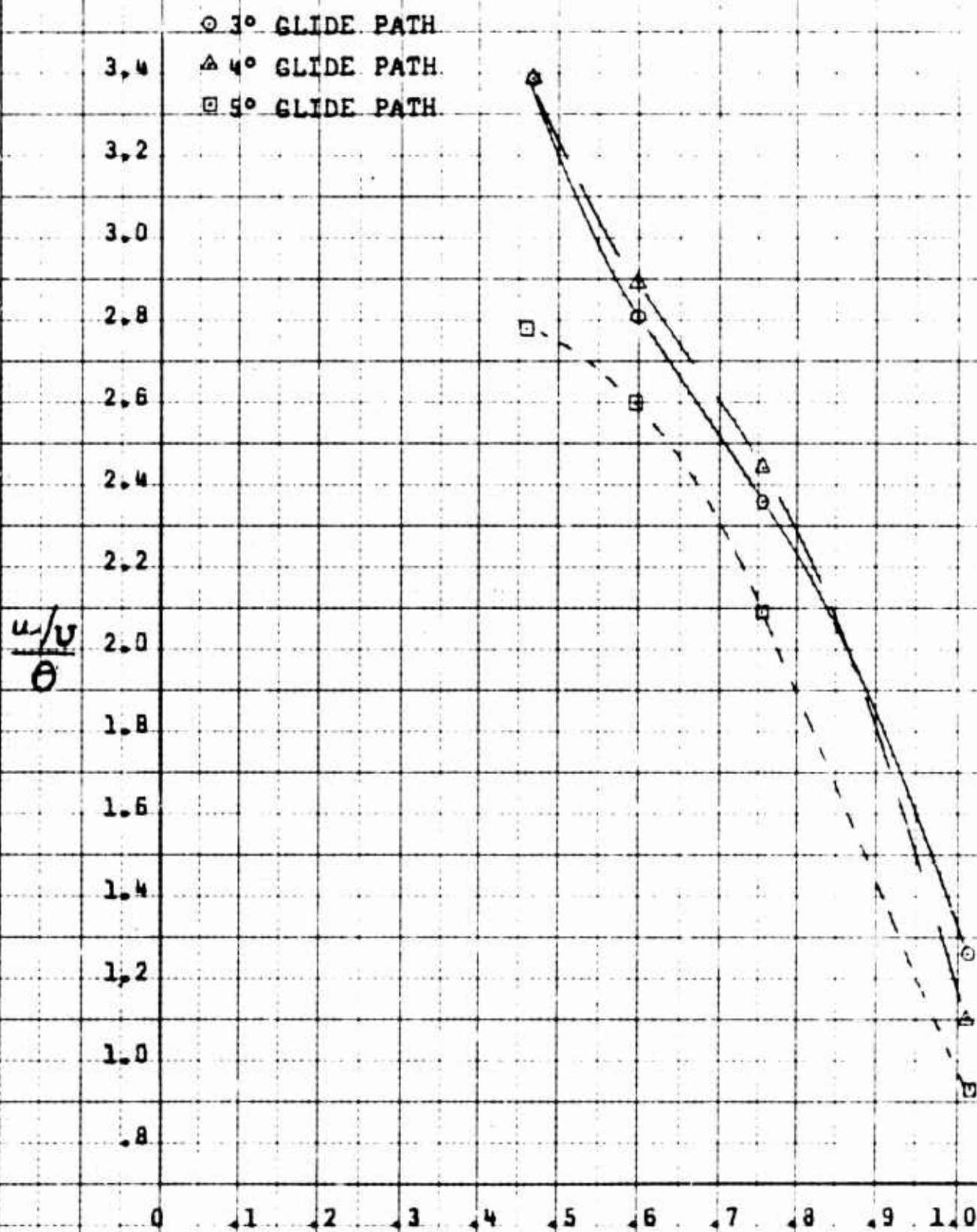
	Page No.
Horizontal Velocity; Pitch Transfer Function Amplitude	
Wind 3° Port	A- 1 - A- 3
Wind 10° Port	A- 9 - A-16
Horizontal Velocity; Pitch Transfer Function Phase	
Wind 3° Port	A-17 - A-20
Wind 10° Port	A-21 - A-24
Vertical Velocity; Pitch Transfer Function Amplitude	
Wind 3° Port	A-25 - A-32
Wind 10° Port	A-33 - A-40
Vertical Velocity; Pitch Transfer Function Phase	
Wind 3° Port	A-41 - A-44
Wind 10° Port	A-45 - A-48
Horizontal Power Spectra	
Wind 3° Port	A-49 - A-52
Wind 10° Port	A-53 - A-56
Vertical Power Spectra	
Wind 3° Port	A-57 - A-58
Wind 10° Port	A-59 - A-60

NOTE: Wind orientation is from the keel-line of the ship; i.e. wind 3° port is 3° port of the ship's keel, wind 10° port is 10° port of the ship's keel.

Distances are given in feet aft of the touchdown point. For Forrestal class carriers, the touchdown point is considered 150 feet ahead of the trailing edge of the ramp. To determine distances aft of the ramp, subtract 150 feet from distances given in the figures.

HORIZONTAL VELOCITY - PITCH TRANSFER FUNCTION AMPLITUDE

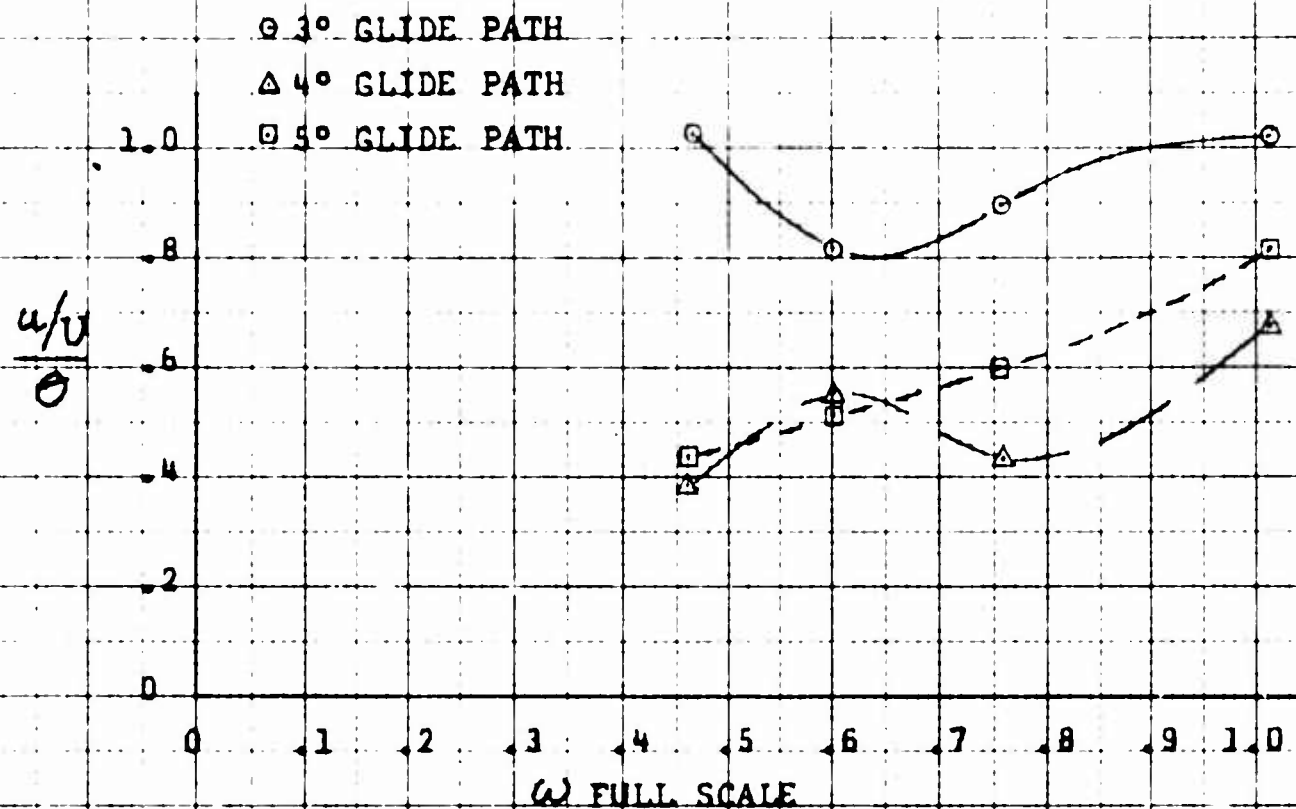
WIND 3° PORT



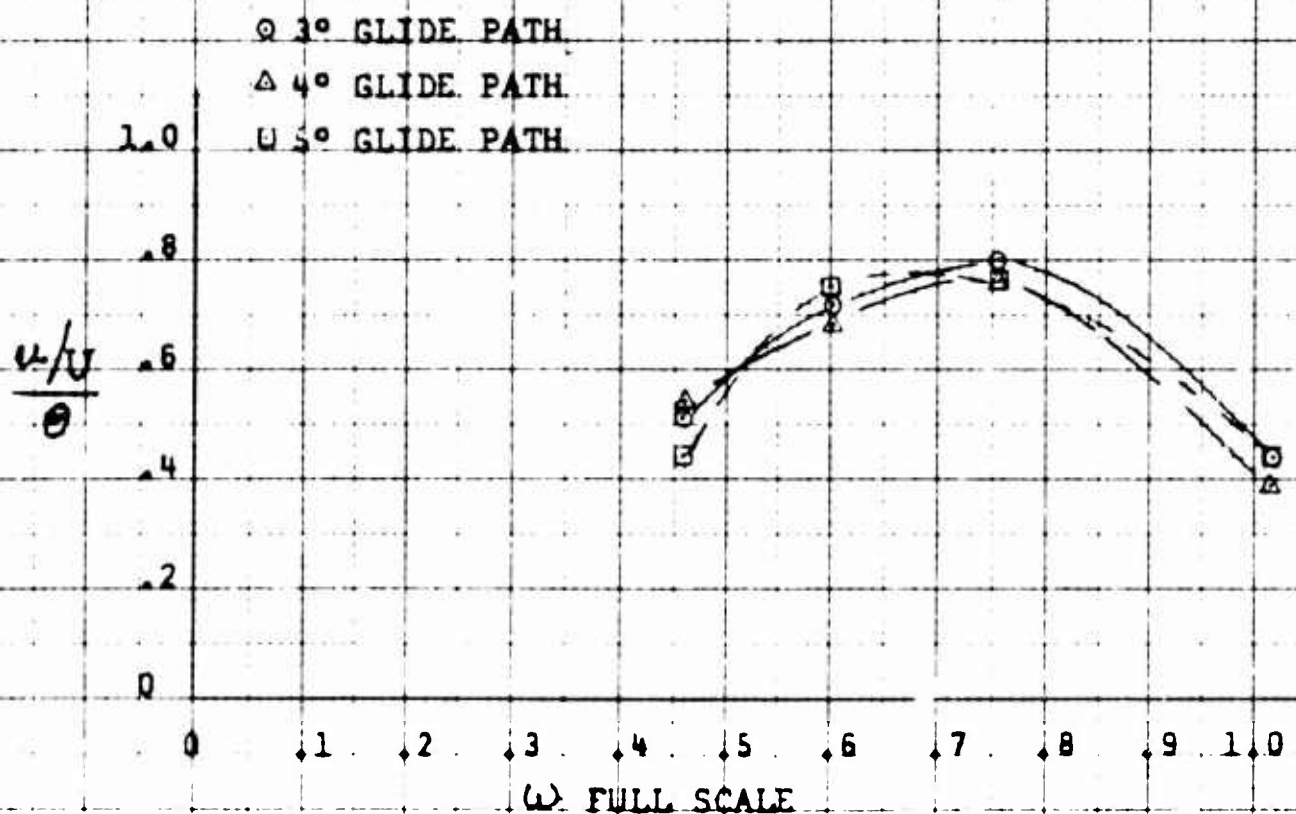
(W) FULL SCALE

226 FEET AFT OF TOUCHDOWN POINT, 47 FEET PORT OF GLIDE PATH

HORIZONTAL VELOCITY - PITCH TRANSFER FUNCTION AMPLITUDE
WIND 3° PORT



226 FEET AFT OF TOUCHDOWN POINT ON GLIDE PATH CENTERLINE



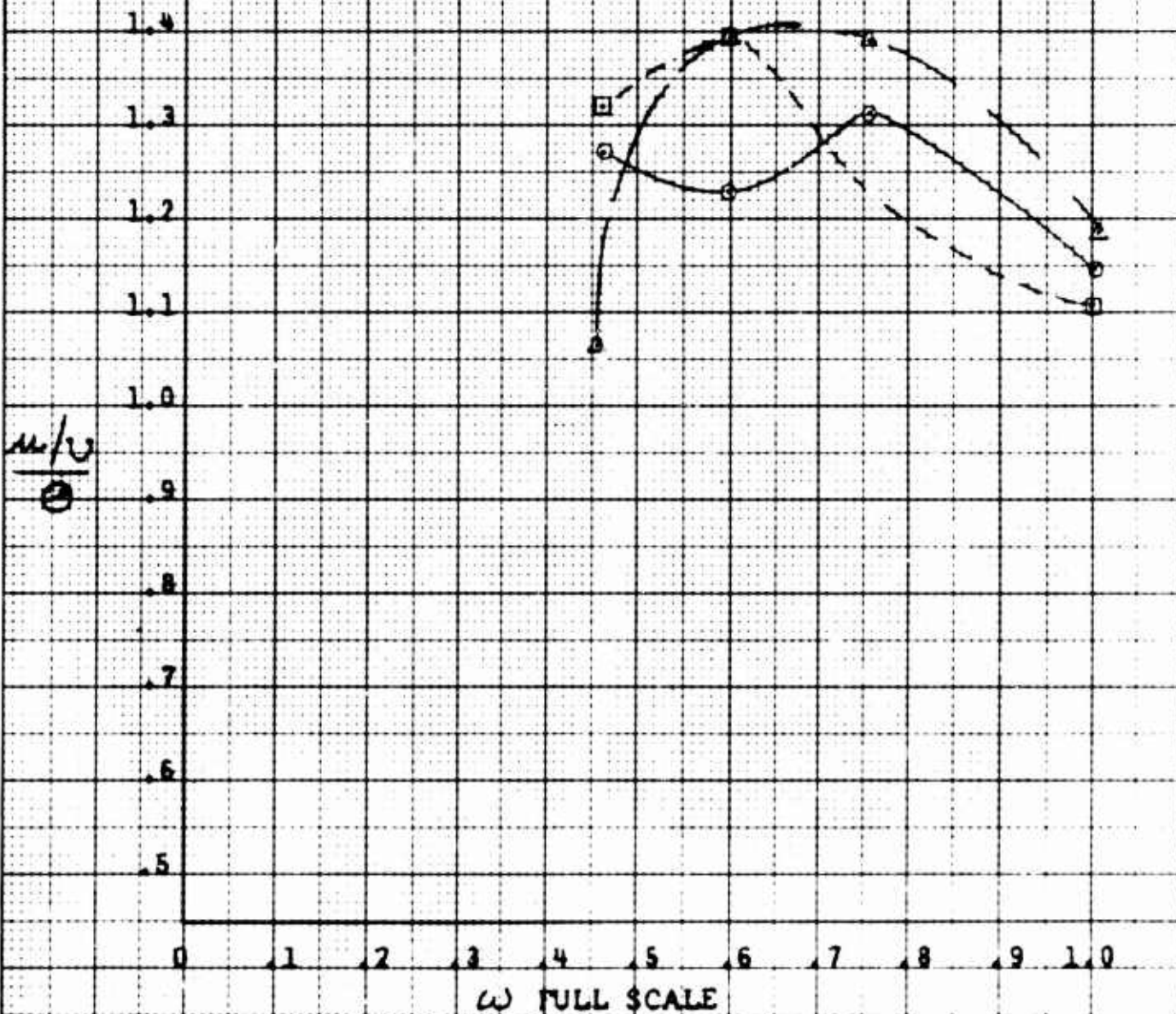
226 FEET AFT OF TOUCHDOWN POINT, 47 FEET STARBOARD OF GLIDE PATH

HORIZONTAL VELOCITY - PITCH TRANSFER FUNCTION AMPLITUDE WIND 3° PORT

○ 3° GLIDE PATH

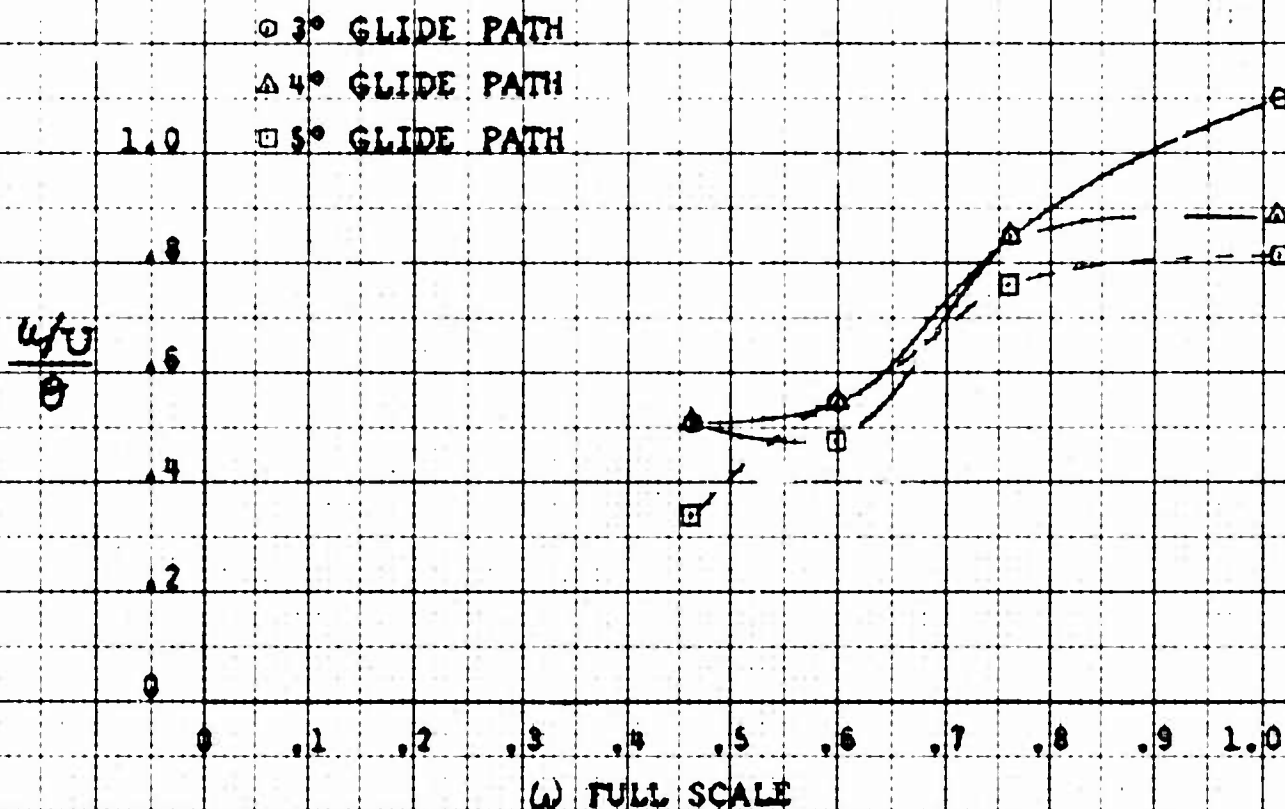
△ 4° GLIDE PATH

□ 5° GLIDE PATH

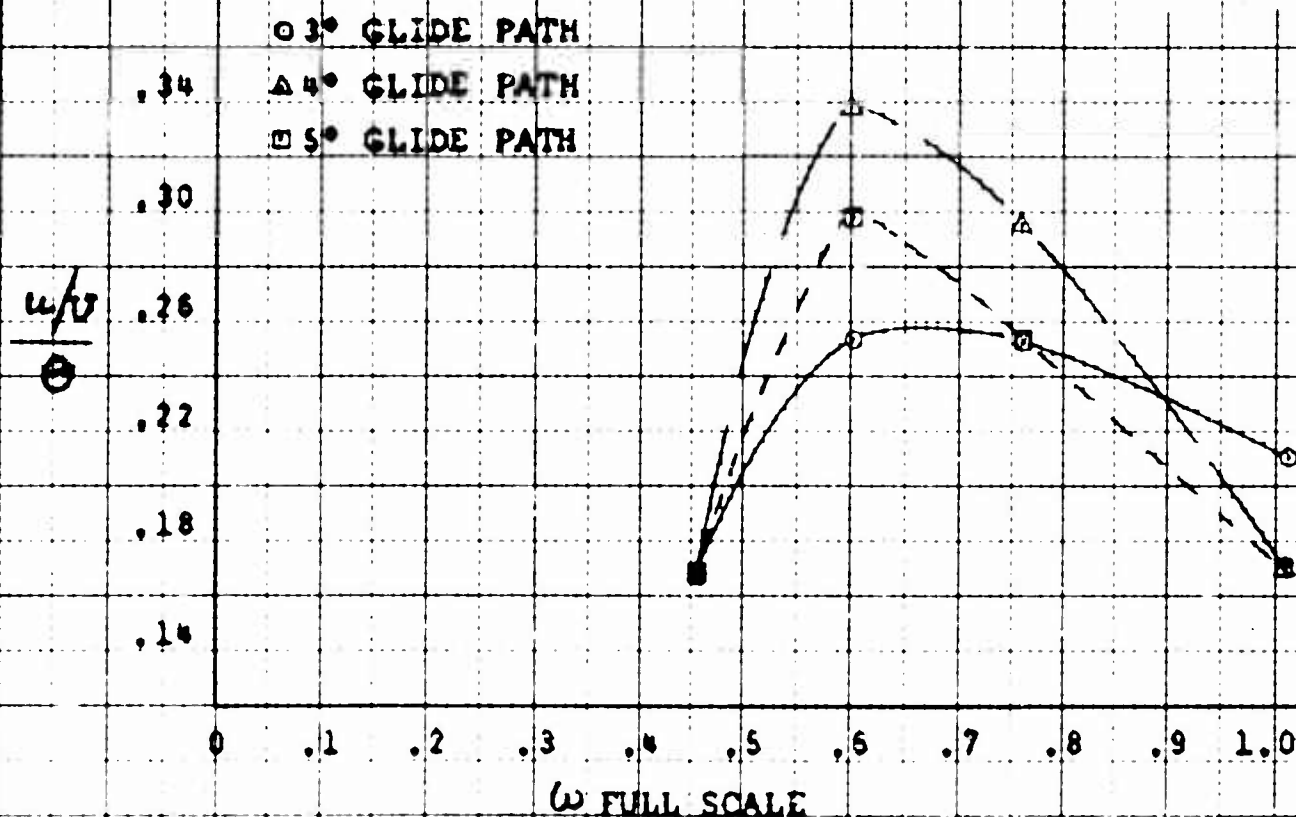


485 FEET AFT OF TOUCHDOWN POINT, 47 FEET PORT OF GLIDE PATH

HORIZONTAL VELOCITY - PITCH TRANSFER FUNCTION AMPLITUDE WIND 3° PORT

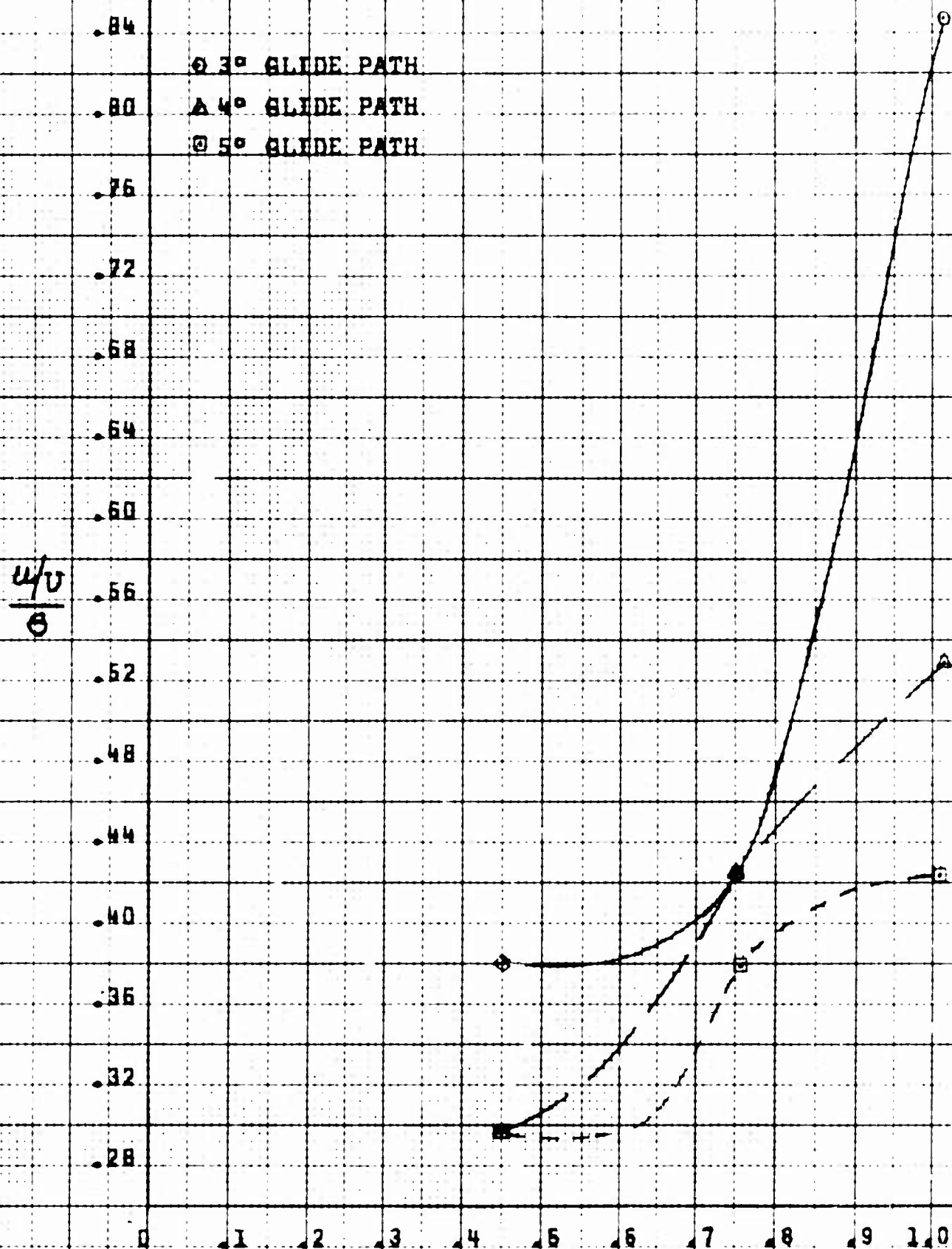


485 FEET AFT OF TOUCHDOWN POINT ON GLIDE PATH CENTERLINE



485 FEET AFT OF TOUCHDOWN POINT, 47 FEET STARBOARD OF GLIDE PATH

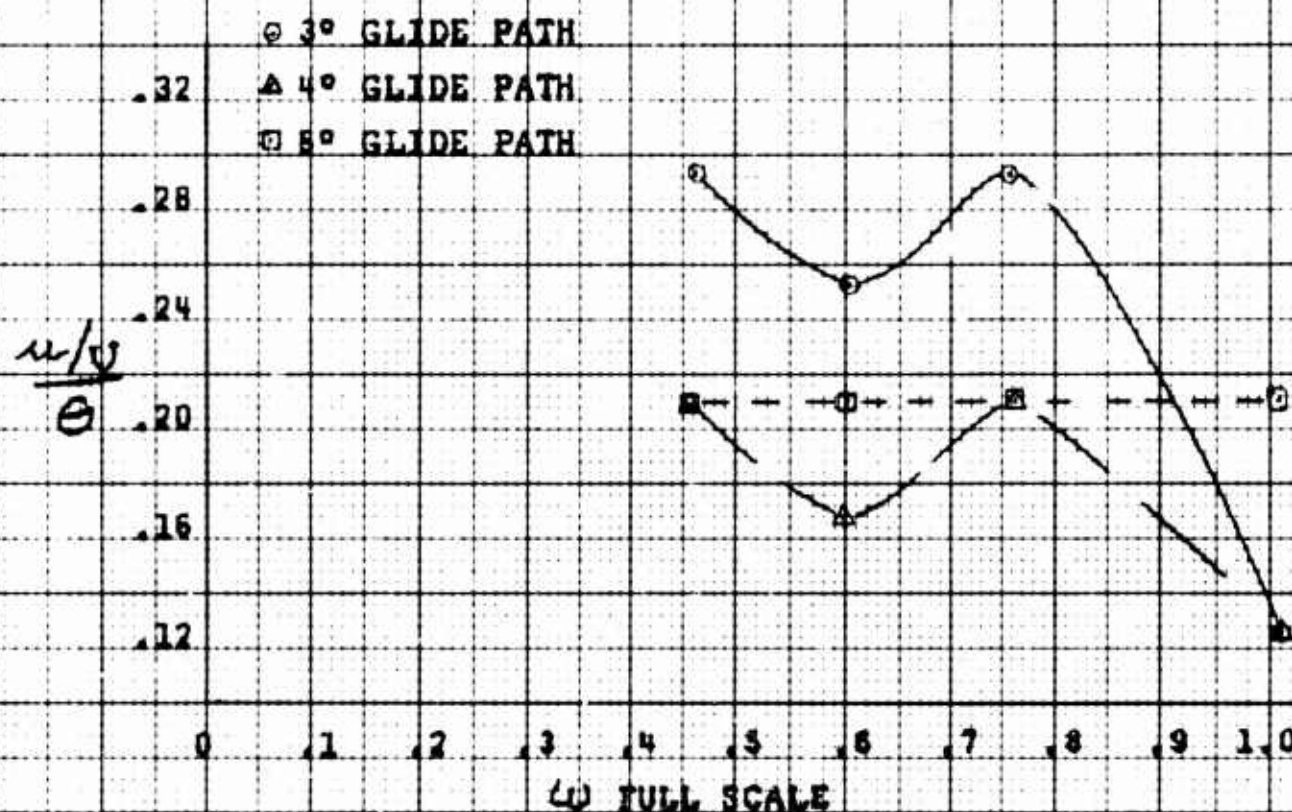
HORIZONTAL VELOCITY - FITCH TRANSFER FUNCTION AMPLITUDE
WIND 3° PORT



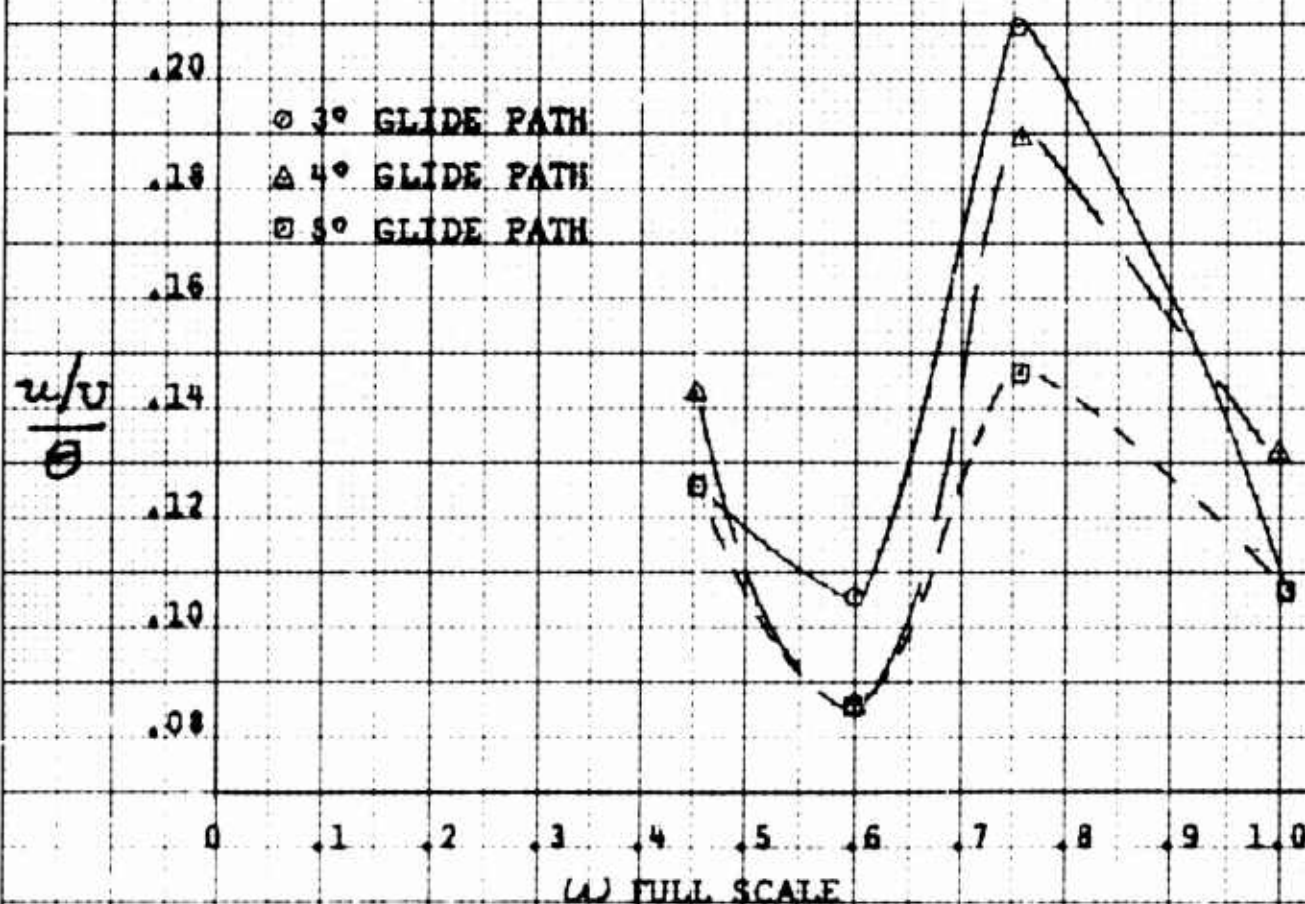
(A) FULL SCALE

764 FEET AFT OF TOUCHDOWN POINT, 47 FEET PORT OF GLIDE PATH

HORIZONTAL VELOCITY - PITCH TRANSFER FUNCTION AMPLITUDE
WIND 3° PORT

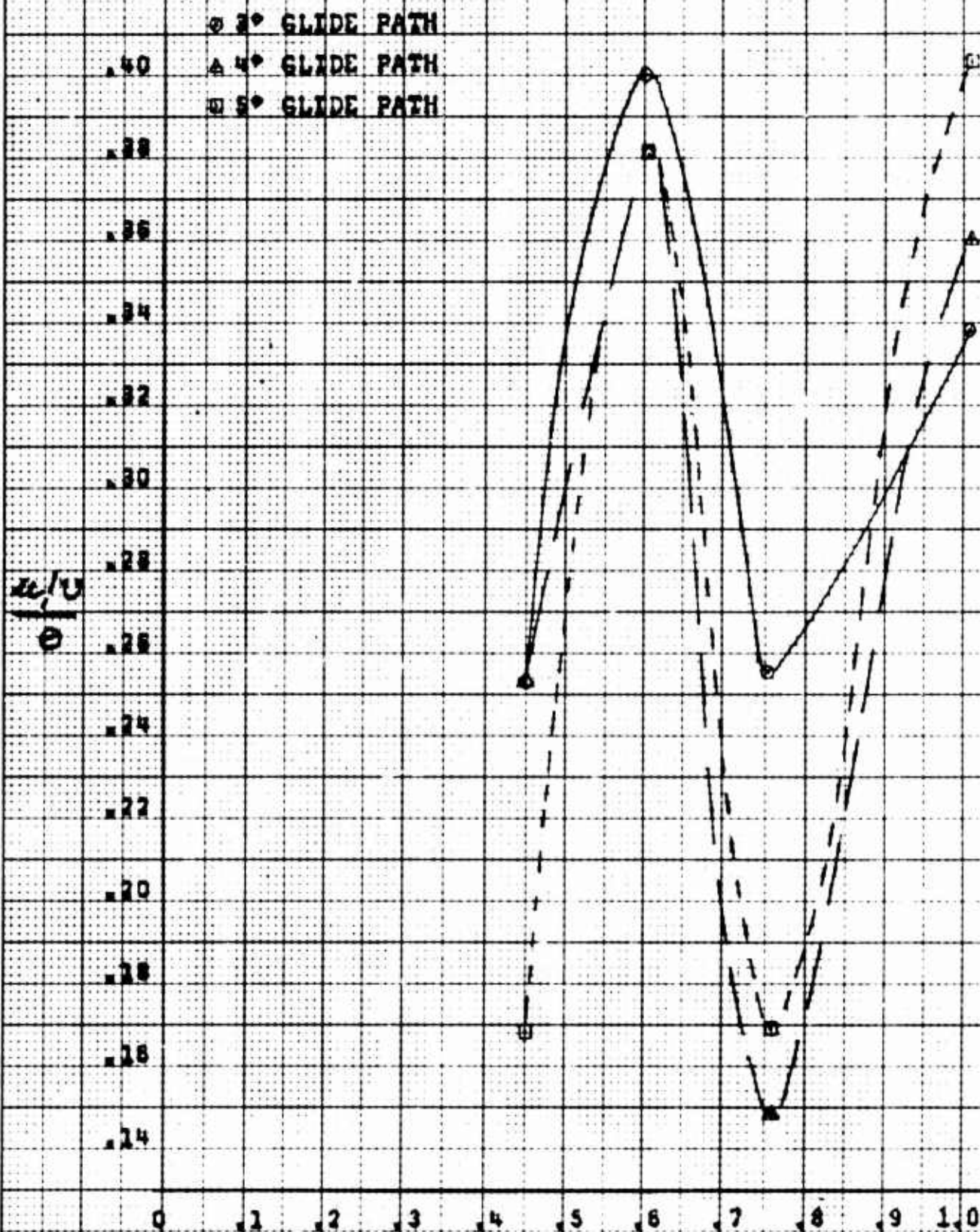


764 FEET AFT OF TOUCHDOWN, JNT ON GLIDE PATH CENTERLINE



764 FEET AFT OF TOUCHDOWN POINT, 47 FEET STARBOARD OF GLIDE PATH

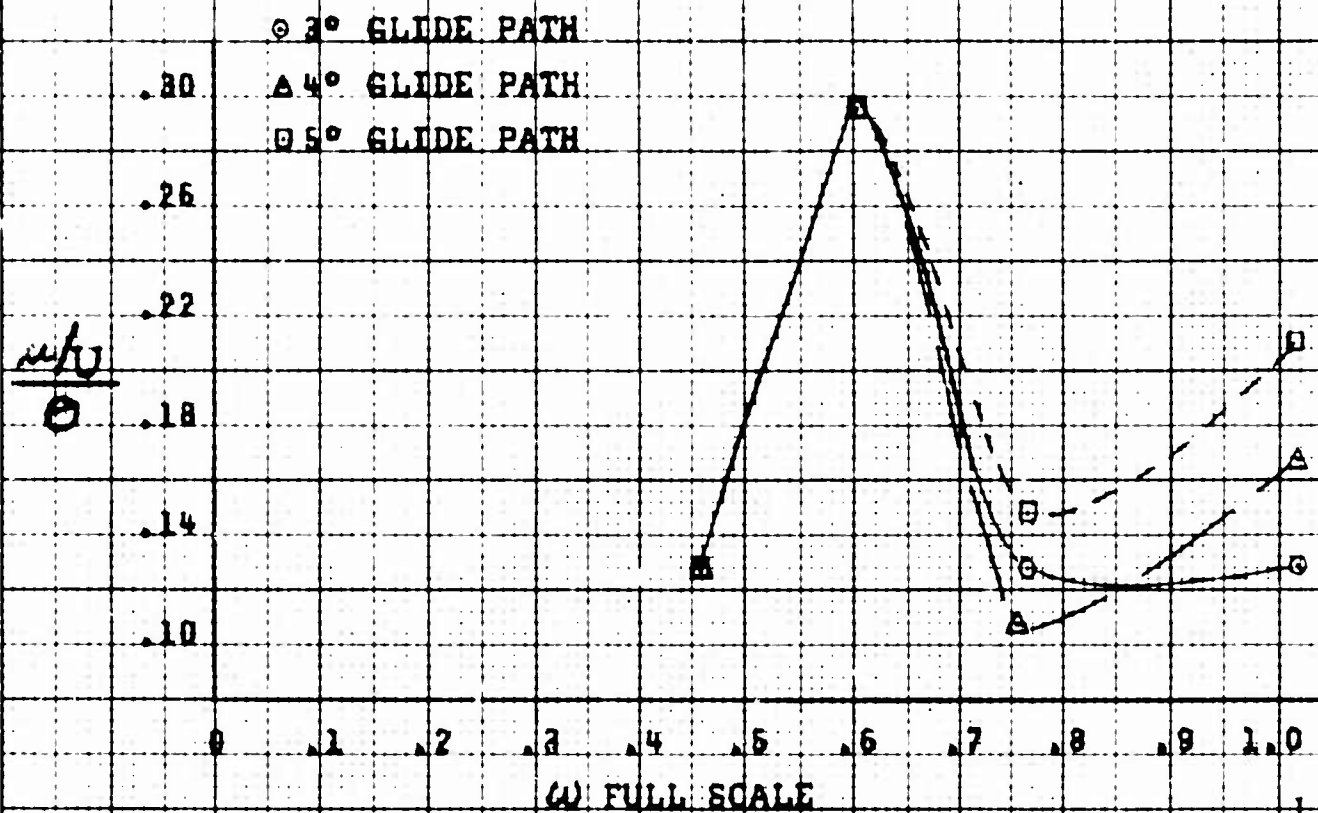
HORIZONTAL VELOCITY - FITCH TRANSFER FUNCTION AMPLITUDE WIND 3° PORT



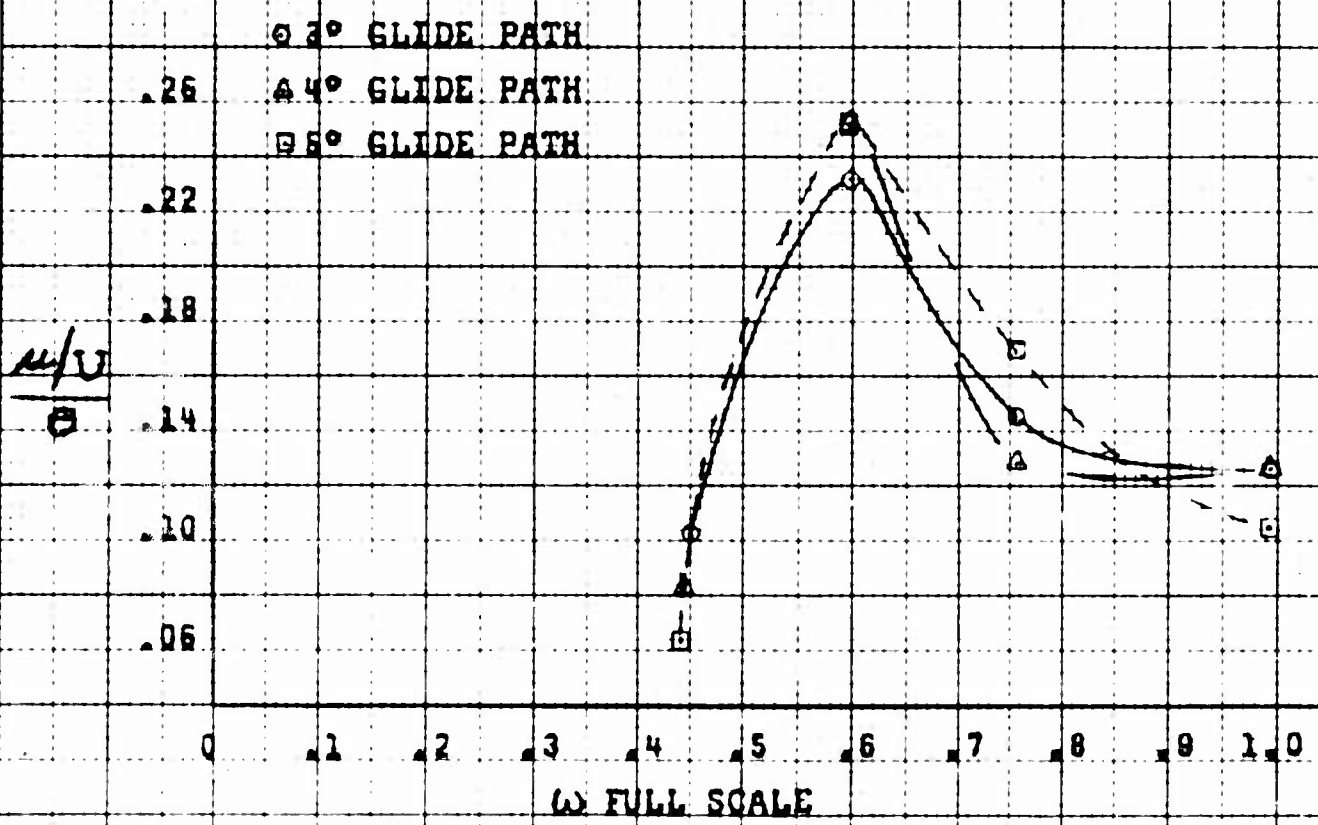
ω FULL SCALE

1040 FEET AFT OF TOUCHDOWN POINT, 47 FEET PORT OF GLIDE PATH

HORIZONTAL VELOCITY - PITCH TRANSFER FUNCTION AMPLITUDE
WIND 3° PORT



1040 FEET AFT OF TOUCHDOWN POINT ON GLIDE PATH CENTERLINE



1040 FEET AFT OF TOUCHDOWN POINT, 47 FEET STARBOARD OF GLIDE PATH

HORIZONTAL VELOCITY - PITCH TRANSFER FUNCTION AMPLITUDE WIND 10° PORT

○ 3° GLIDE PATH

△ 4° GLIDE PATH

□ 5° GLIDE PATH

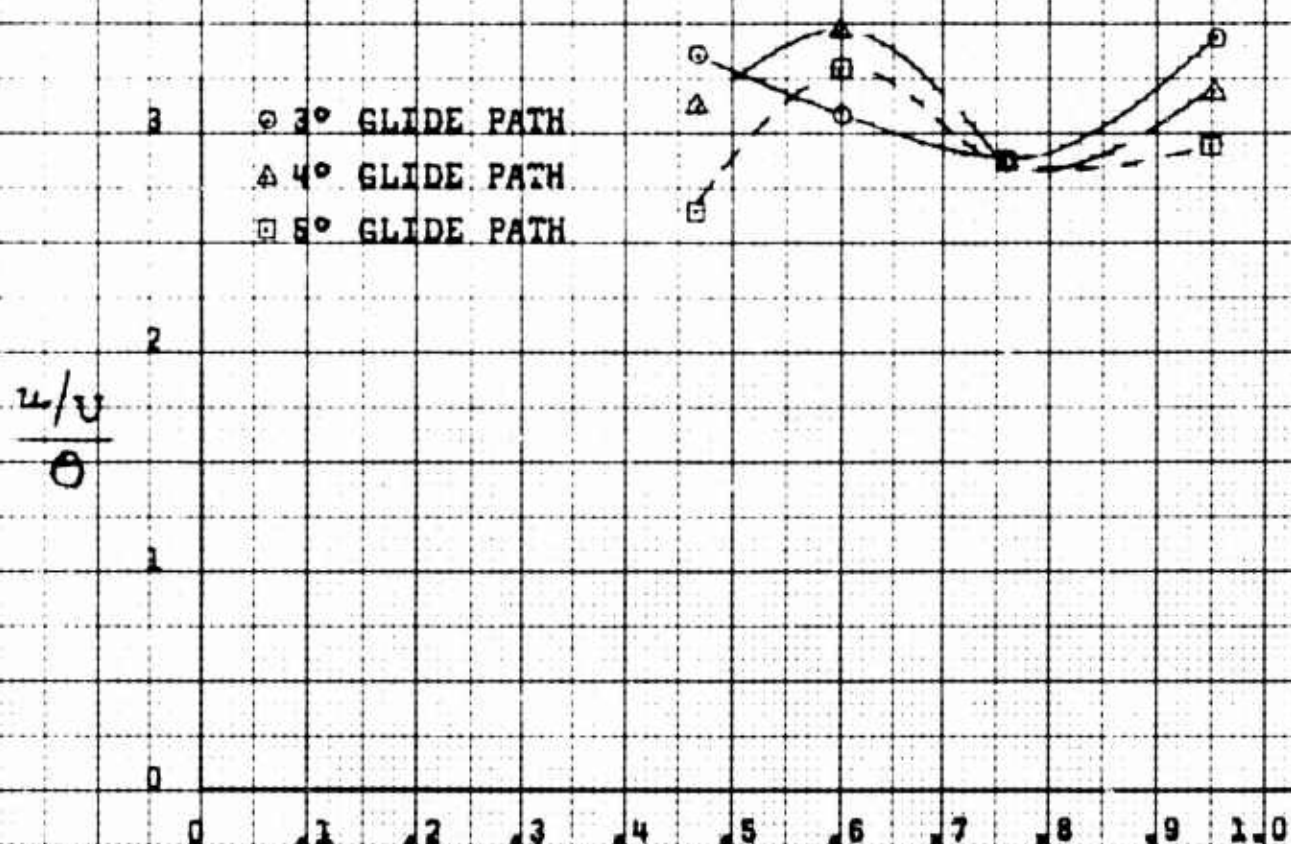
$\frac{u}{U}$
⊕

0 .1 .2 .3 .4 .5 .6 .7 .8 .9 1.0

ω FULL SCALE

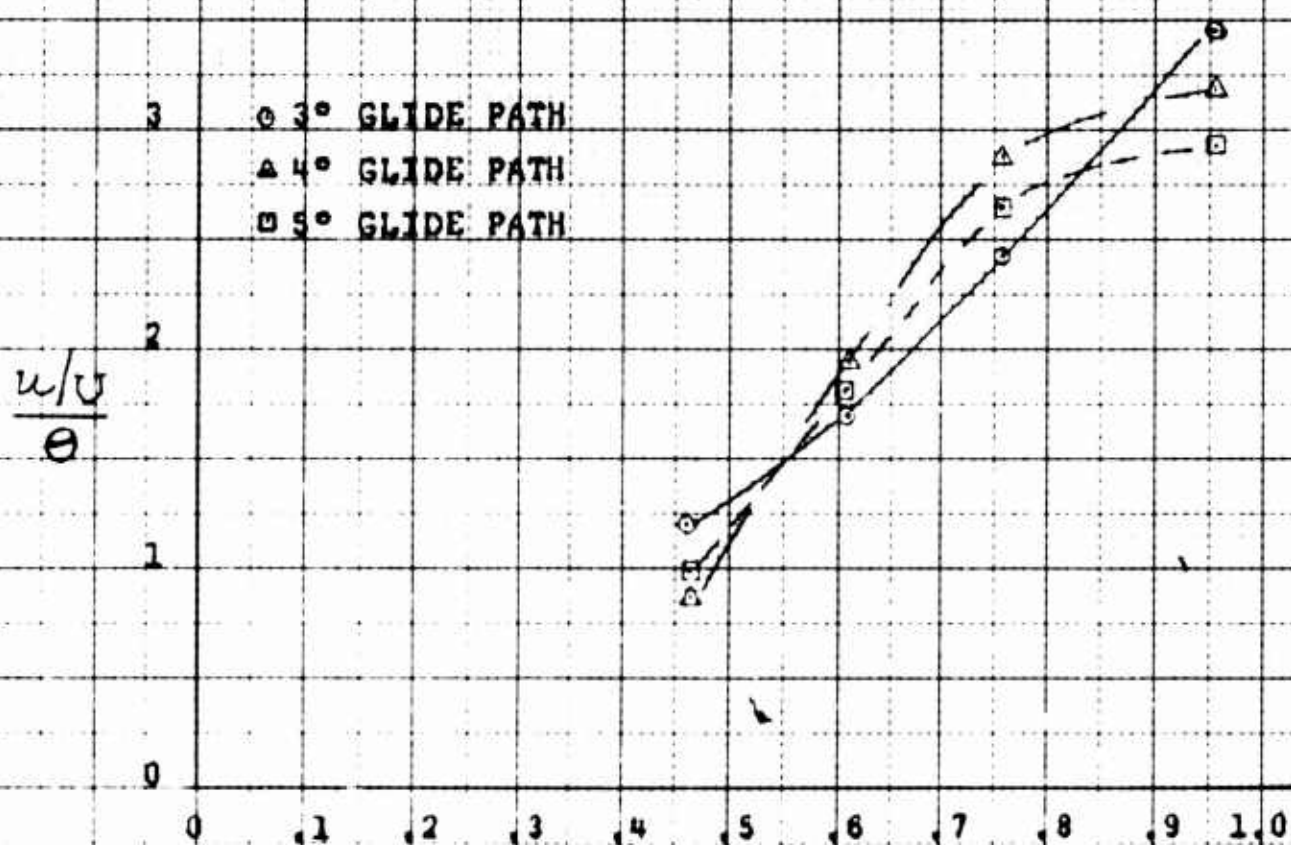
226 FEET AFT OF TOUCHDOWN POINT ON GLIDE PATH CENTERLINE

HORIZONTAL VELOCITY - PITCH TRANSFER FUNCTION AMPLITUDE
WIND 10° PORT



(a) FULL SCALE

226 FEET AFT OF TOUCHDOWN POINT, 47 FEET PORT OF GLIDE PATH



(b) FULL SCALE

226 FEET AFT OF TOUCHDOWN POINT, 47 FEET STARBOARD OF GLIDE PATH

HORIZONTAL VELOCITY - FITCH TRANSFER FUNCTION AMPLITUDE WIND 10° PORT

0.3° GLIDE PATH
0.4° GLIDE PATH
0.5° GLIDE PATH

u/V

0.2

1

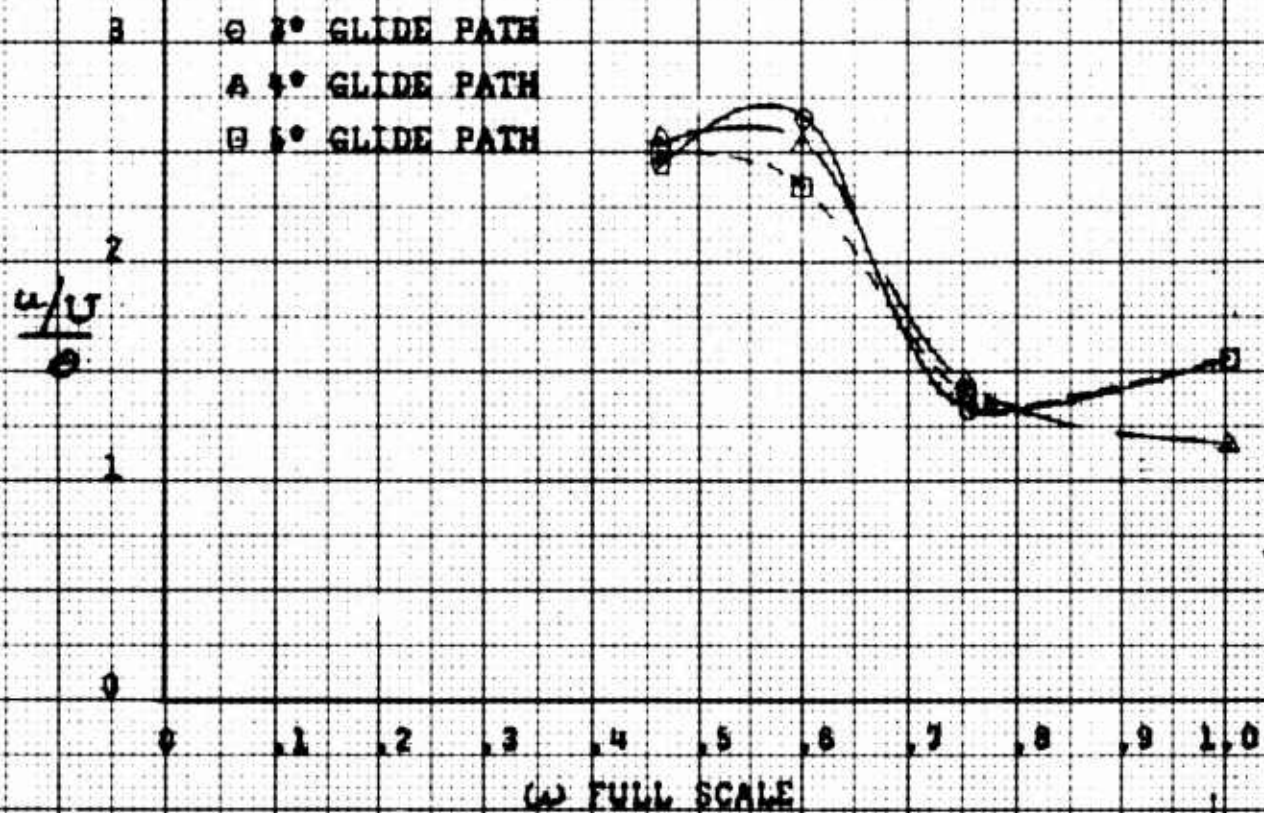
0

0 1 2 3 4 5 6 7 8 9 1.0

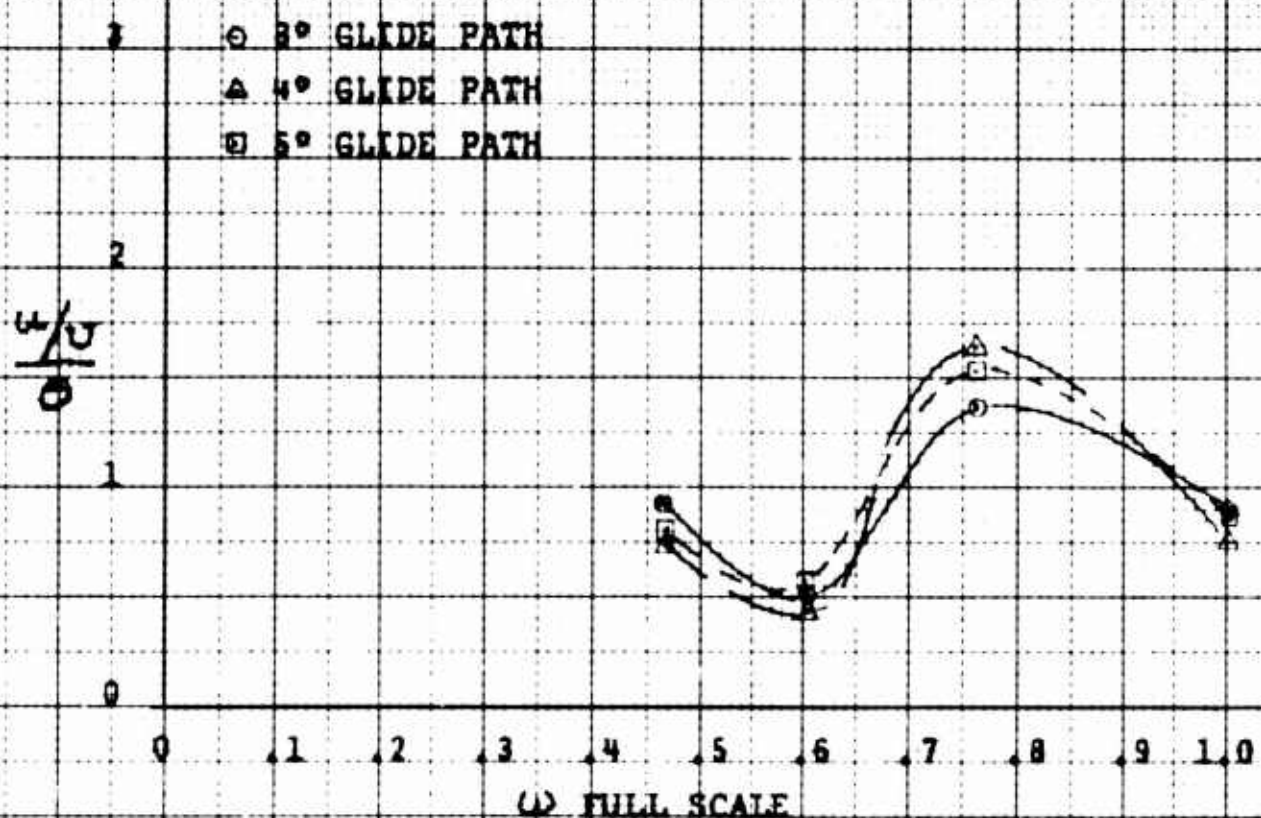
(1) FULL SCALE

485 FEET AFT OF TOUCHDOWN POINT ON GLIDE PATH CENTERLINE

HORIZONTAL VELOCITY - PITCH TRANSFER FUNCTION AMPLITUDE WIND 10° PORT



485 FEET AFT OF TOUCHDOWN POINT, 47 FEET PORT OF GLIDE PATH



485 FEET AFT OF TOUCHDOWN POINT, 47 FEET STARBOARD OF GLIDE PATH

HORIZONTAL VELOCITY - PITCH TRANSFER FUNCTION AMPLITUDE WIND 10° PORT

6 3° GLIDE PATH

4 4° GLIDE PATH

6 5° GLIDE PATH

$\frac{u/v}{e}$

2

1

0

0

.1

.2

.3

.4

.5

.6

.7

.8

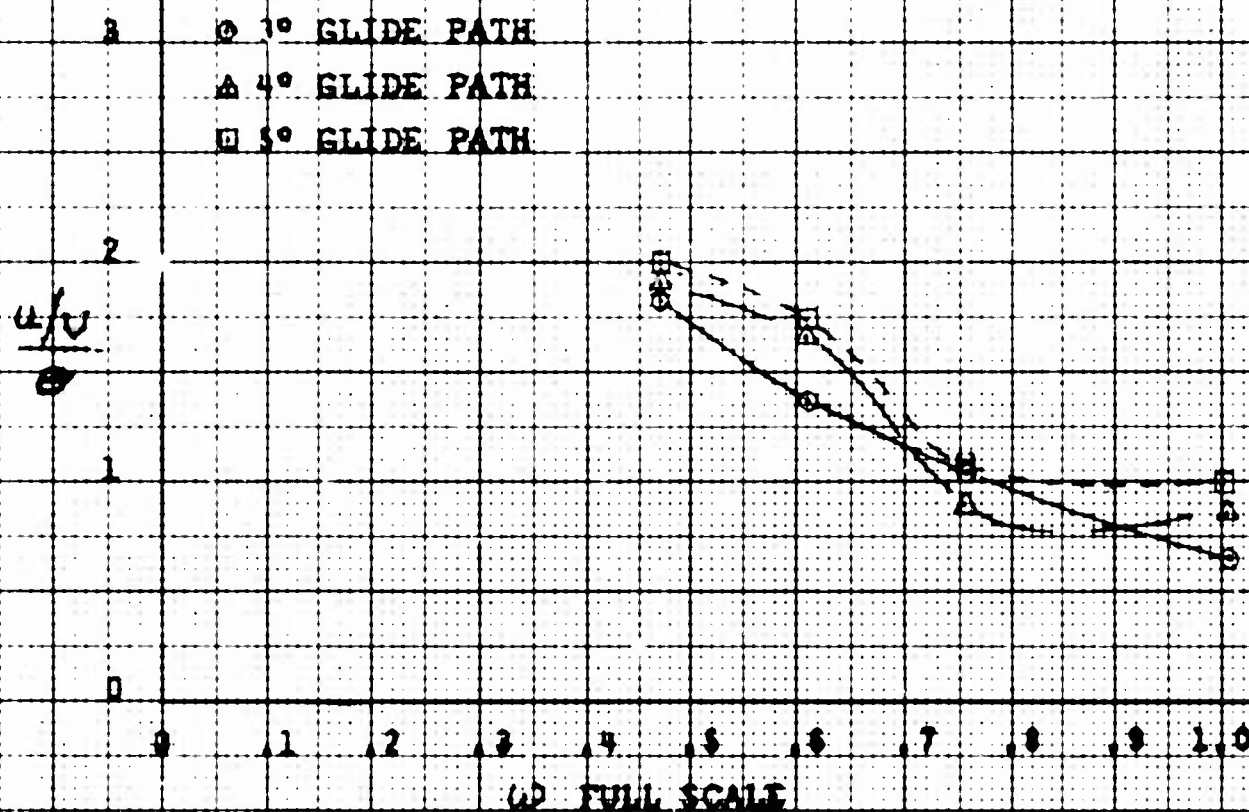
.9

1.0

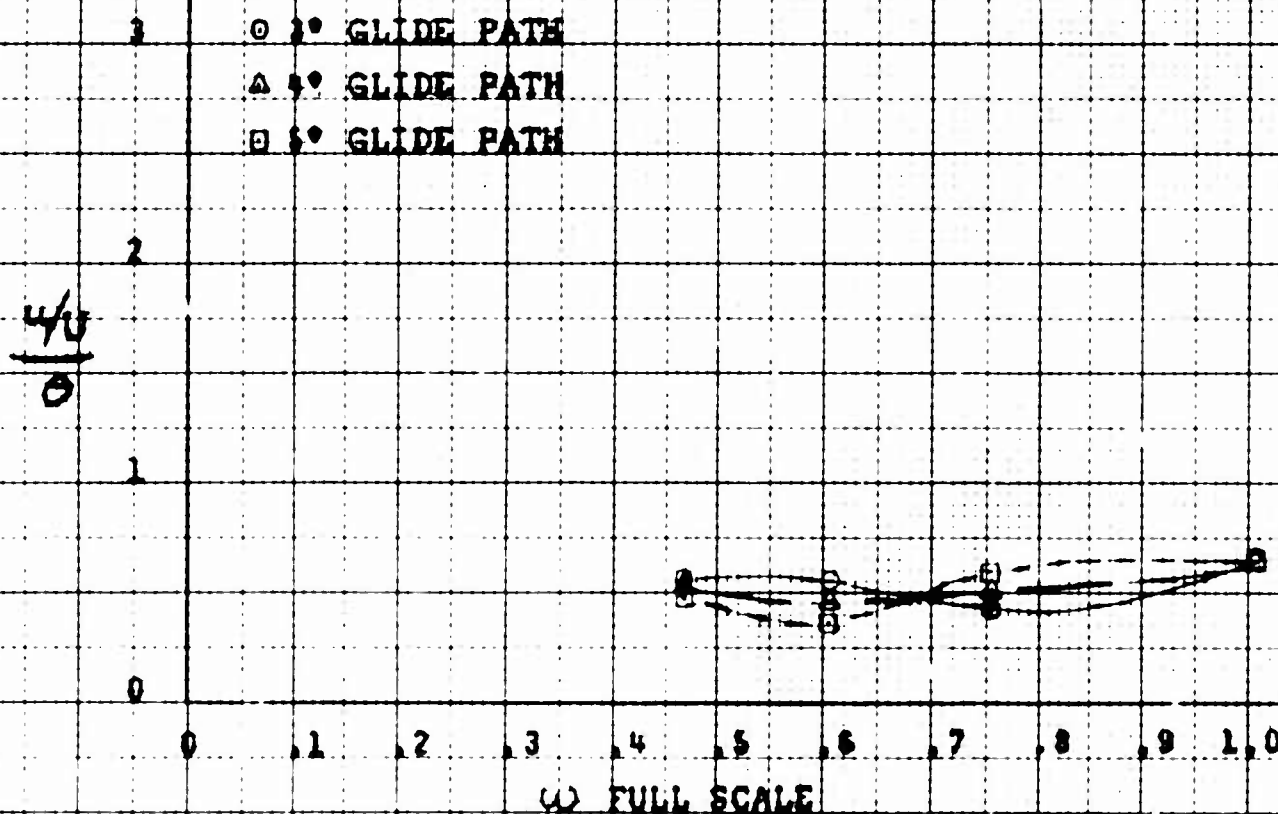
(1) FULL SCALE

764 FEET AFT OF TOUCHDOWN POINT ON GLIDE PATH CENTERLINE

HORIZONTAL VELOCITY - PITCH TRANSFER FUNCTION AMPLITUDE WIND 10° PORT



764 FEET AFT OF TOUCHDOWN POINT, 47 FEET PORT OF GLIDE PATH



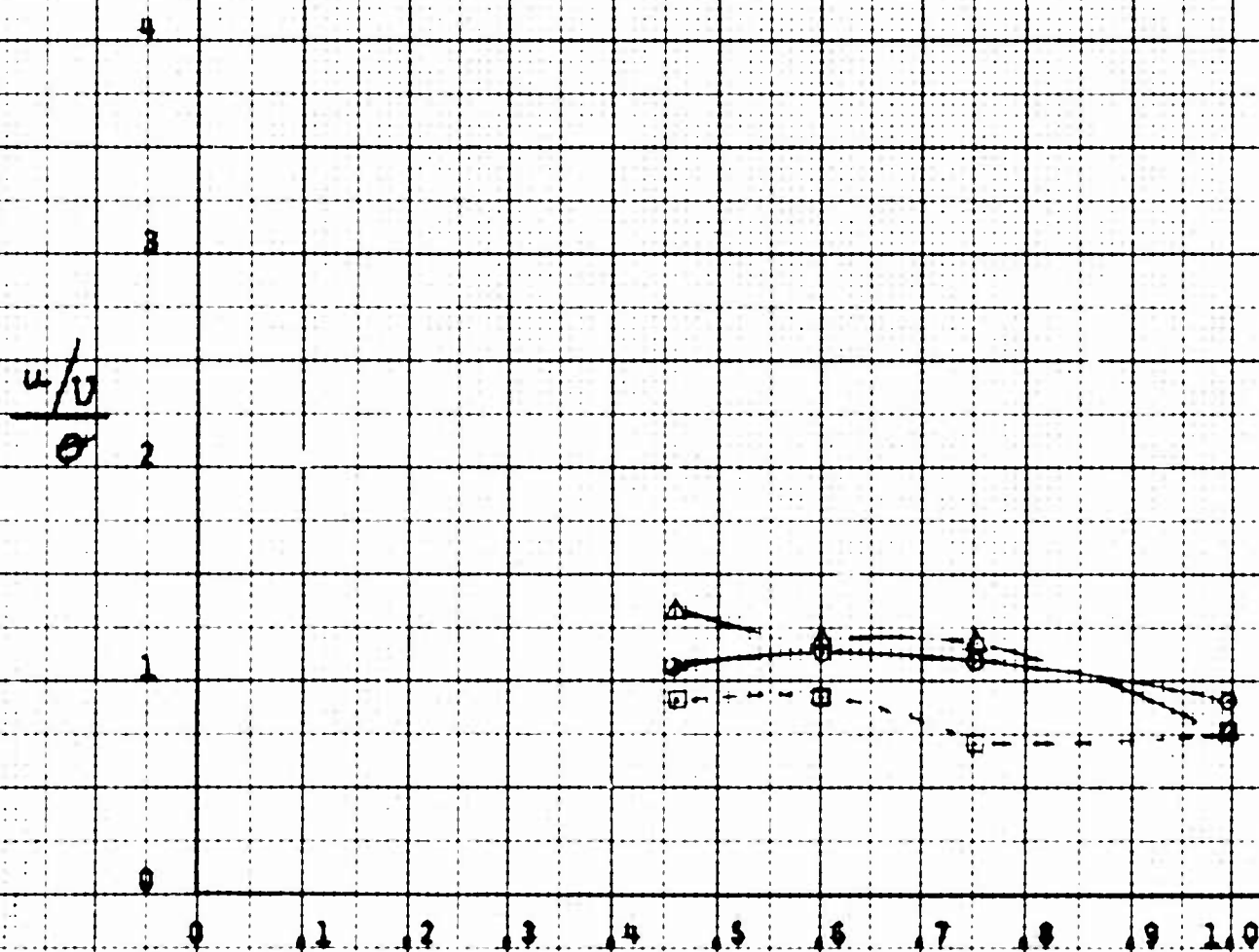
764 FEET AFT OF TOUCHDOWN POINT, 47 FEET STARBOARD OF GLIDE PATH

HORIZONTAL VELOCITY - PITCH TRANSFER FUNCTION AMPLITUDE WIND 10° PORT

○ 3° GLIDE PATH

△ 4° GLIDE PATH

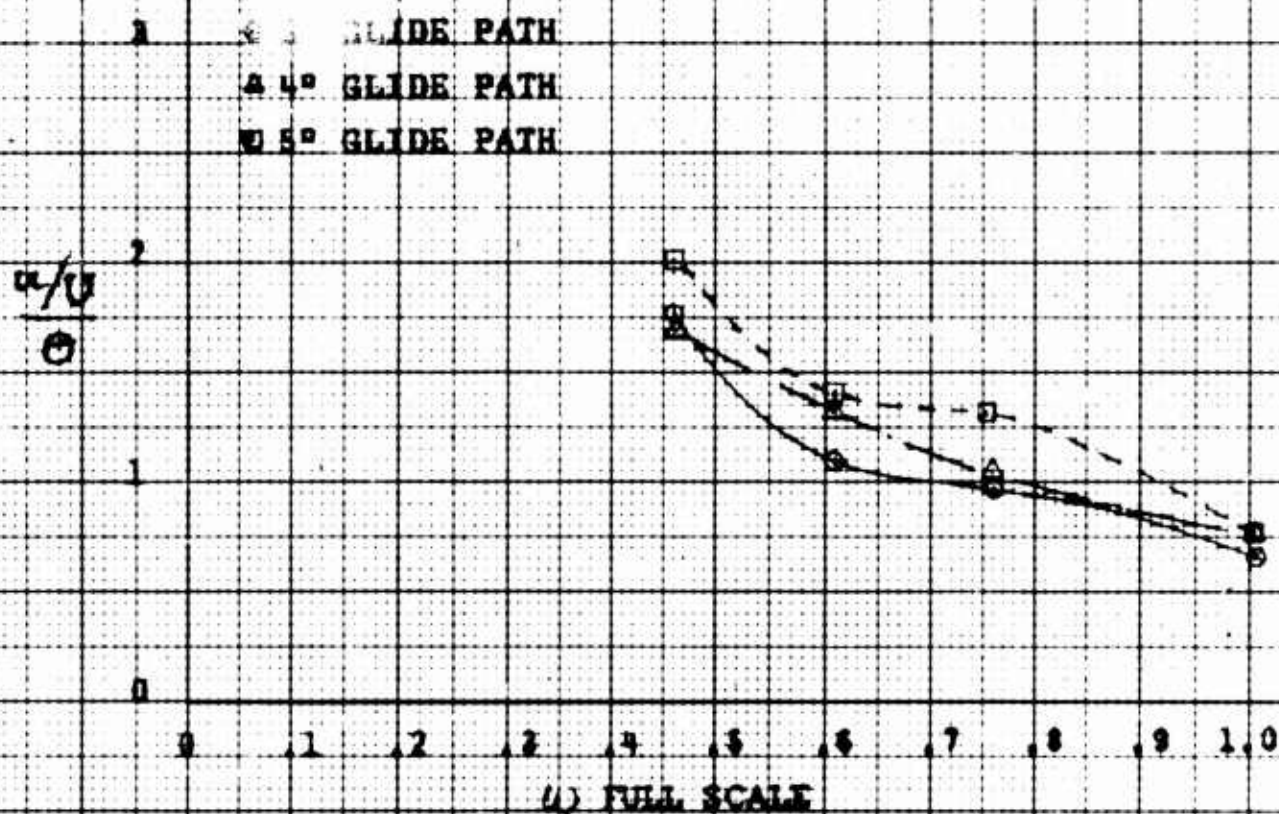
□ 5° GLIDE PATH



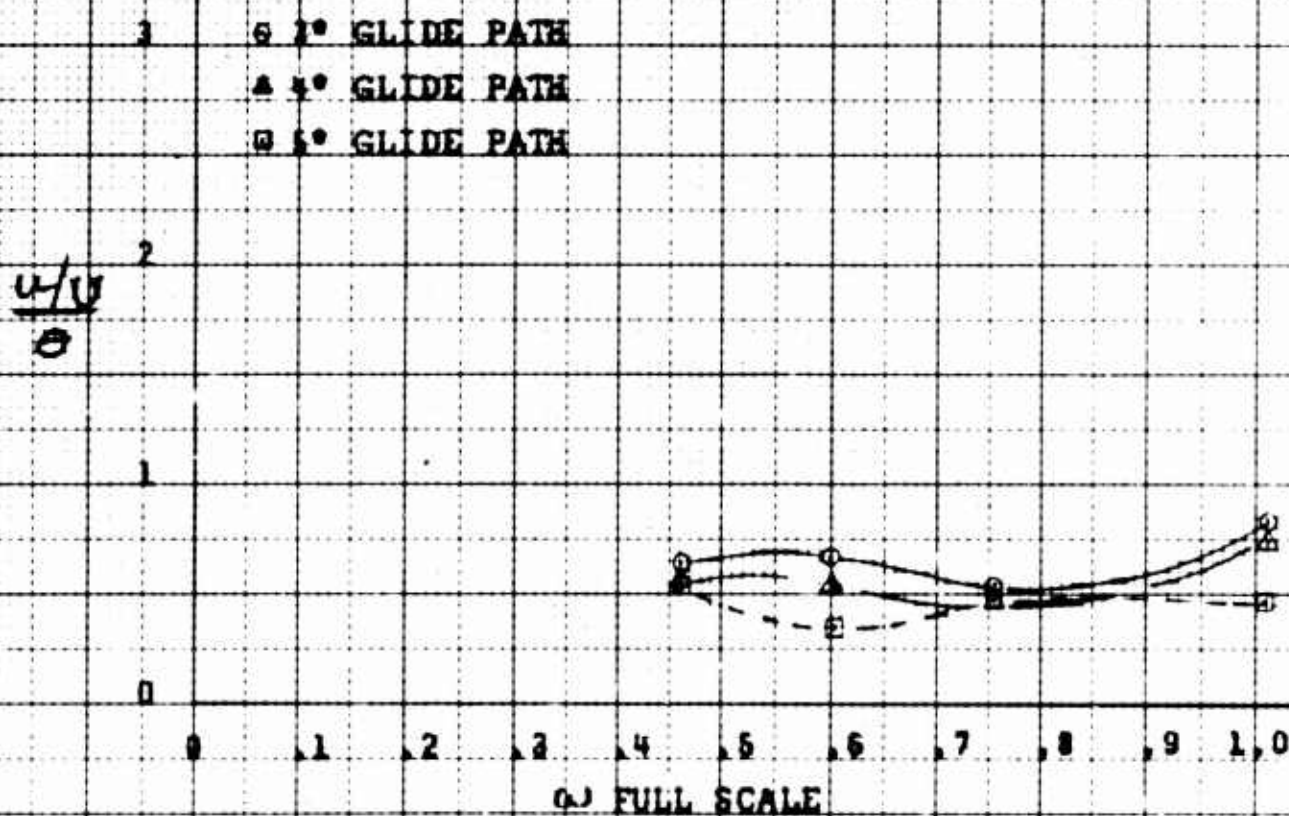
○ FULL SCALE

1040 FEET AFT OF TOUCHDOWN POINT ON GLIDE PATH CENTERLINE

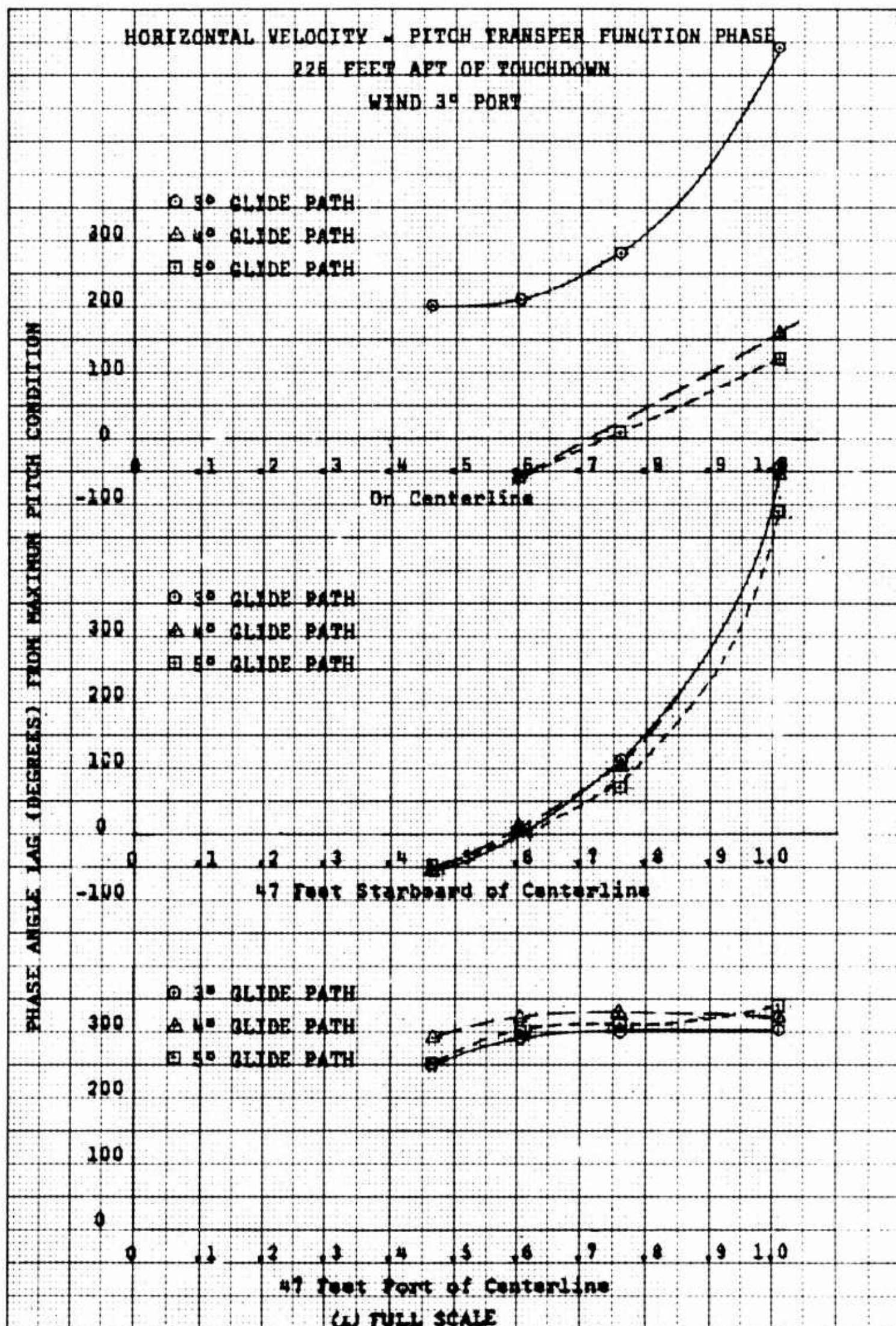
HORIZONTAL VELOCITY - PITCH TRANSFER FUNCTION AMPLITUDE WIND 10° PORT

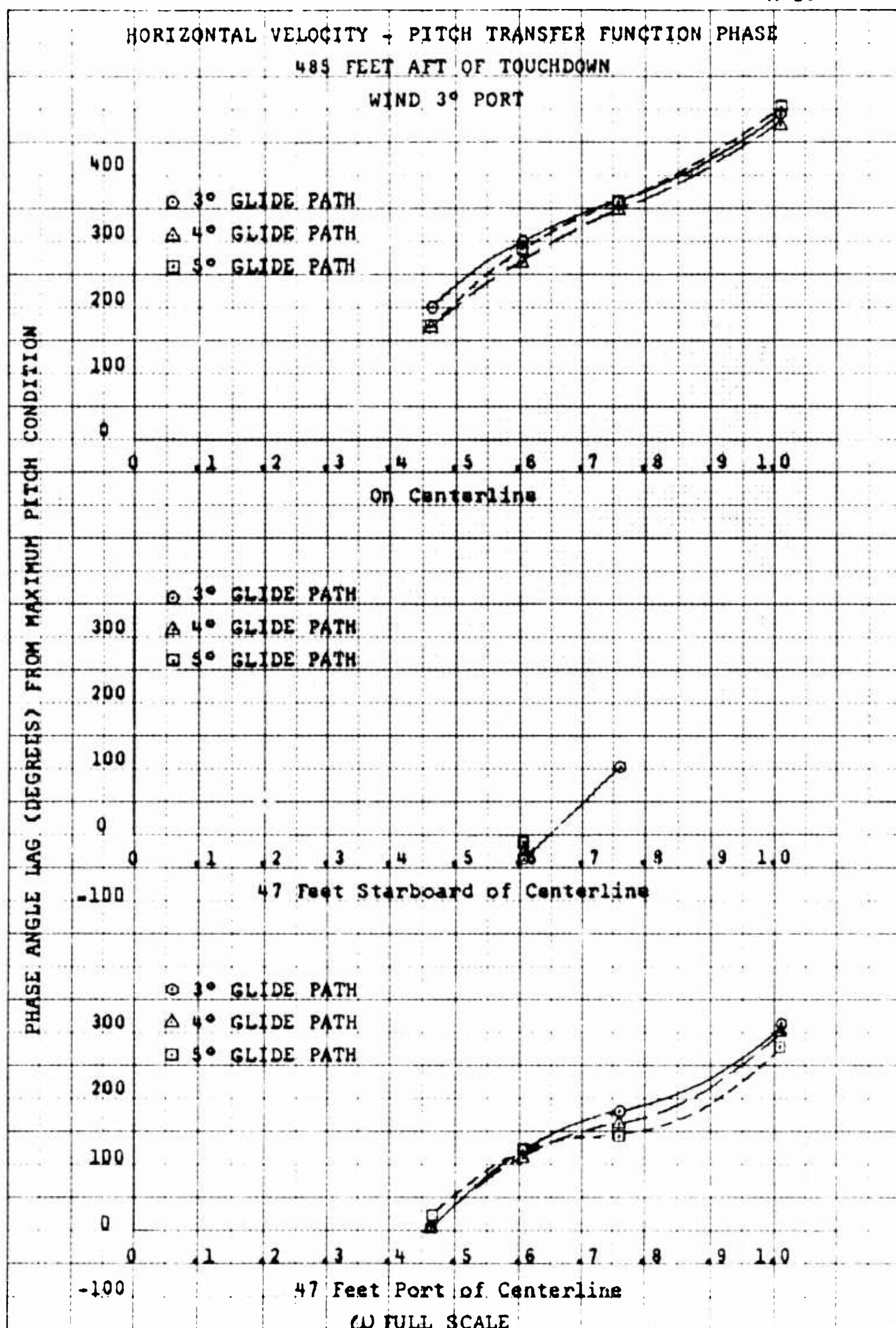


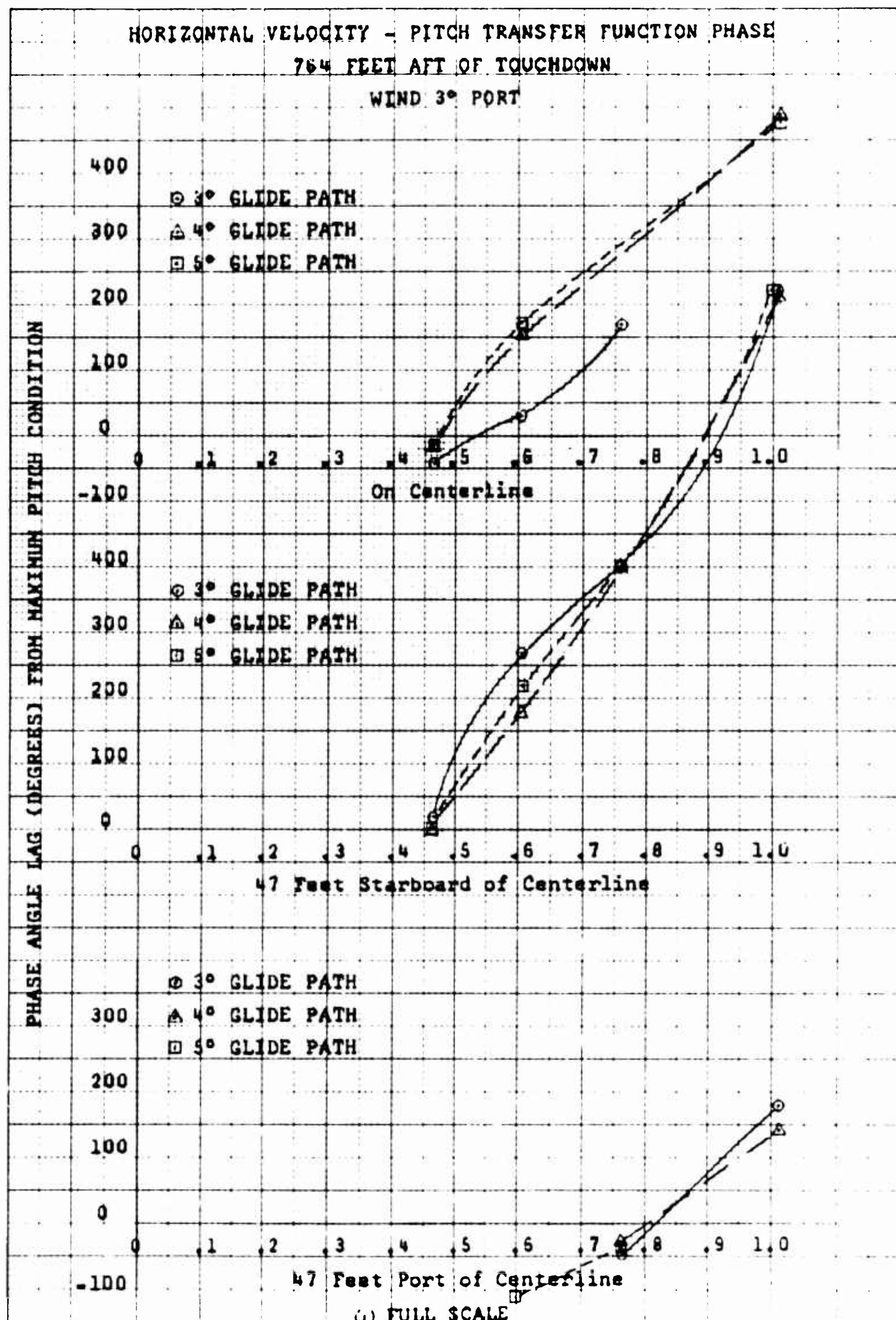
1040 FEET AFT OF TOUCHDOWN POINT, 47 FEET PORT OF GLIDE PATH

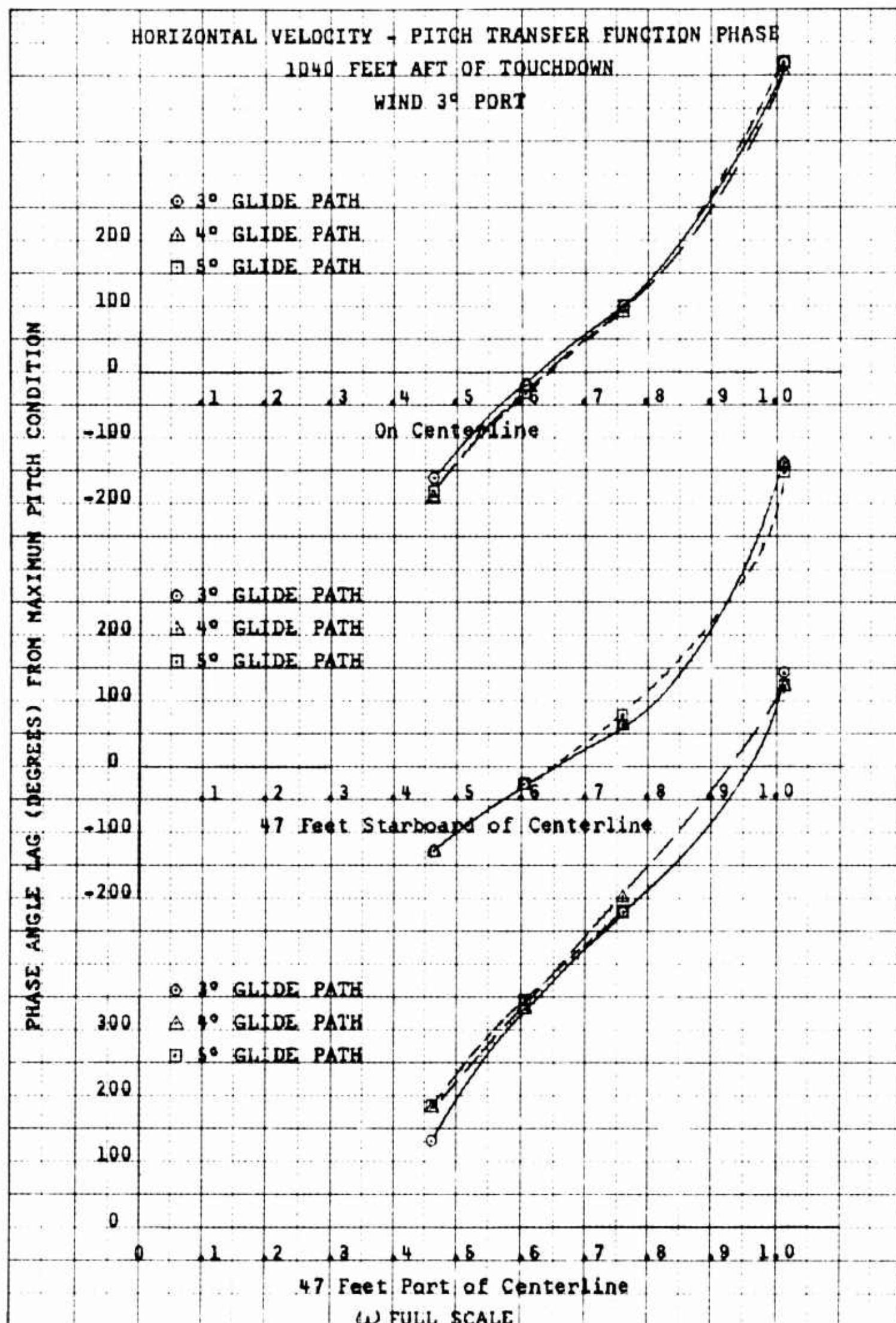


1040 FEET AFT OF TOUCHDOWN POINT, 47 FEET STARBOARD OF GLIDE PATH

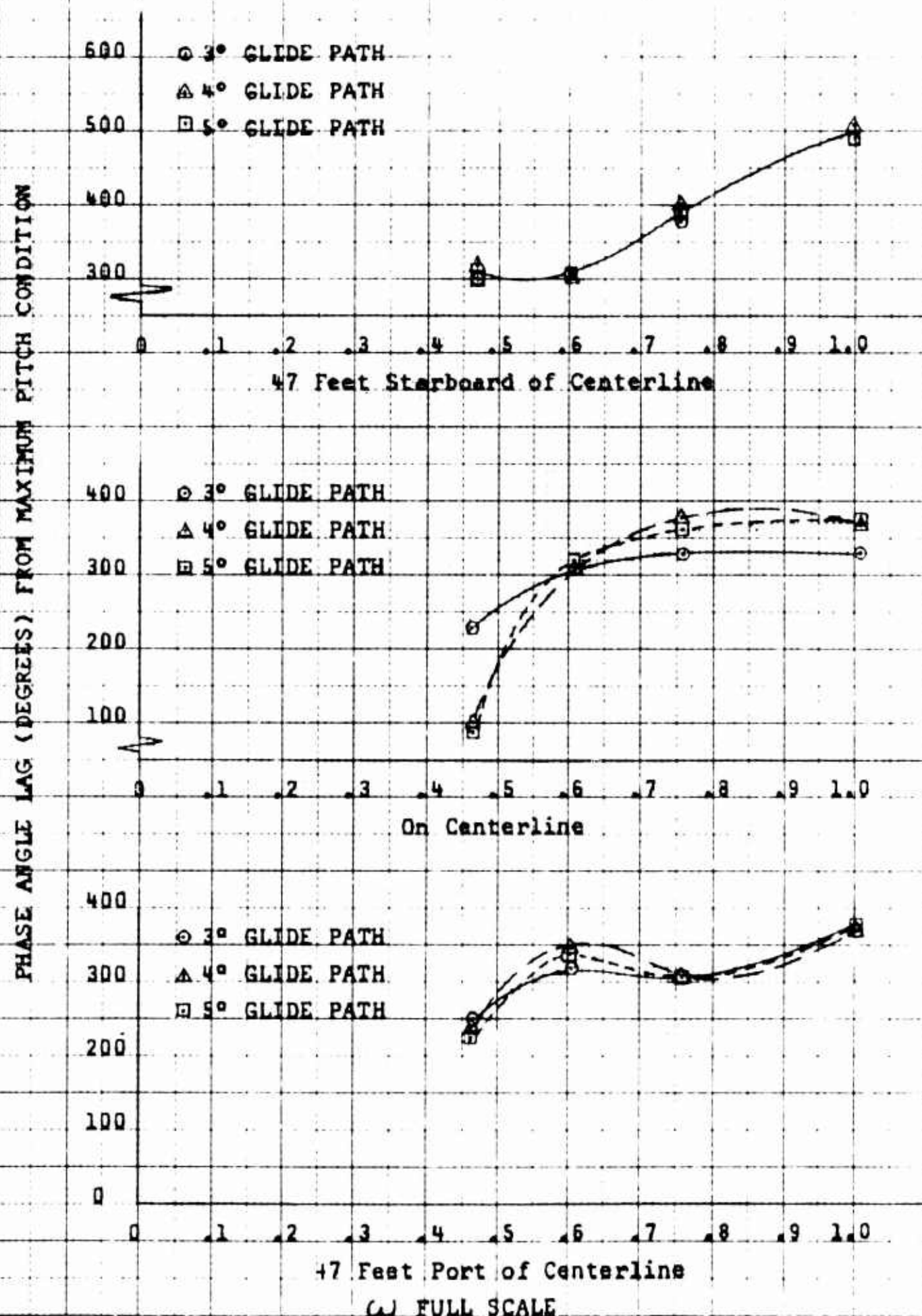






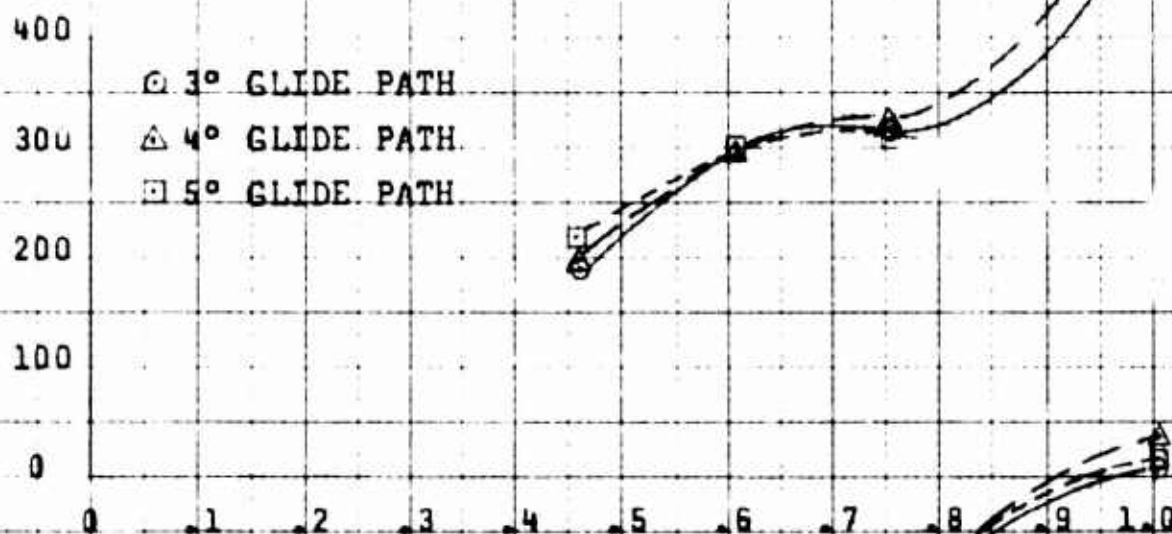


HORIZONTAL VELOCITY - PITCH TRANSFER FUNCTION PHASE
 226 FEET AFT OF TOUCHDOWN
 WIND 10° PORT

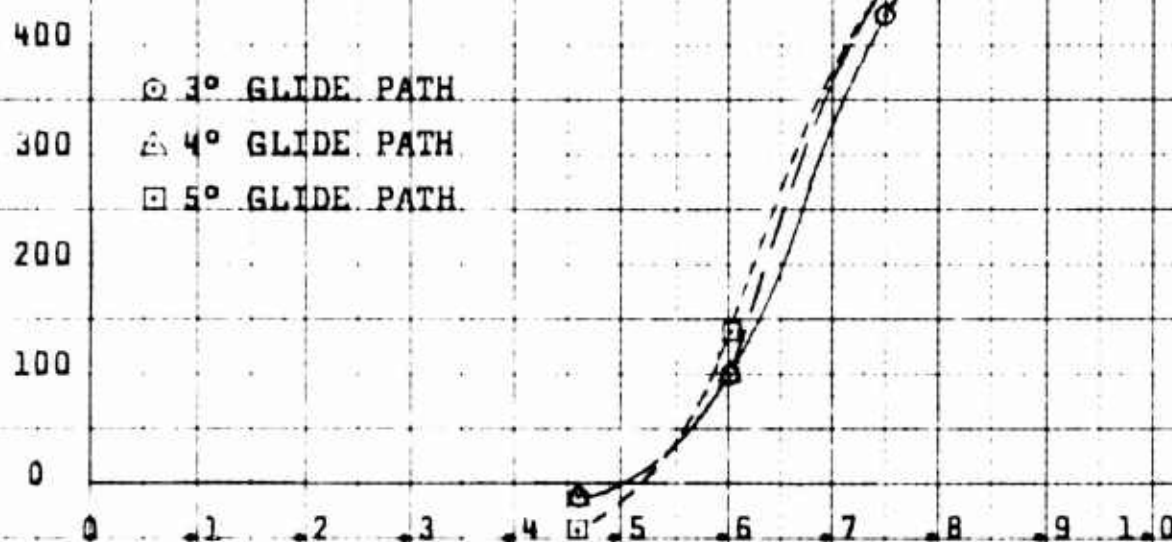


HORIZONTAL VELOCITY - PITCH TRANSFER FUNCTION PHASE
 485 FEET AFT OF TOUCHDOWN
 WIND 10° PORT

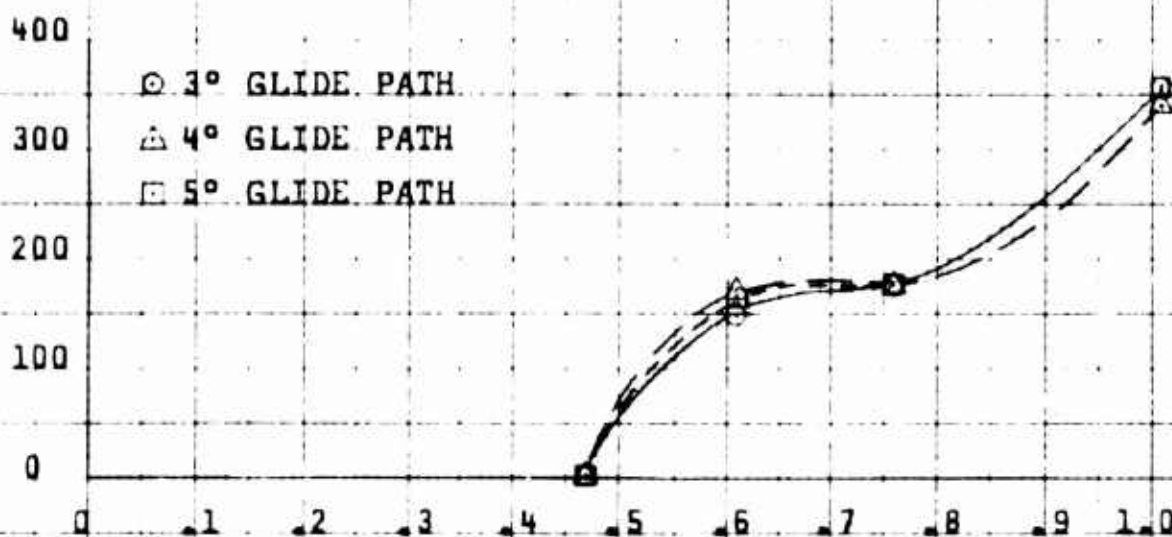
PHASE ANGLE LAG (DEGREES) FROM MAXIMUM PITCH CONDITION



47 Feet Starboard of Centerline



On Centerline

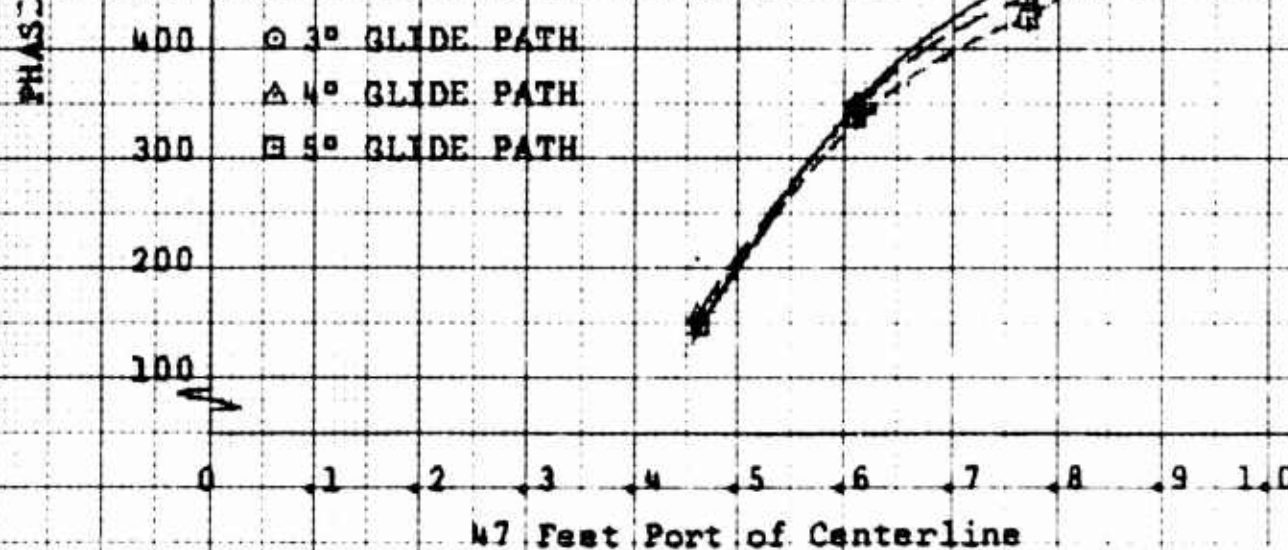
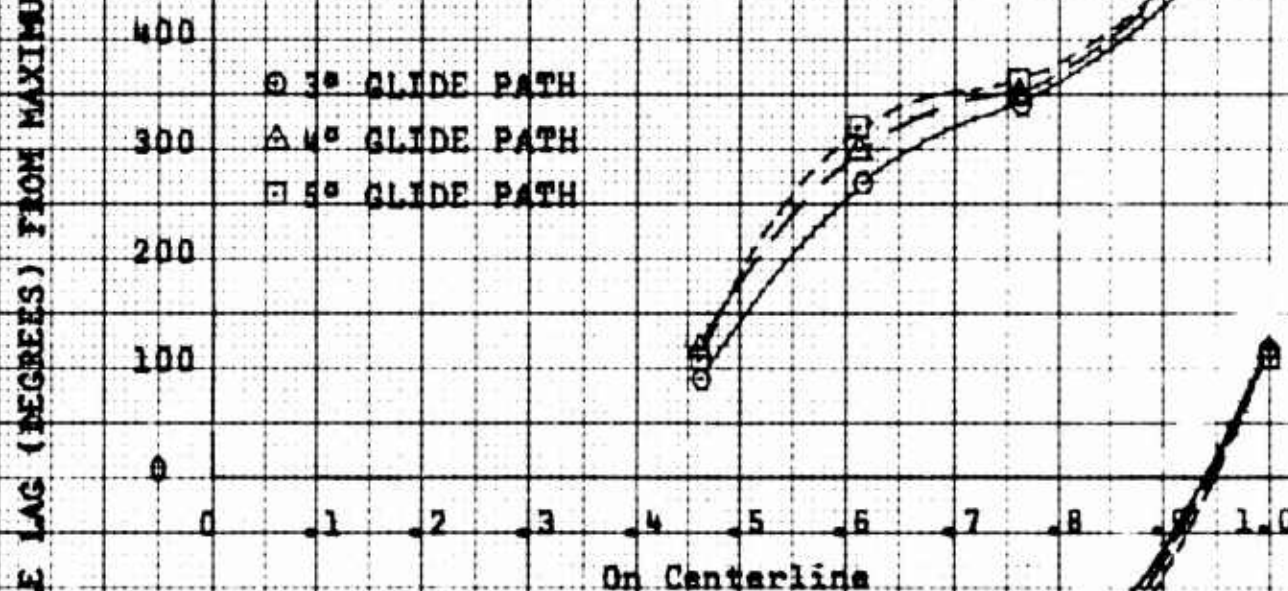
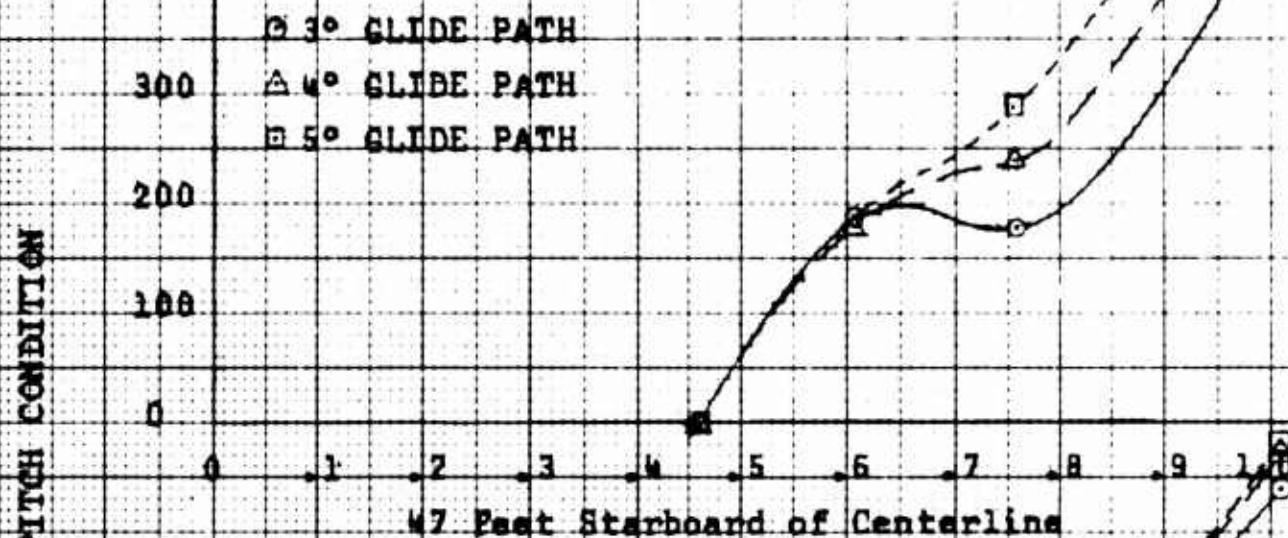


47 Feet Port of Centerline

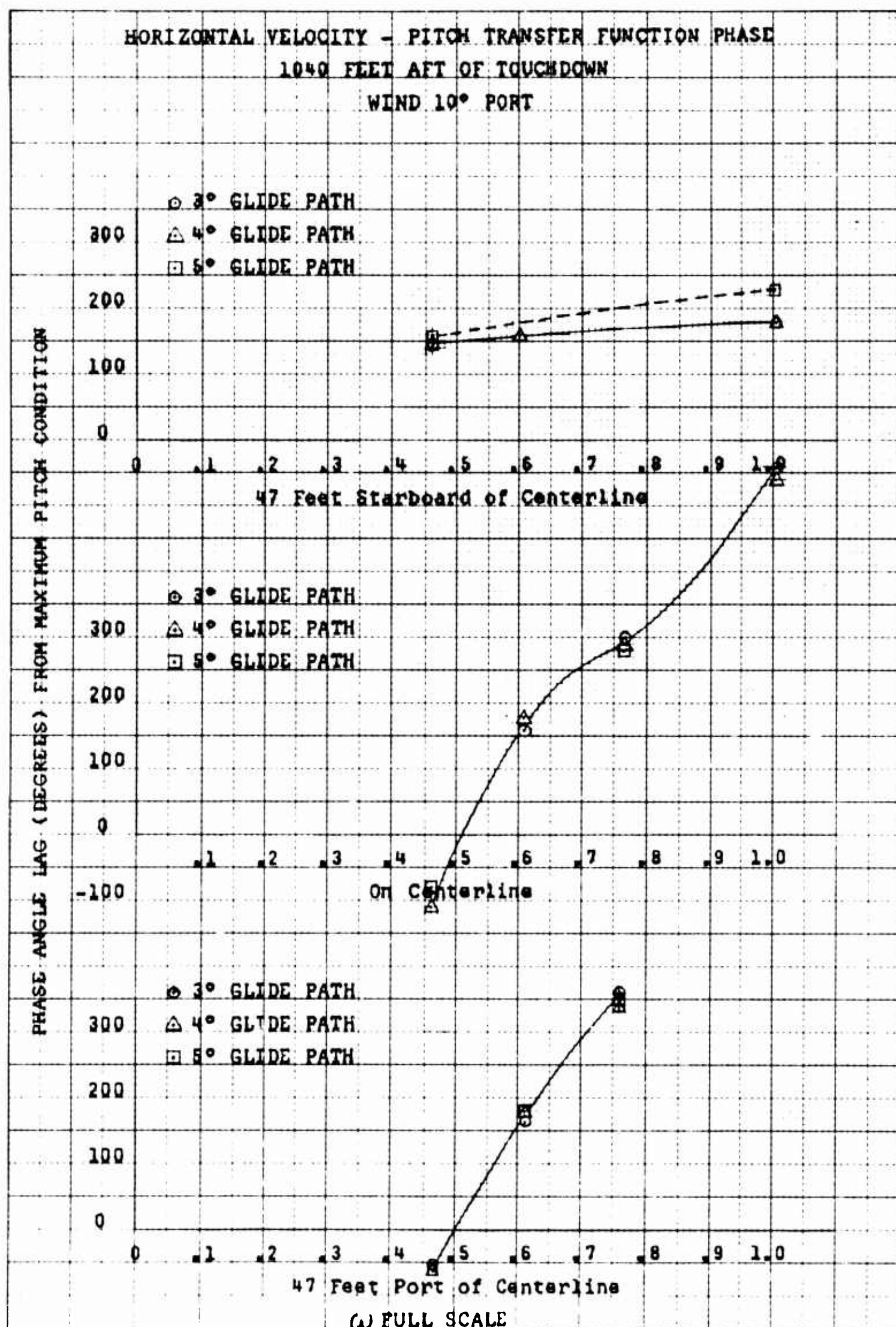
() FULL SCALE

OCEANICS

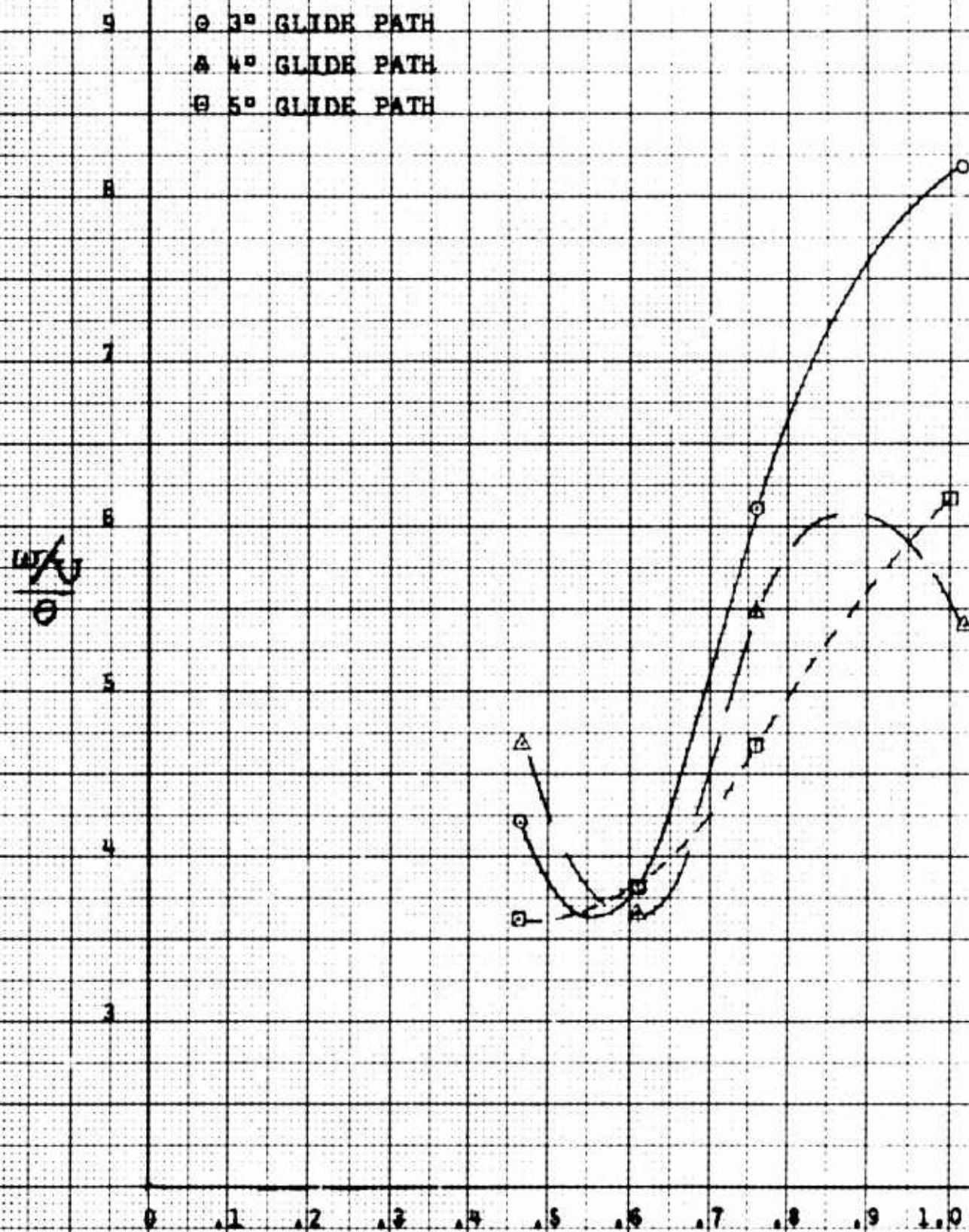
HORIZONTAL VELOCITY - PITCH TRANSFER FUNCTION PHASE
 764 FEET AFT OF TOUCHDOWN
 WIND 10° PORT



() FULL SCALE



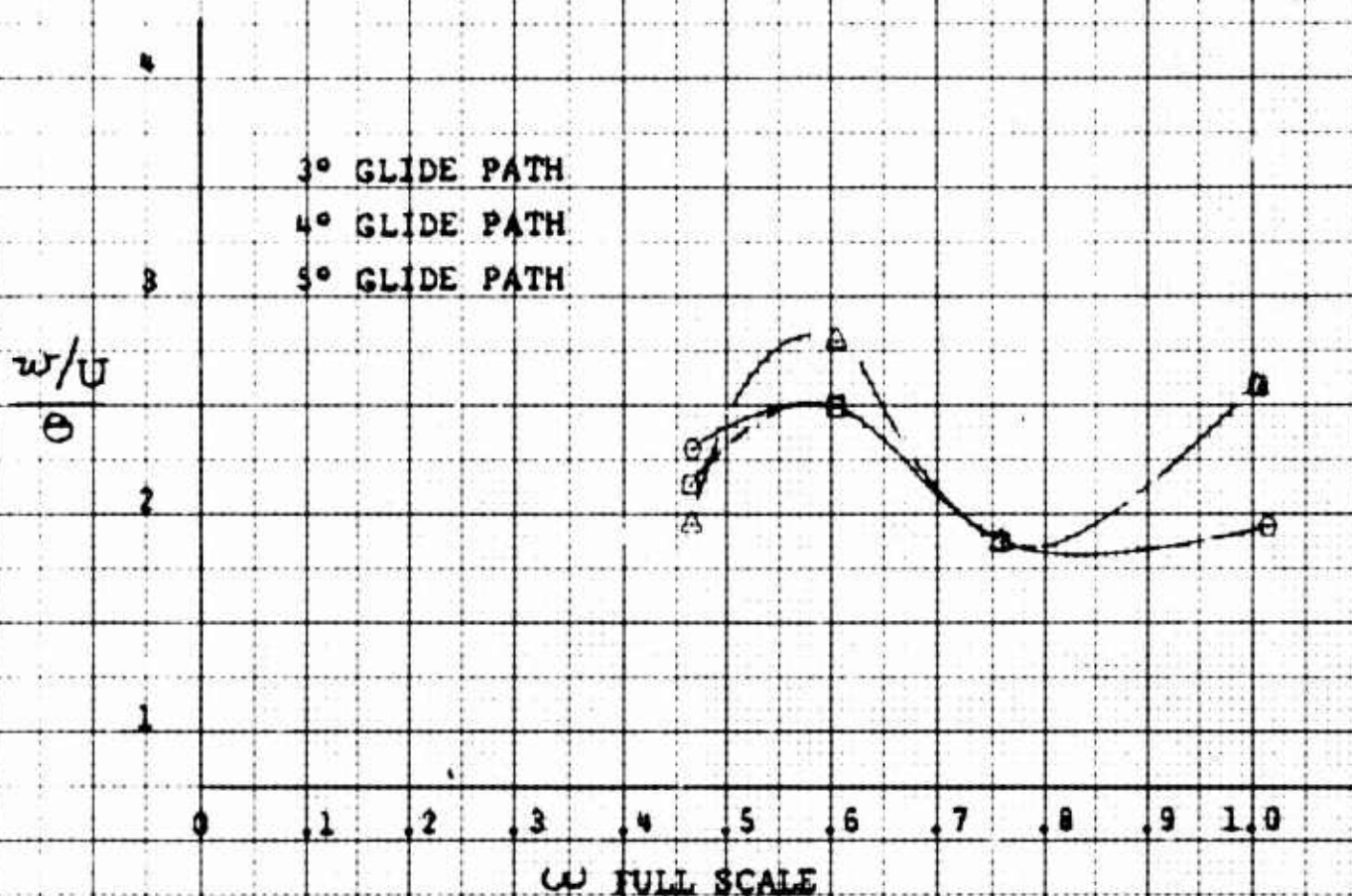
VERTICAL VELOCITY - PITCH TRANSFER FUNCTION AMPLITUDE
WIND 3° PORT



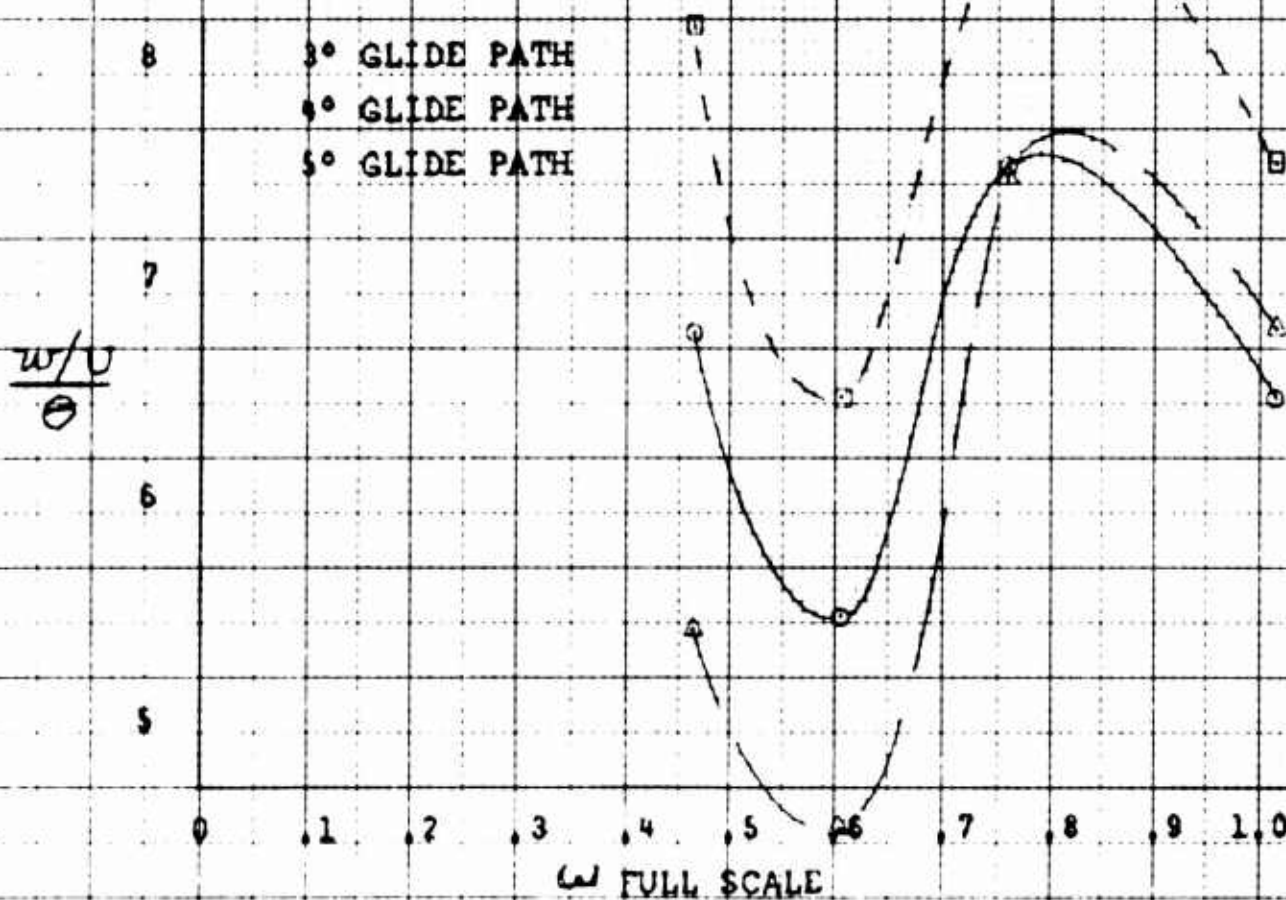
(1) FULL SCALE

226 FEET AFT OF TOUCHDOWN POINT ON GLIDE PATH CENTERLINE

VERTICAL VELOCITY - PITCH TRANSFER FUNCTION AMPLITUDE
WIND 3° PORT



226 FEET AFT OF TOUCHDOWN POINT, 47 FEET STARBOARD OF GLIDE PATH



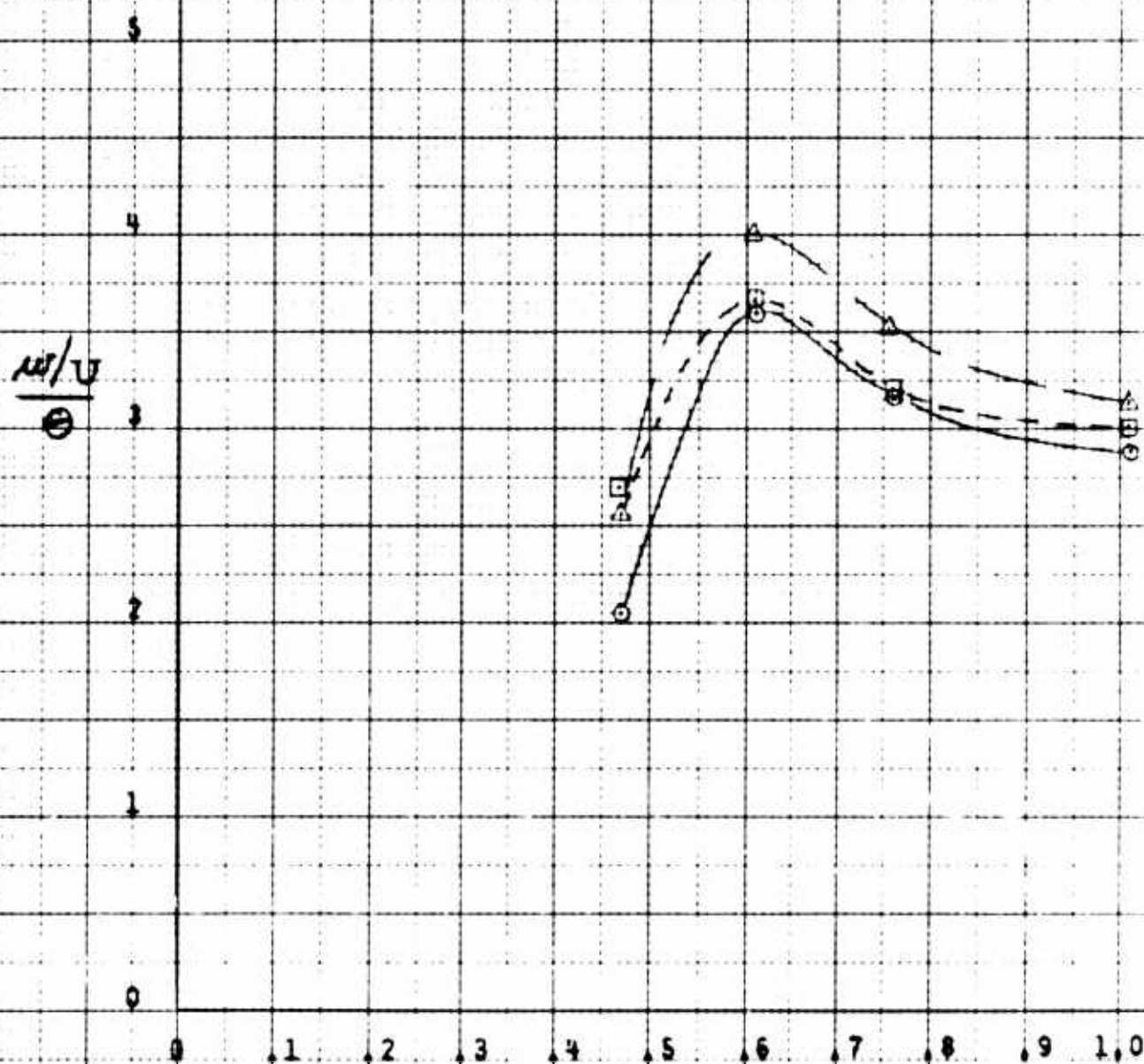
226 FEET AFT OF TOUCHDOWN POINT, 47 FEET PORT OF GLIDE PATH

VERTICAL VELOCITY - PITCH TRANSFER FUNCTION AMPLITUDE
WIND 3° PORT

○ 3° GLIDE PATH

△ 4° GLIDE PATH

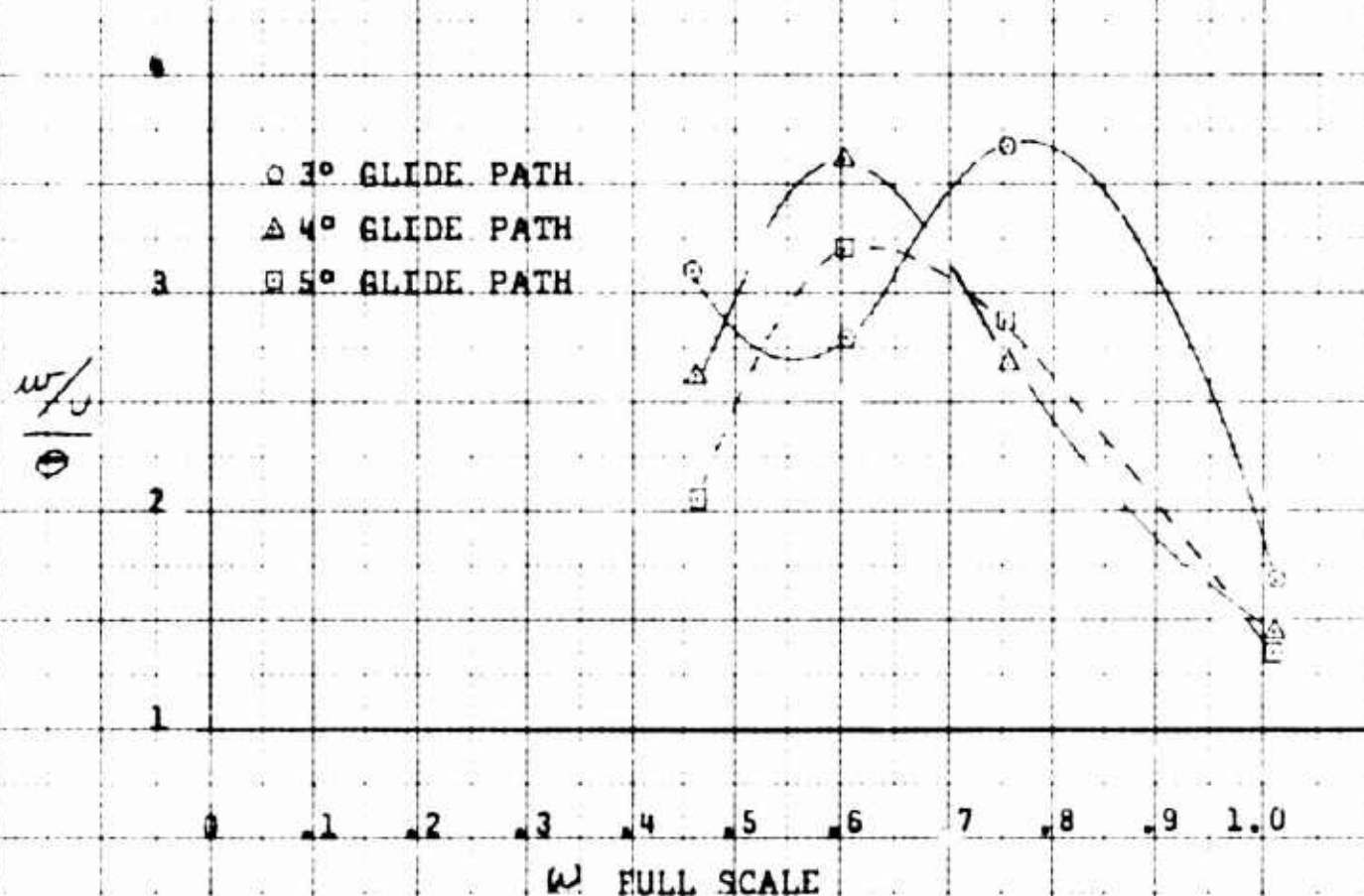
□ 5° GLIDE PATH



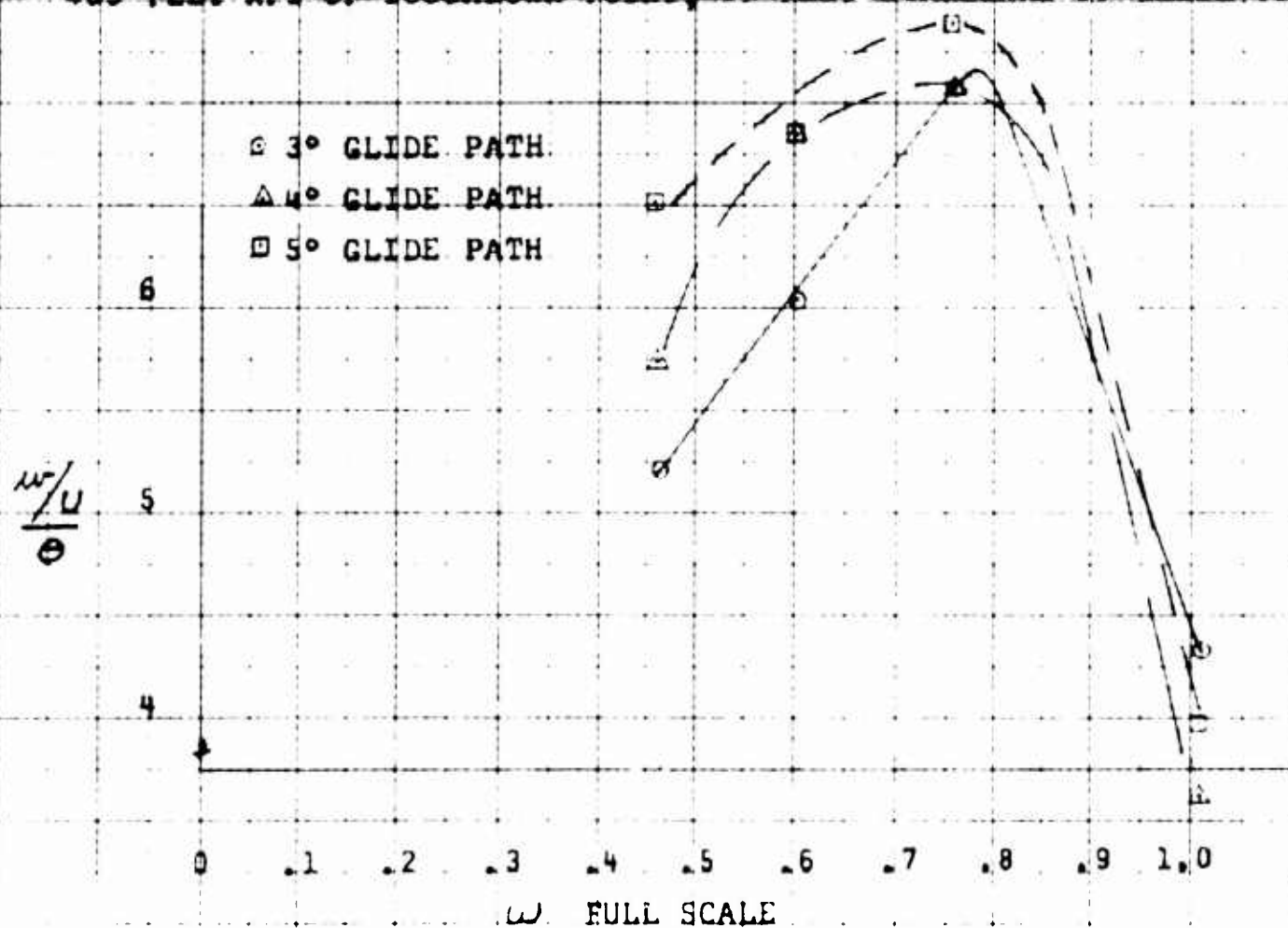
(ω) FULL SCALE

485 FEET AFT OF TOUCHDOWN POINT ON GLIDE PATH CENTERLINE

VERTICAL VELOCITY - PITCH TRANSFER FUNCTION AMPLITUDE
WIND 3° PORT

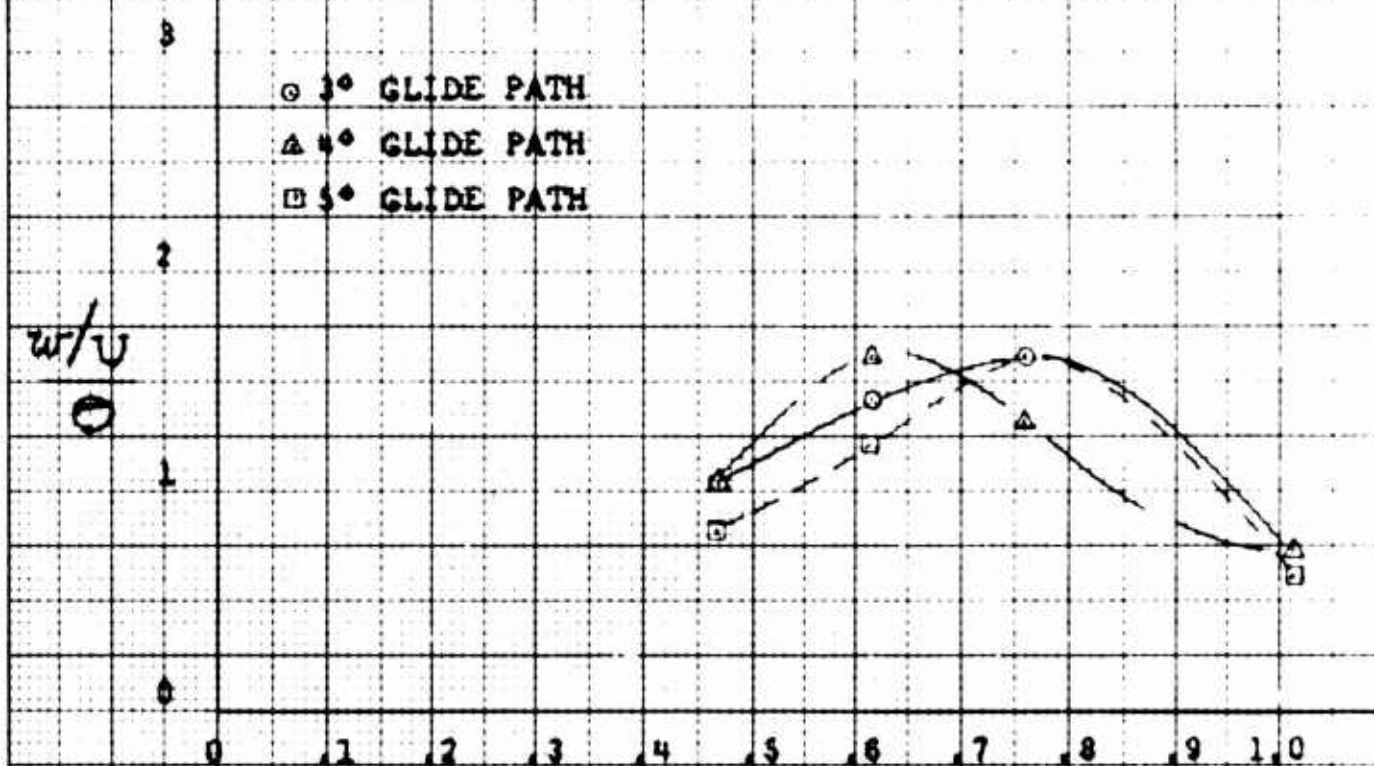


485 FEET AFT OF TOUCHDOWN POINT, 47 FEET STARBOARD OF GLIDE PATH



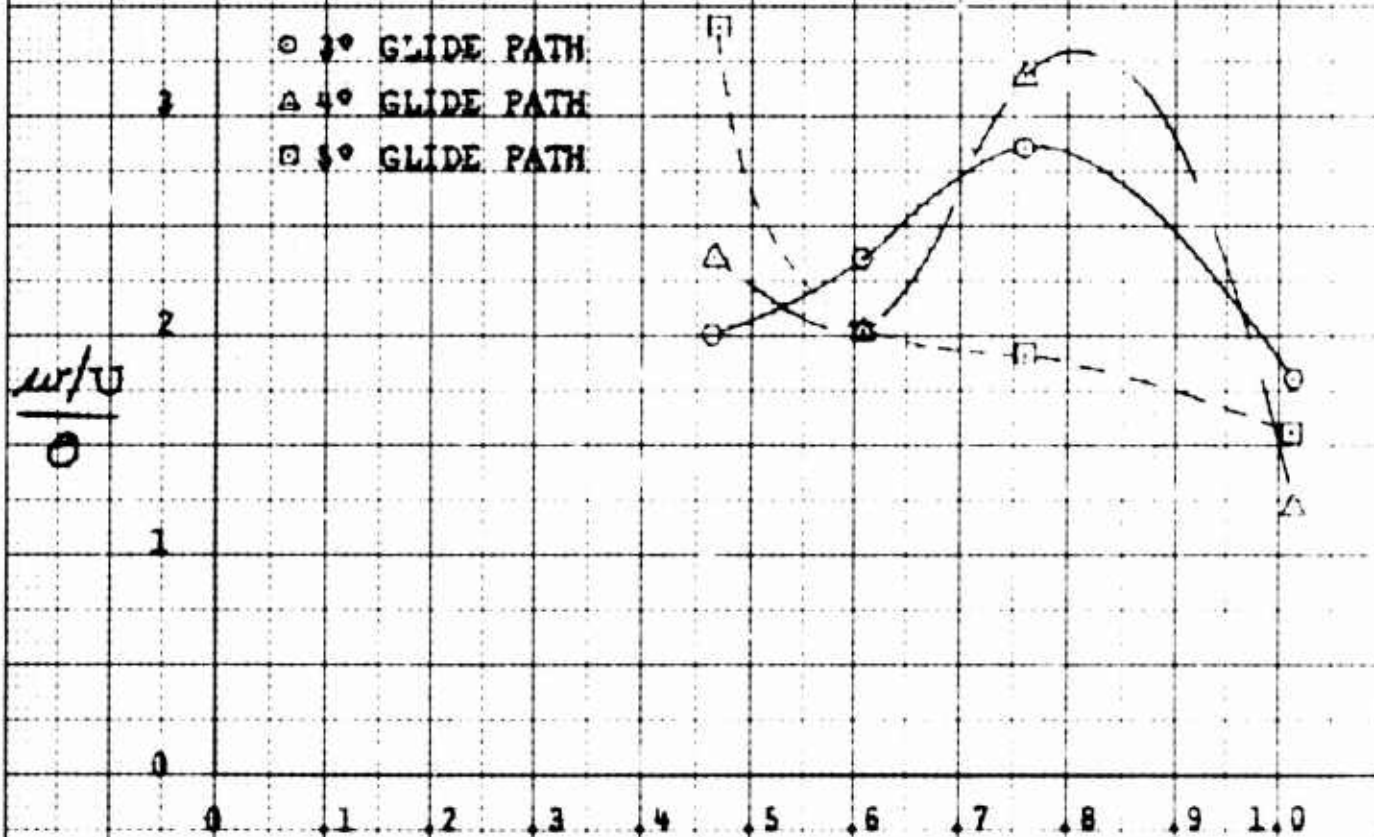
485 FEET AFT OF TOUCHDOWN POINT, 47 FEET PORT OF GLIDE PATH

VERTICAL VELOCITY - PITCH TRANSFER FUNCTION AMPLITUDE
WIND 3° PORT



(A) FULL SCALE

764 FEET AFT OF TOUCHDOWN POINT, 47 FEET STARBOARD OF GLIDE PATH



(B) FULL SCALE

764 FEET AFT OF TOUCHDOWN POINT, 47 FEET PORT OF GLIDE PATH

VERTICAL VELOCITY - PITCH TRANSFER FUNCTION AMPLITUDE
WIND 3° PORT

- 3° GLIDE PATH
△ 4° GLIDE PATH
□ 5° GLIDE PATH

$\frac{w/v}{\theta}$

5

4

3

2

1

0

0 1 2 3 4 5 6 7 8 9 10

(w) FULL SCALE

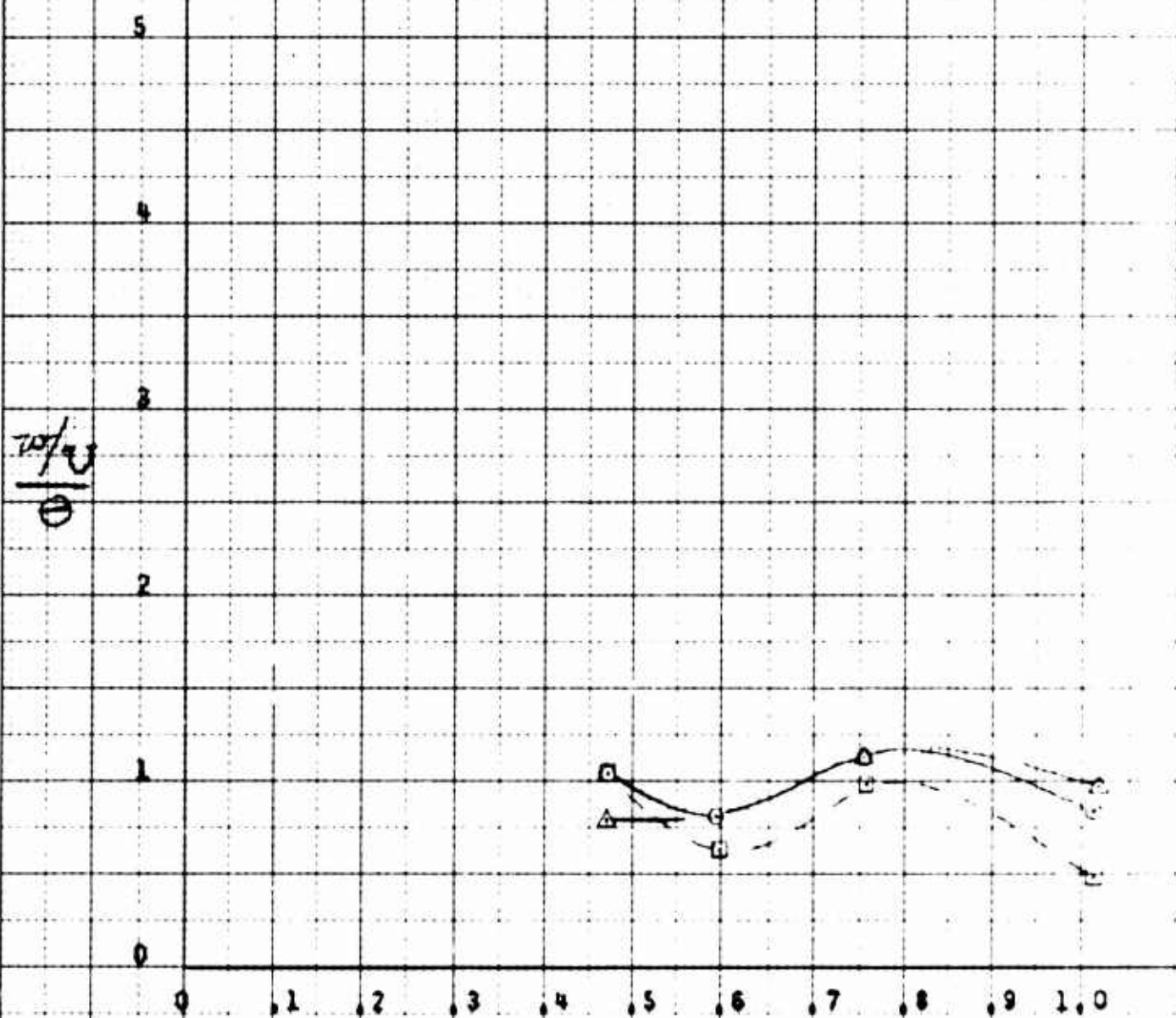
764 FEET AFT OF TOUCHDOWN POINT ON GLIDE PATH CENTERLINE

VERTICAL VELOCITY - PITCH TRANSFER FUNCTION AMPLITUDE WIND 3° PORT

○ 3° GLIDE PATH

△ 4° GLIDE PATH

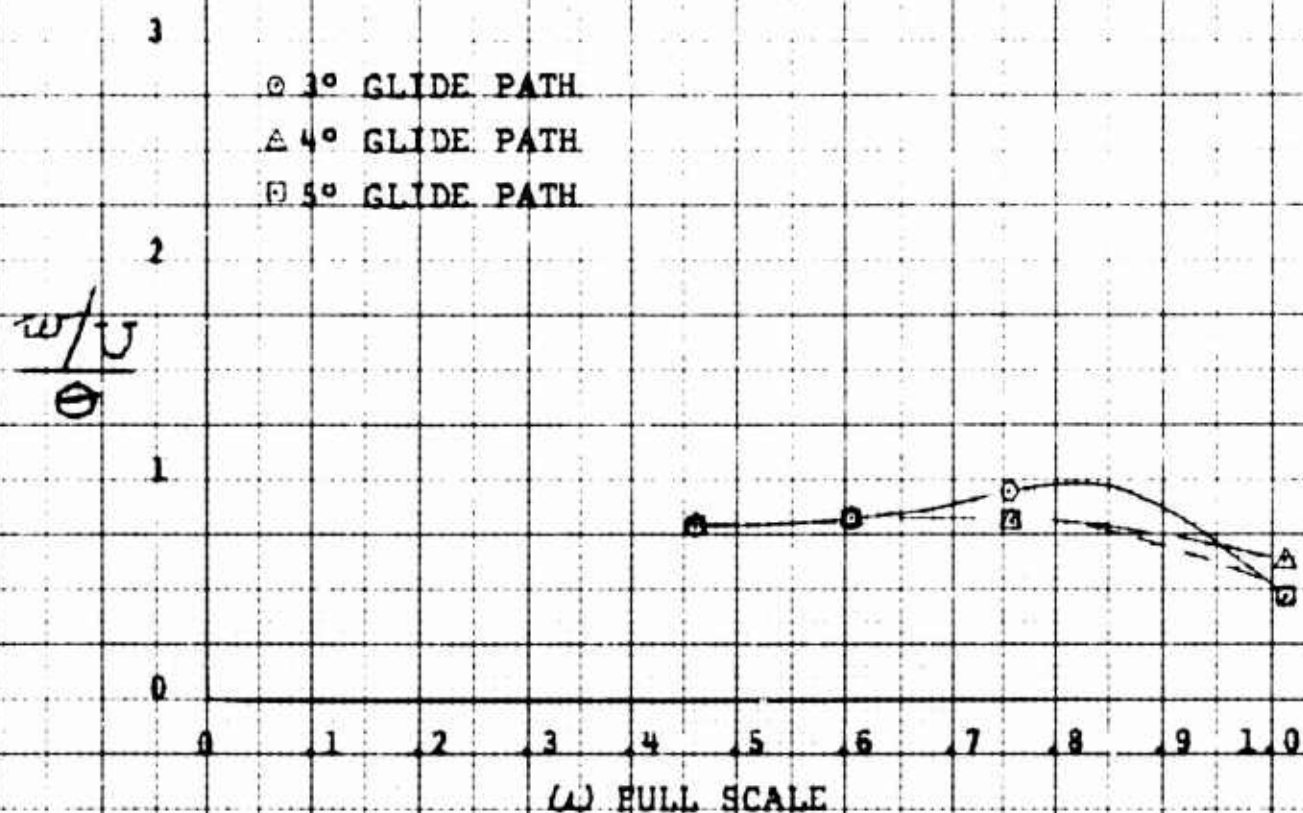
□ 5° GLIDE PATH



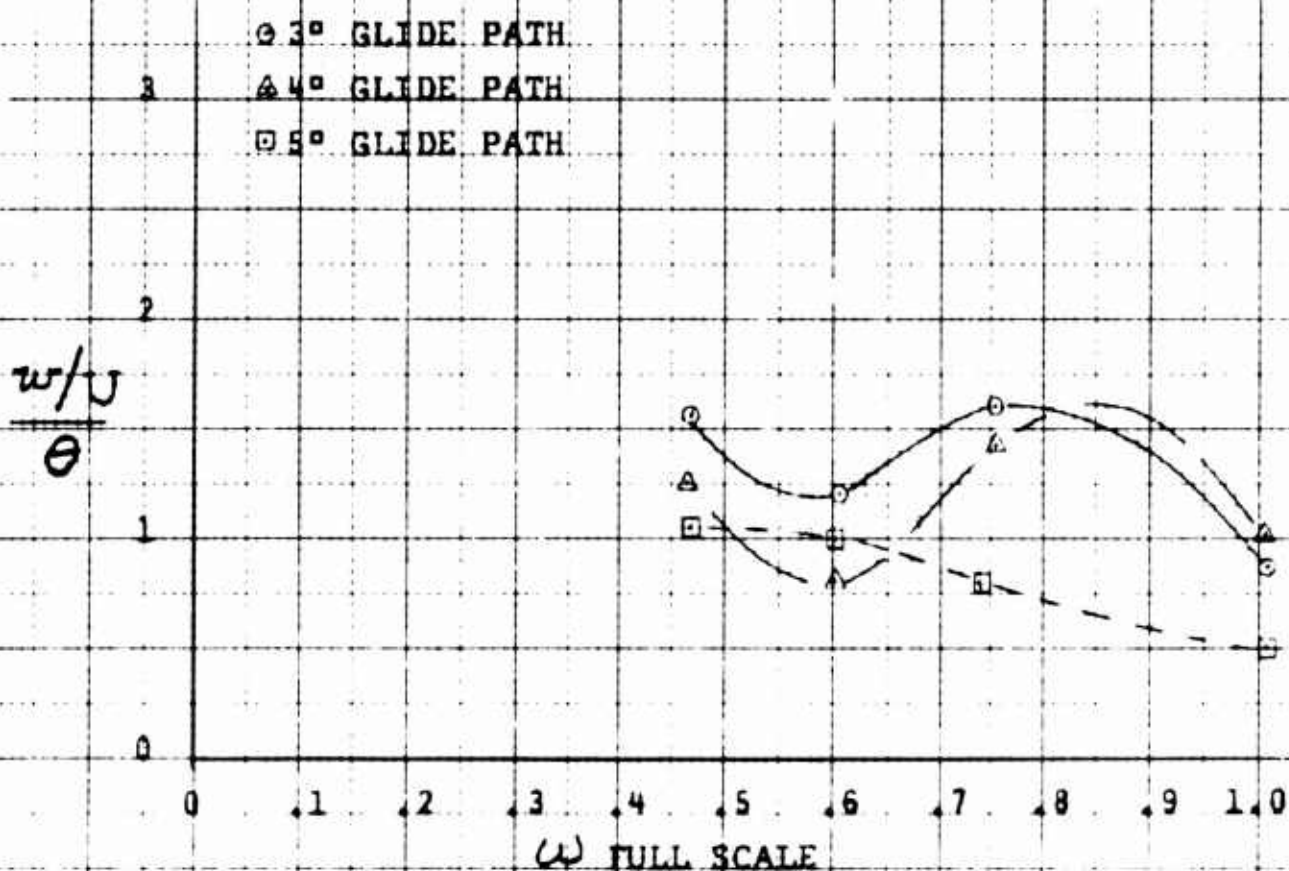
(W) FULL SCALE

1040 FEET AFT OF TOUCHDOWN POINT ON GLIDE PATH CENTERLINE

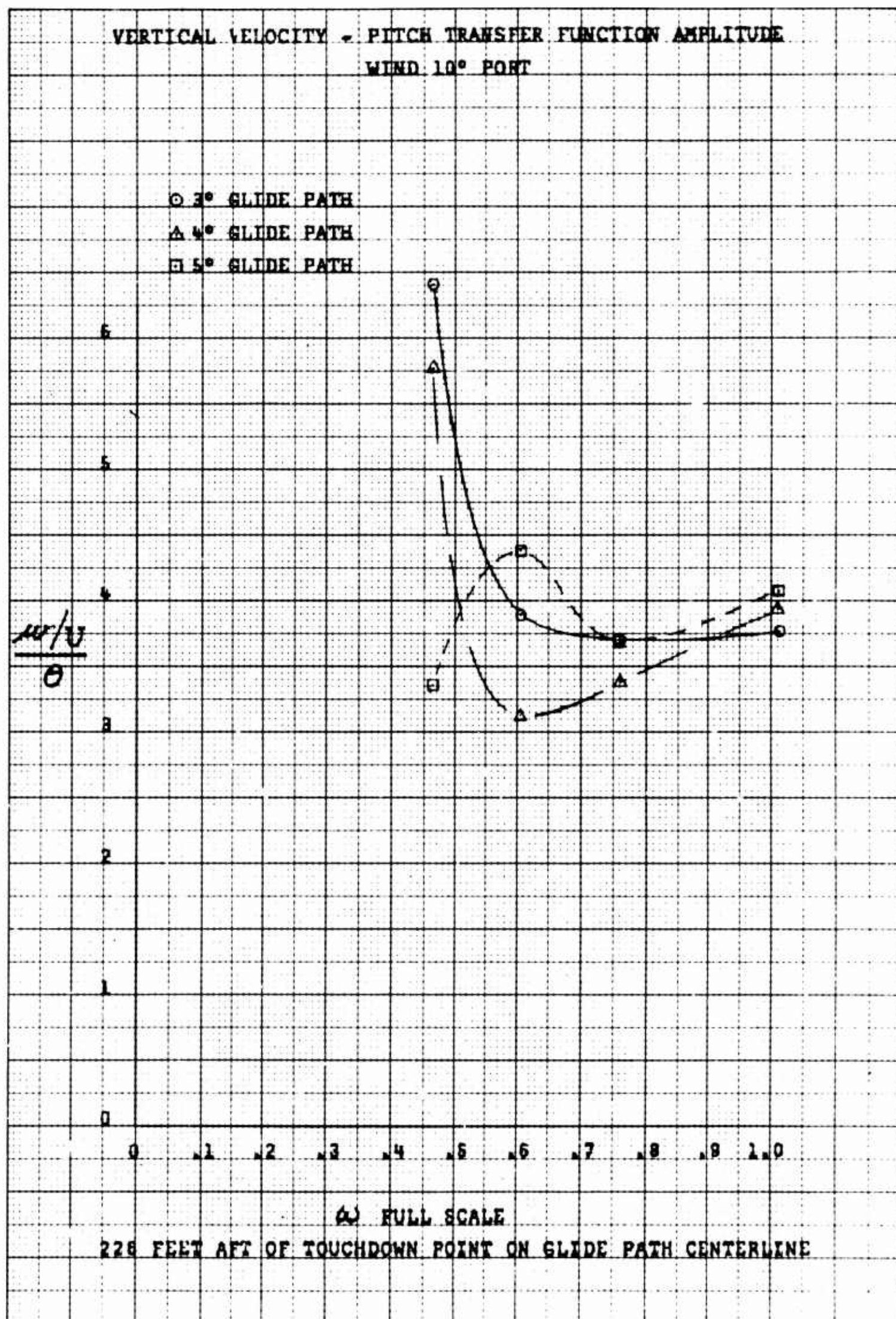
VERTICAL VELOCITY - PITCH TRANSFER FUNCTION AMPLITUDE
WIND 3° PORT



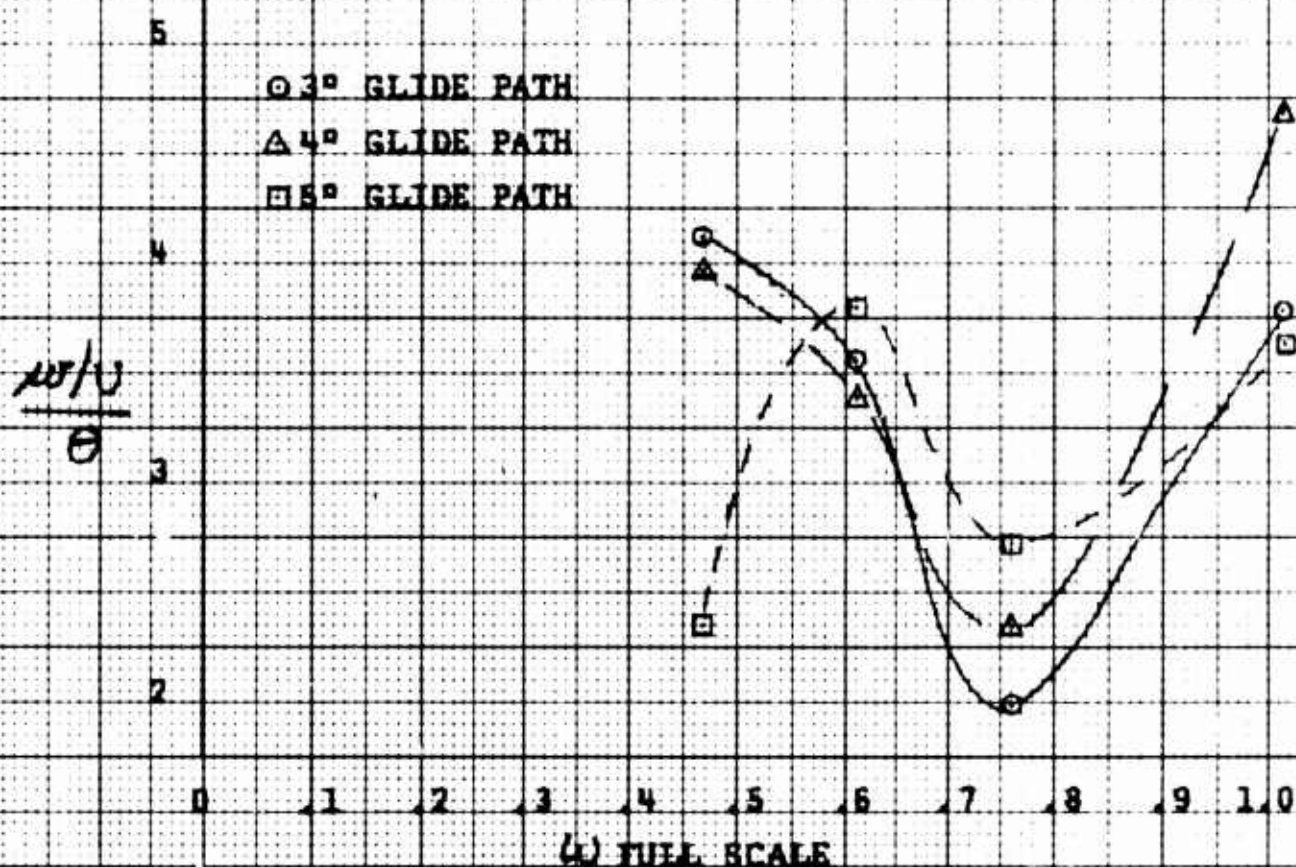
1040 FEET AFT OF TOUCHDOWN POINT, 47 FEET STARBOARD OF GLIDE PATH



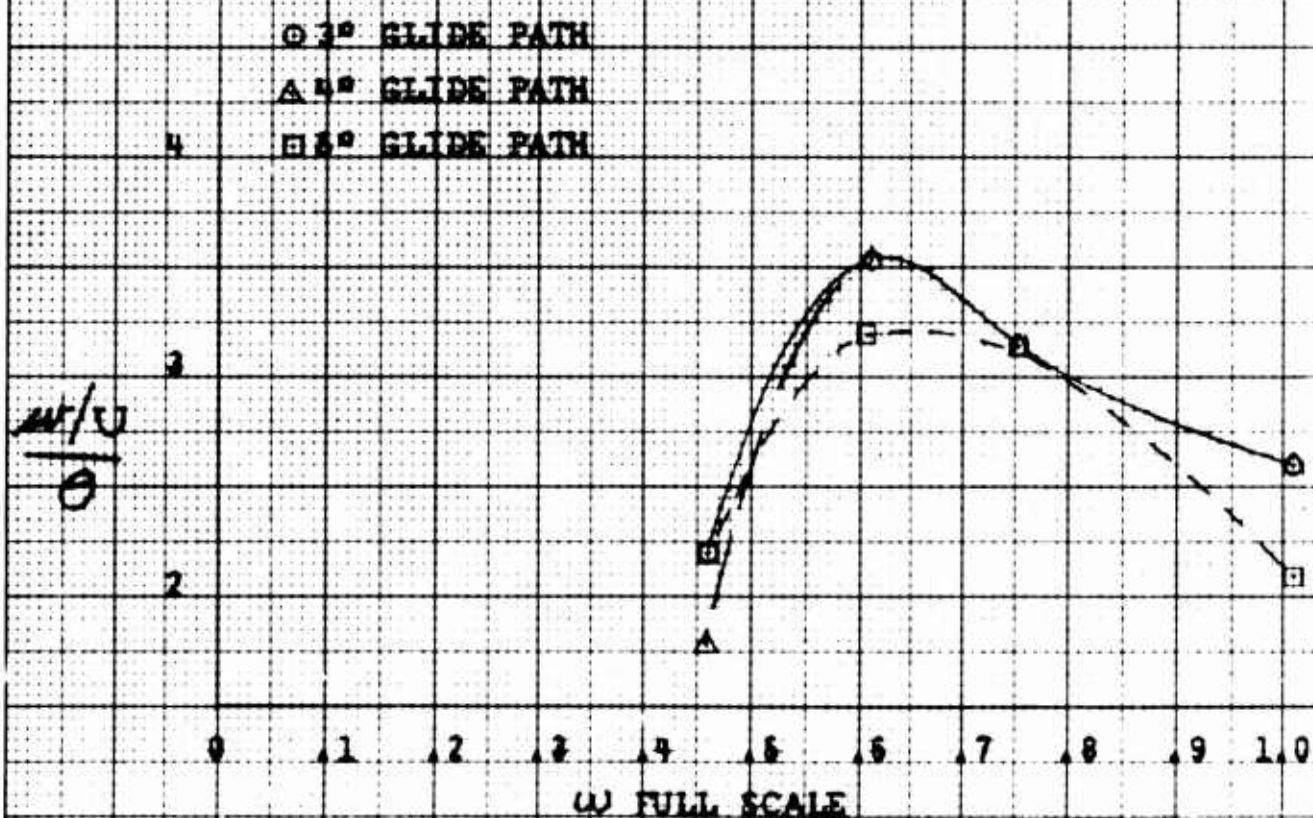
1040 FEET AFT OF TOUCHDOWN POINT, 47 FEET PORT OF GLIDE PATH



VERTICAL VELOCITY - PITCH TRANSFER FUNCTION AMPLITUDE
WIND 10° PORT



226 FEET AFT OF TOUCHDOWN POINT, 47 FEET PORT OF GLIDE PATH



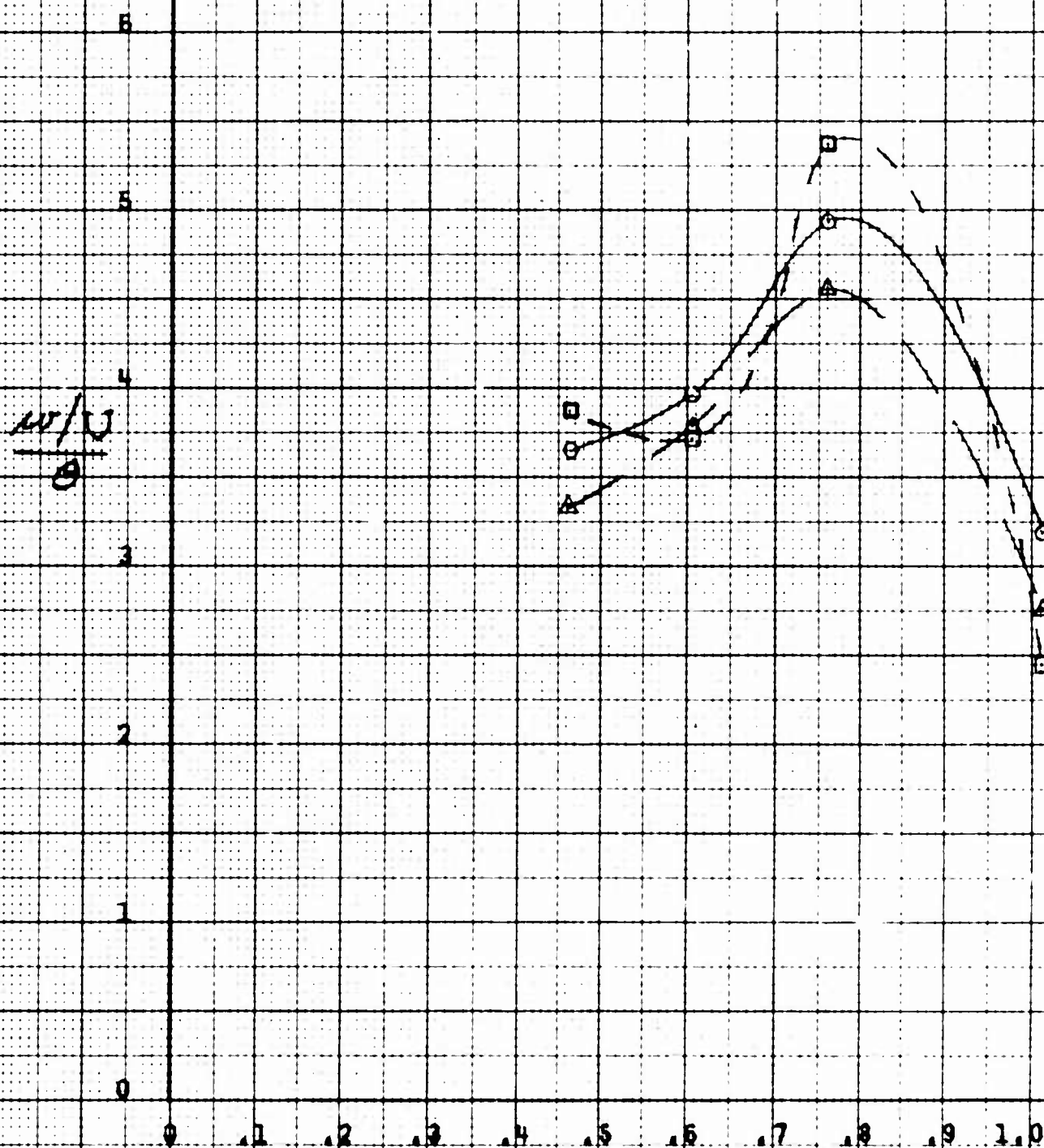
226 FEET AFT OF TOUCHDOWN POINT, 47 FEET STARBOARD OF GLIDE PATH

VERTICAL VELOCITY - PITCH TRANSFER FUNCTION AMPLITUDE
WIND 10P PORT

□ 3° GLIDE PATH

△ 4° GLIDE PATH

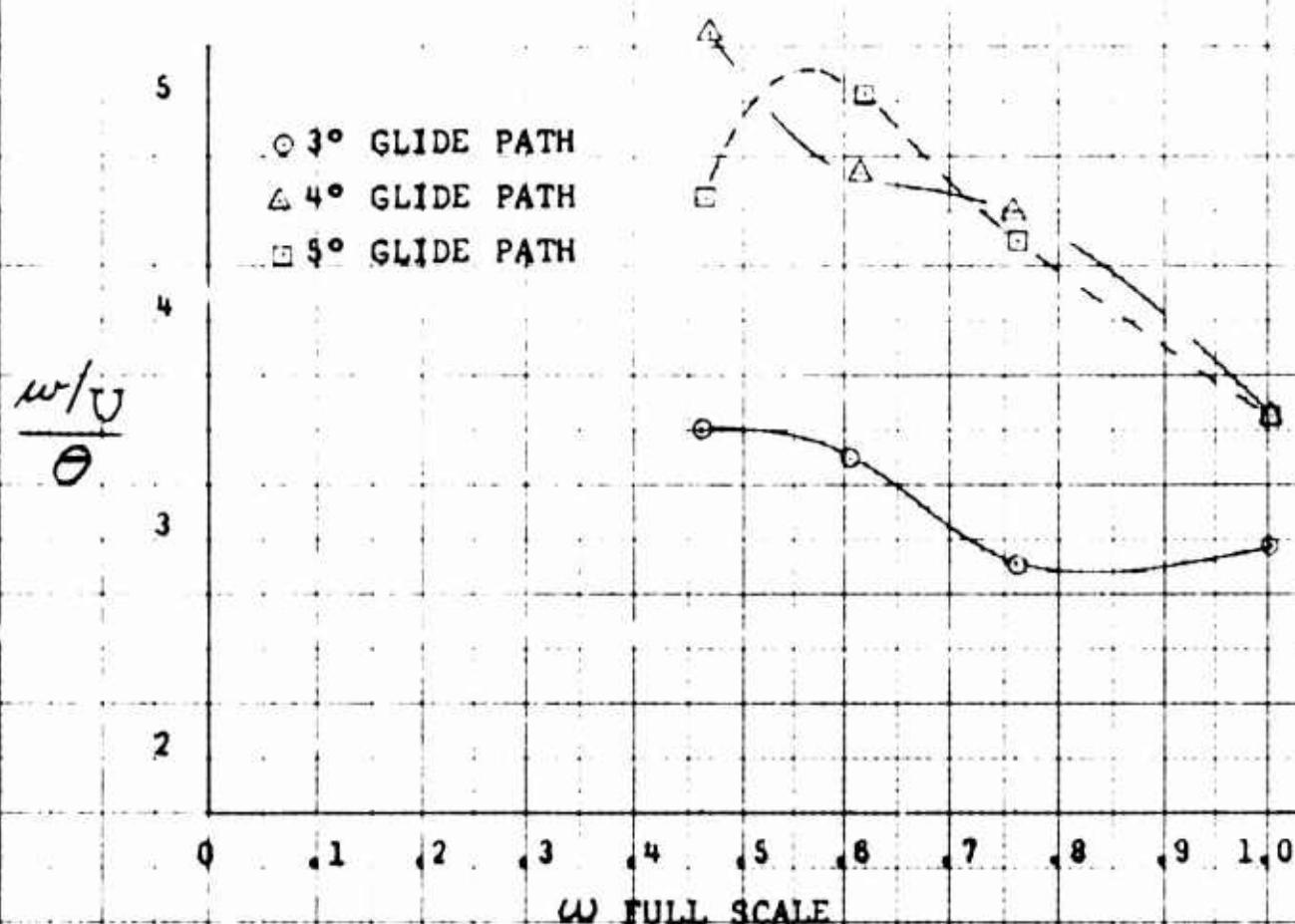
■ 5° GLIDE PATH



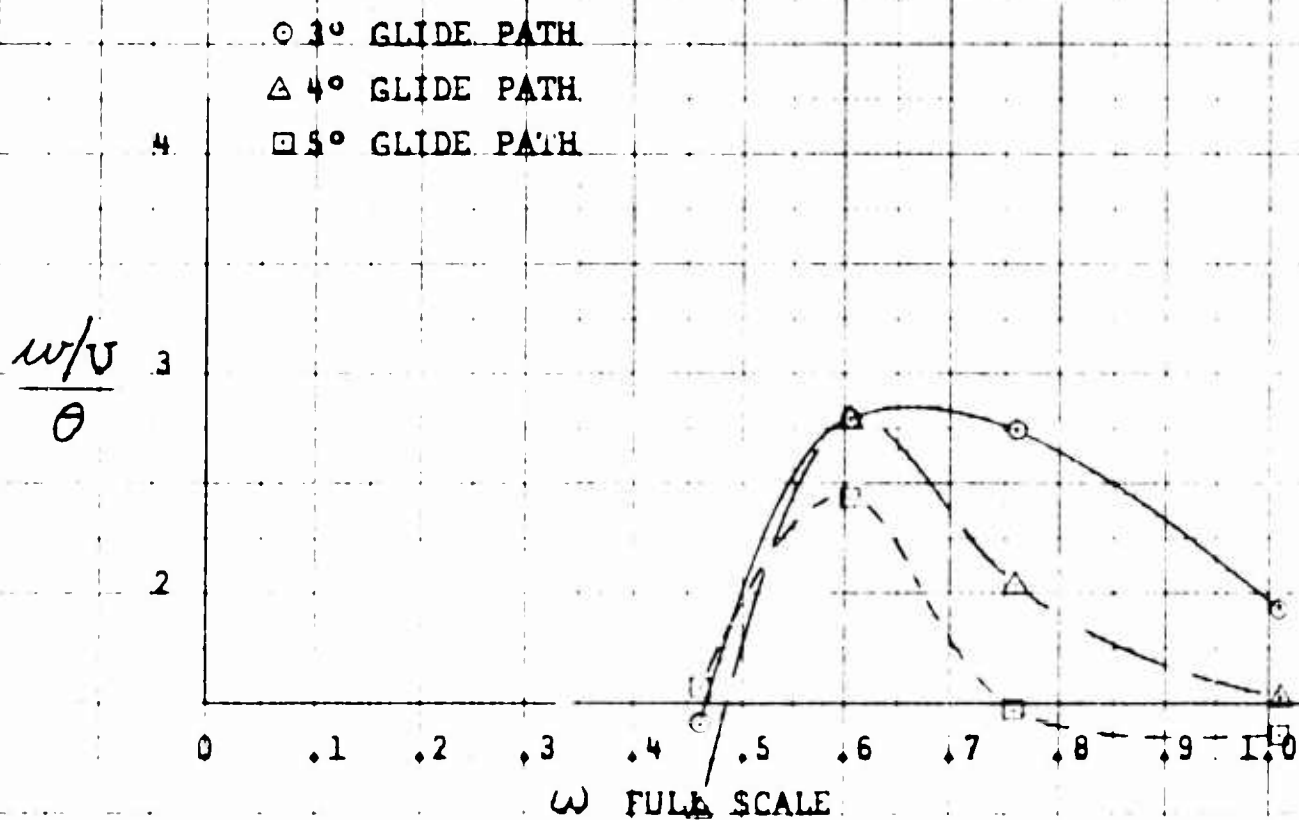
ω FULL SCALE

485 FEET AFT OF TOUCHDOWN POINT ON GLIDE PATH CENTERLINE

VERTICAL VELOCITY - PITCH TRANSFER FUNCTION AMPLITUDE
WIND 10° PORT



485 FEET AFT OF TOUCHDOWN POINT, 47 FEET PORT OF GLIDE PATH



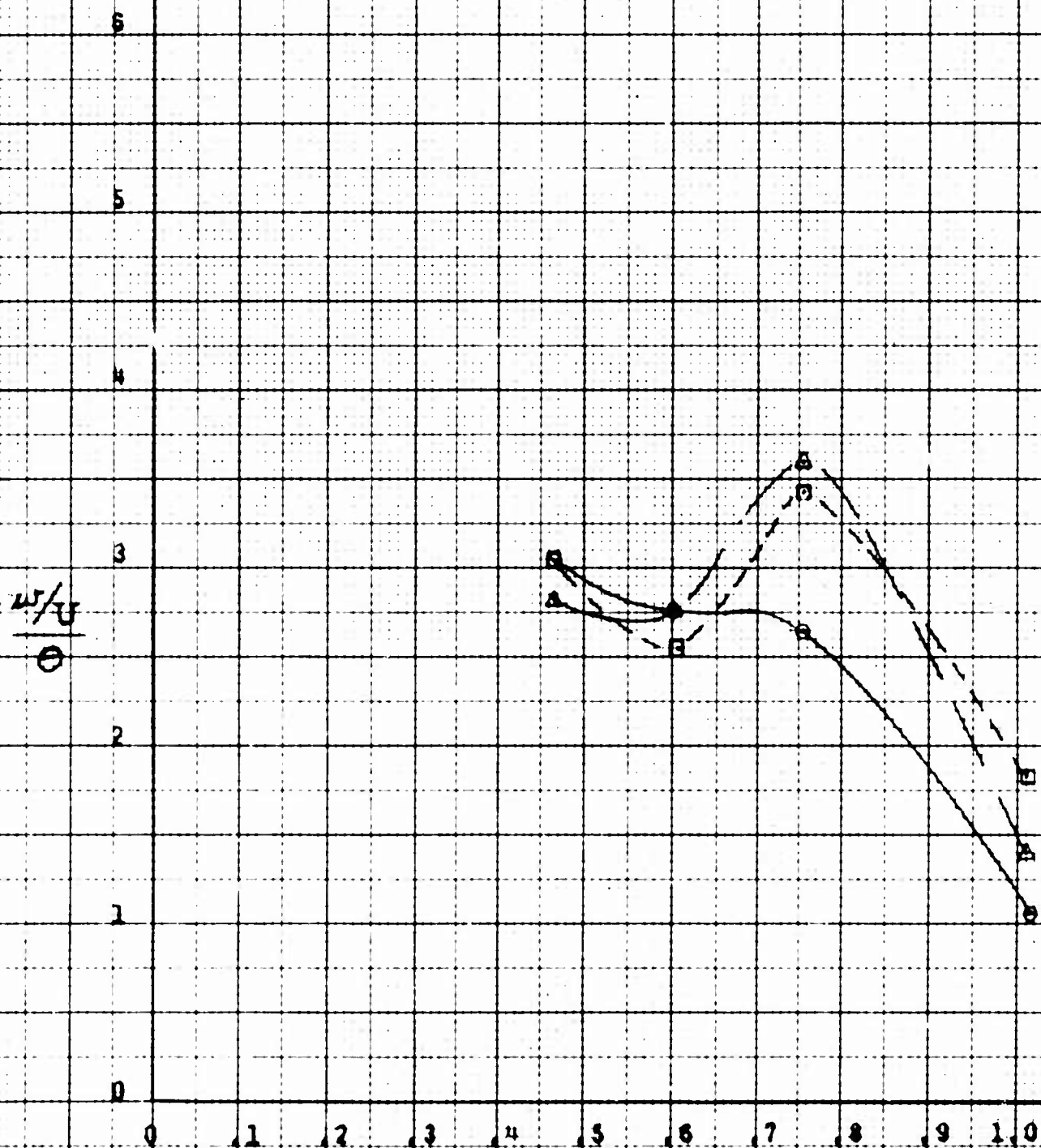
485 FEET AFT OF TOUCHDOWN POINT, 47 FEET STARBOARD OF GLIDE PATH

VERTICAL VELOCITY - PITCH TRANSFER FUNCTION AMPLITUDE WIND 10° PORT

○ 3° GLIDE PATH

△ 4° GLIDE PATH

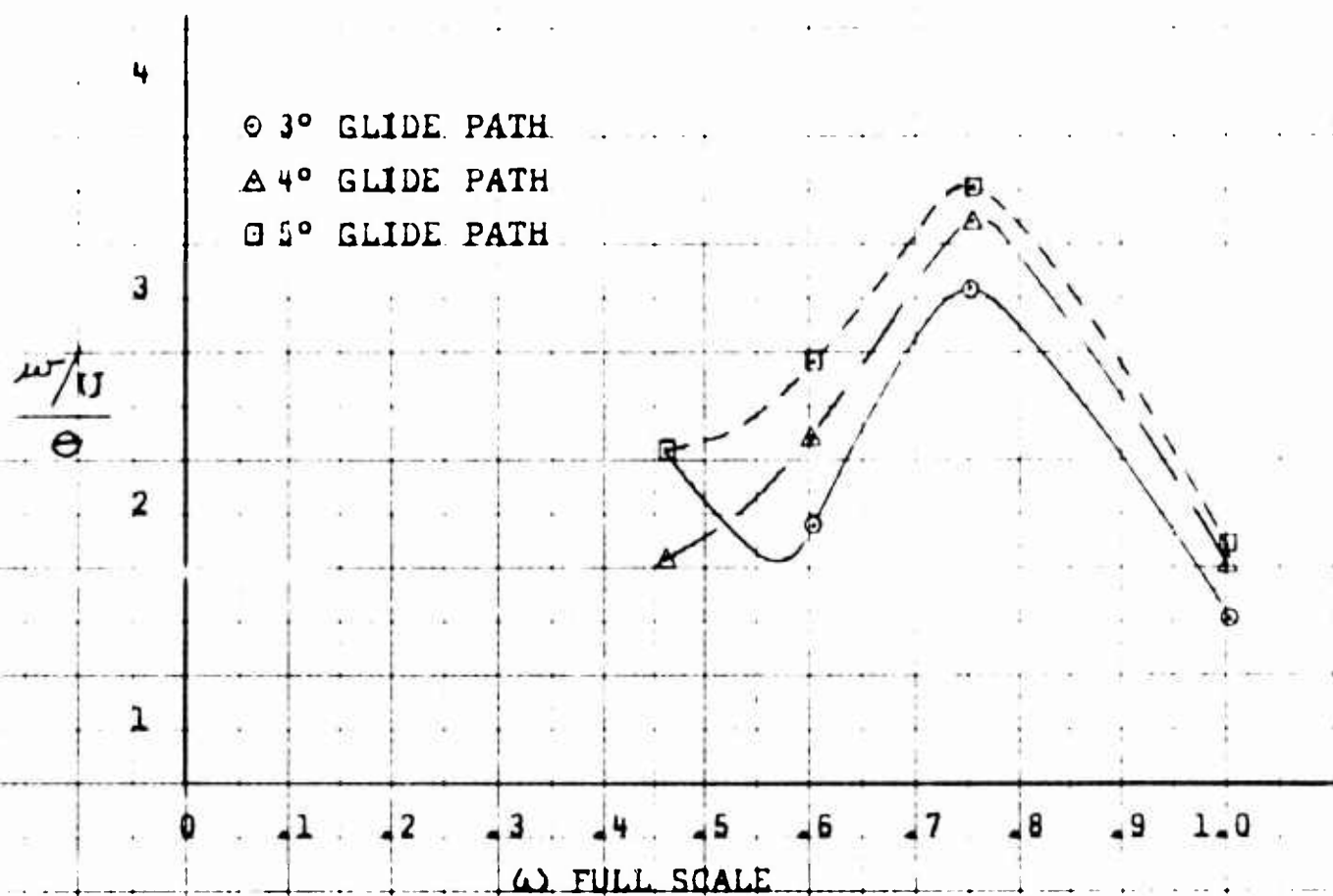
□ 5° GLIDE PATH



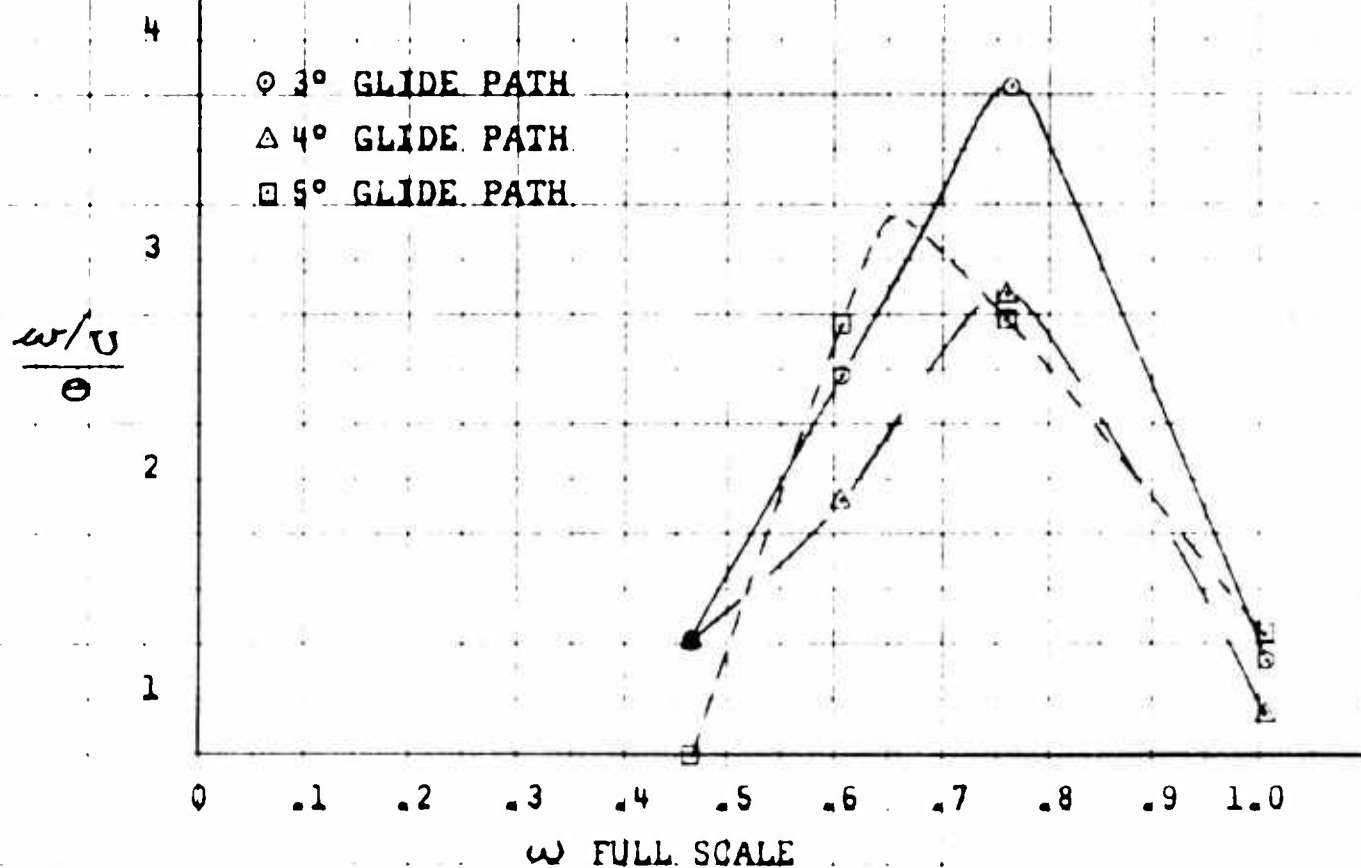
W FULL SCALE

754 FEET AFT OF TOUCHDOWN POINT ON GLIDE PATH CENTERLINE

VERTICAL VELOCITY - PITCH TRANSFER FUNCTION AMPLITUDE
WIND 10° PORT



764 FEET AFT OF TOUCHDOWN POINT, 47 FEET PORT OF GLIDE PATH



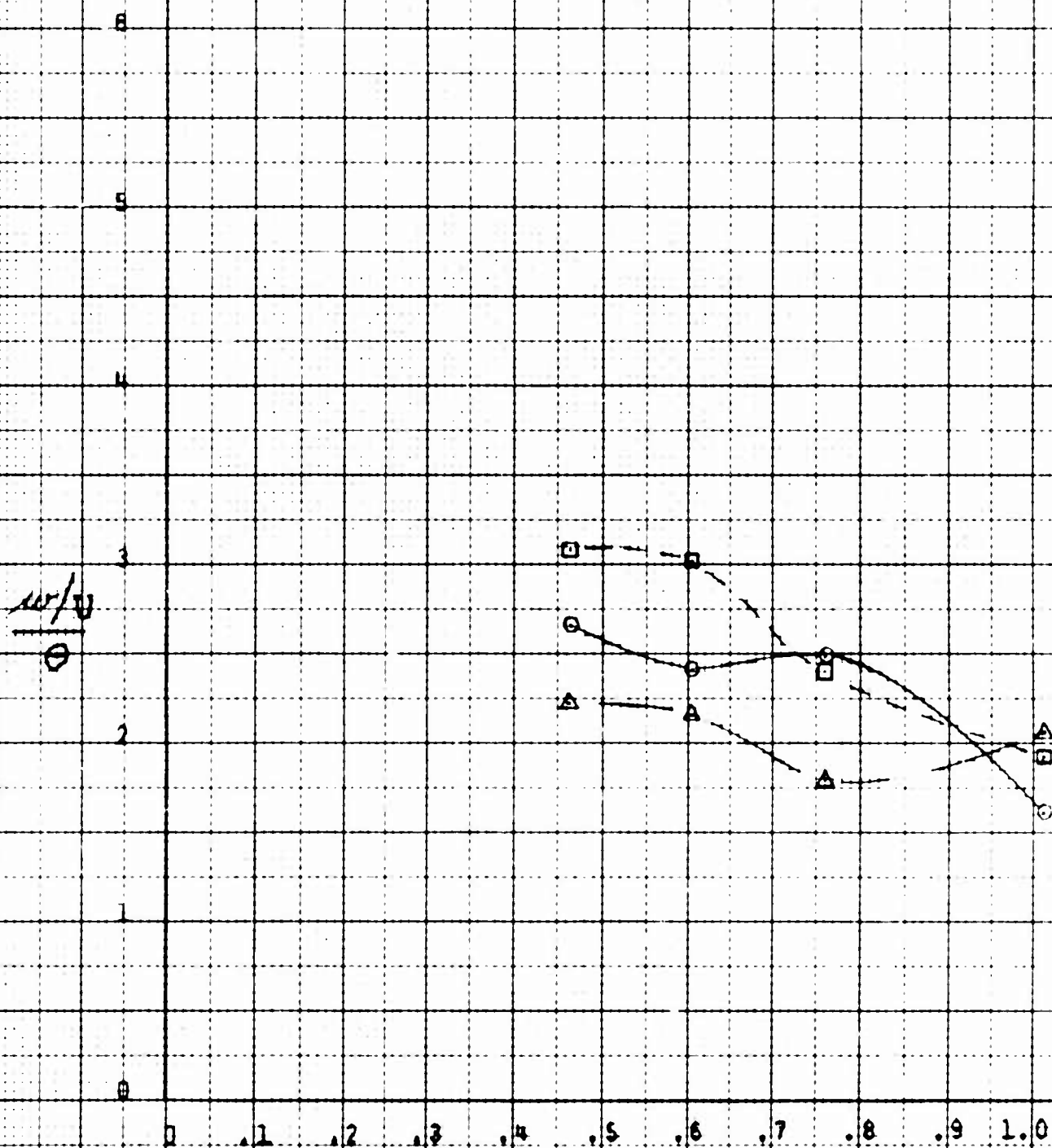
764 FEET AFT OF TOUCHDOWN POINT, 47 FEET STARBOARD OF GLIDE PATH

VERTICAL VELOCITY - PITCH TRANSFER FUNCTION AMPLITUDE
WIND 10° PORT

○ 3° GLIDE PATH

△ 4° GLIDE PATH

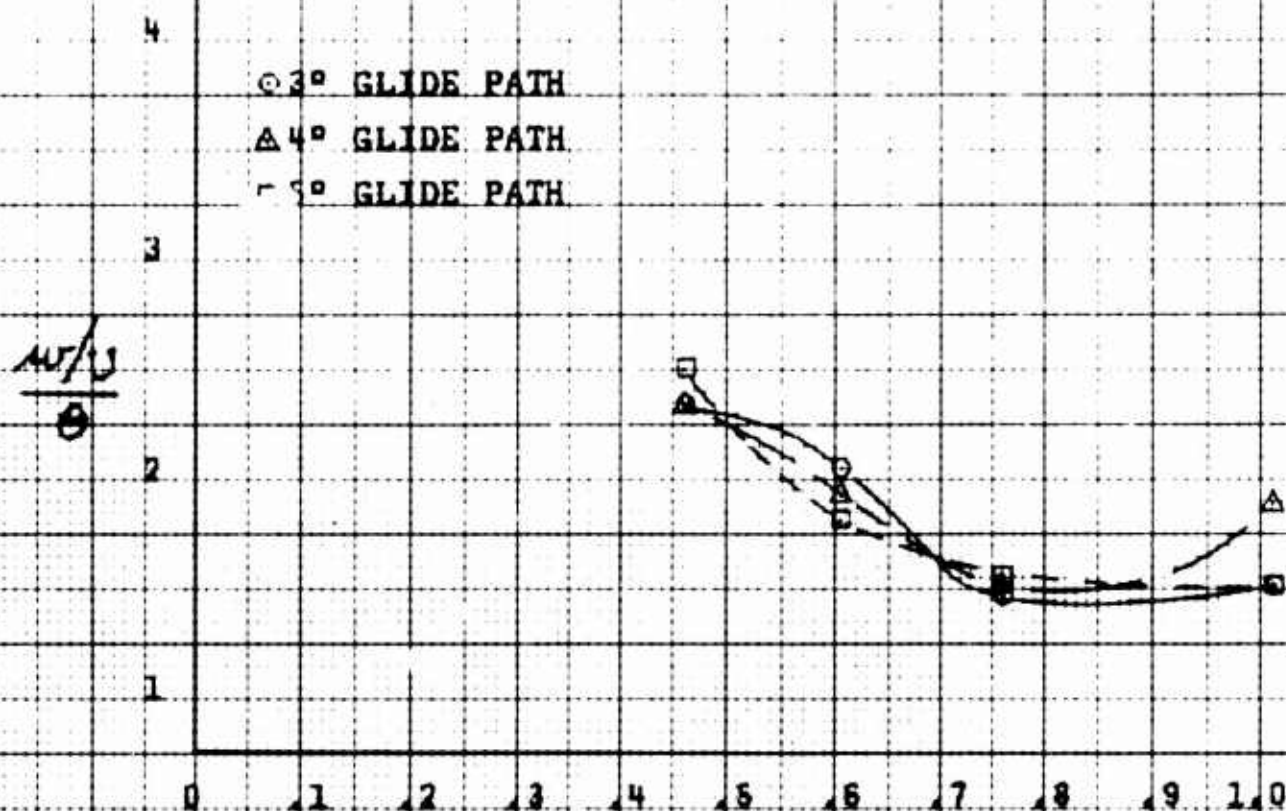
□ 5° GLIDE PATH



(U) FULL SCALE

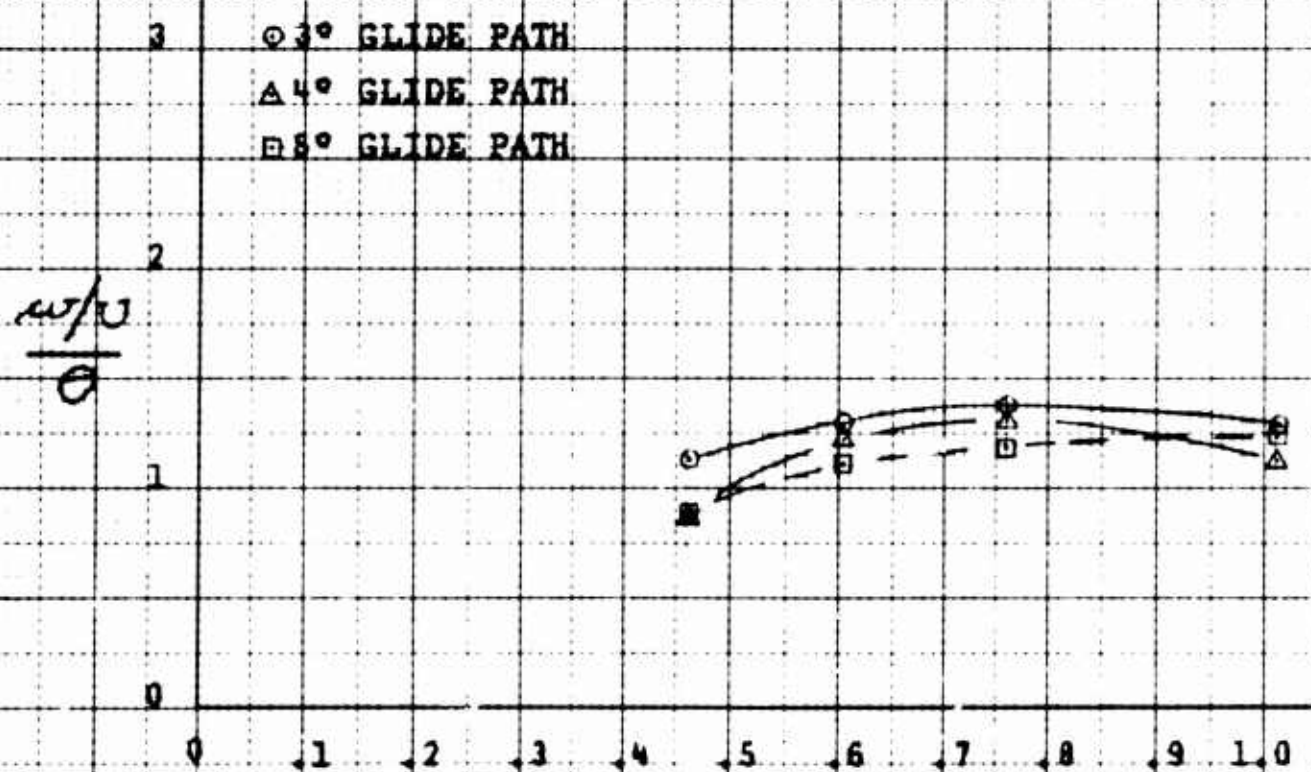
1040 FEET AFT OF TOUCHDOWN POINT ON GLIDE PATH CENTERLINE

VERTICAL VELOCITY - PITCH TRANSFER FUNCTION AMPLITUDE
WIND 10° PORT



(a) FULL SCALE

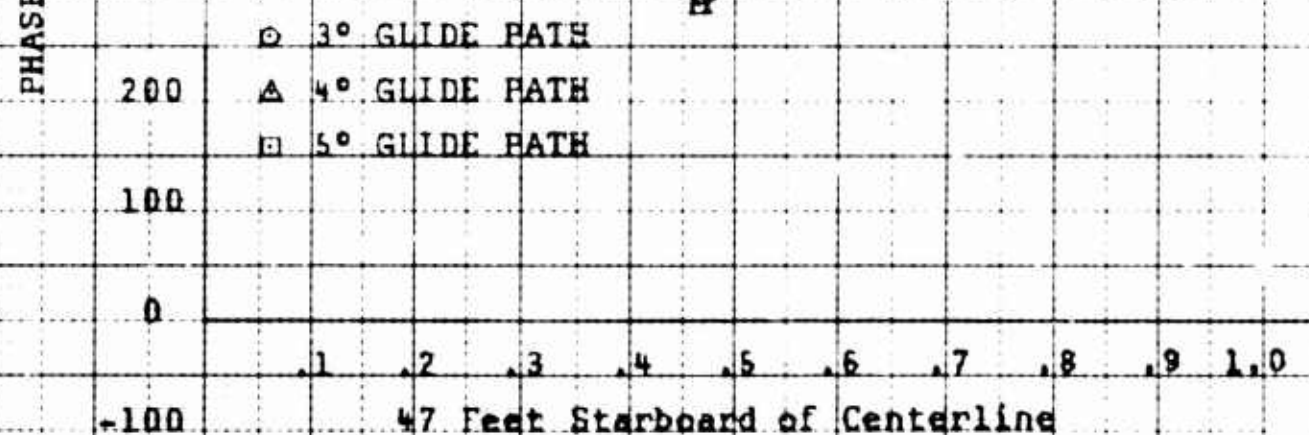
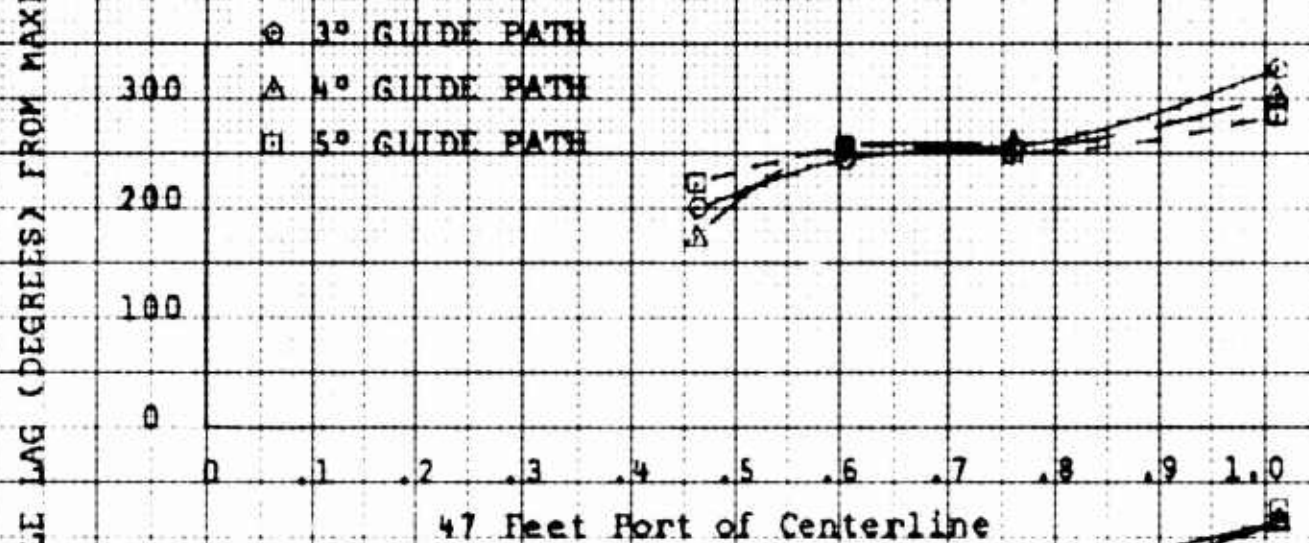
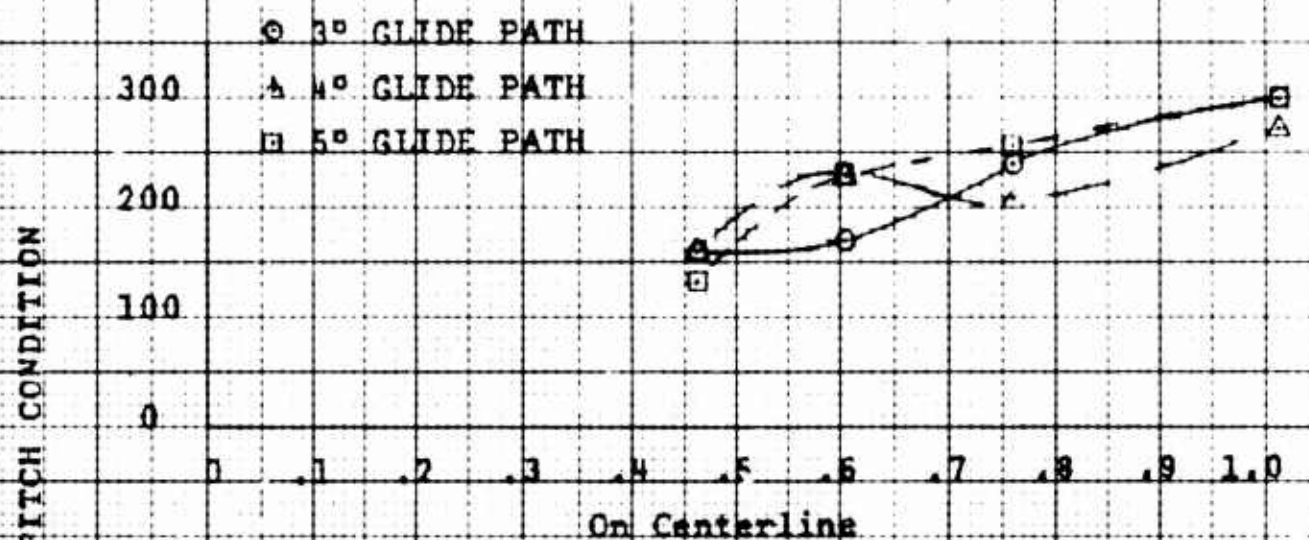
1040 FEET AFT OF TOUCHDOWN POINT, 47 FEET PORT OF GLIDE PATH



(b) FULL SCALE

1040 FEET AFT OF TOUCHDOWN POINT, 47 FEET STARBOARD OF GLIDE PATH

VERTICAL VELOCITY - PITCH TRANSFER FUNCTION PHASE
 225 FEET AFT OF TOUCHDOWN
 WIND 3° PORT



W FULL SCALE

OCEANICS

VERTICAL VELOCITY - PITCH TRANSFER FUNCTION PHASE
 485 FEET AFT OF TOUCHDOWN
 WIND 3° PORT

PHASE ANGLE LAG (DEGREES) FROM MAXIMUM PITCH CONDITION

400

300

200

100

0

○ 3° GLIDE PATH

△ 4° GLIDE PATH

□ 5° GLIDE PATH

0

.1

.2

.3

.4

.5

.6

.7

.8

.9

1.0

On Centerline

300

200

100

0

-100

○ 3° GLIDE PATH

△ 4° GLIDE PATH

□ 5° GLIDE PATH

.1

.2

.3

.4

.5

.6

.7

.8

.9

1.0

47 Feet Port of Centerline

400

300

200

100

0

○ 3° GLIDE PATH

△ 4° GLIDE PATH

□ 5° GLIDE PATH

.1

.2

.3

.4

.5

.6

.7

.8

.9

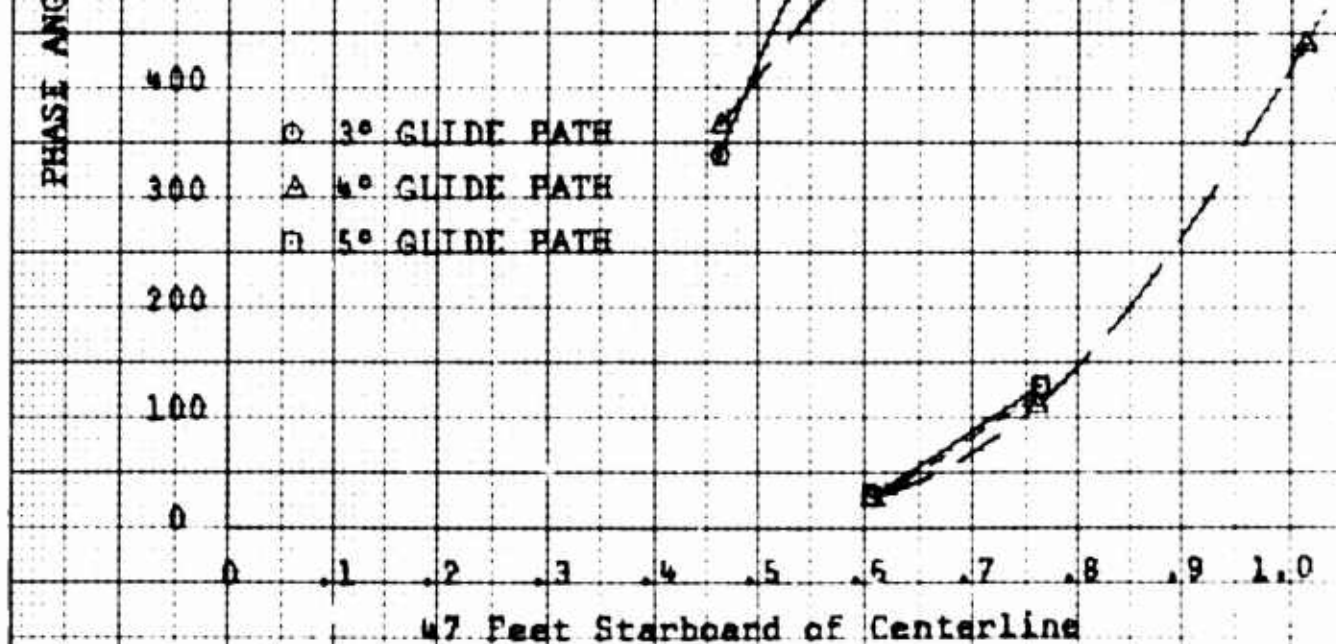
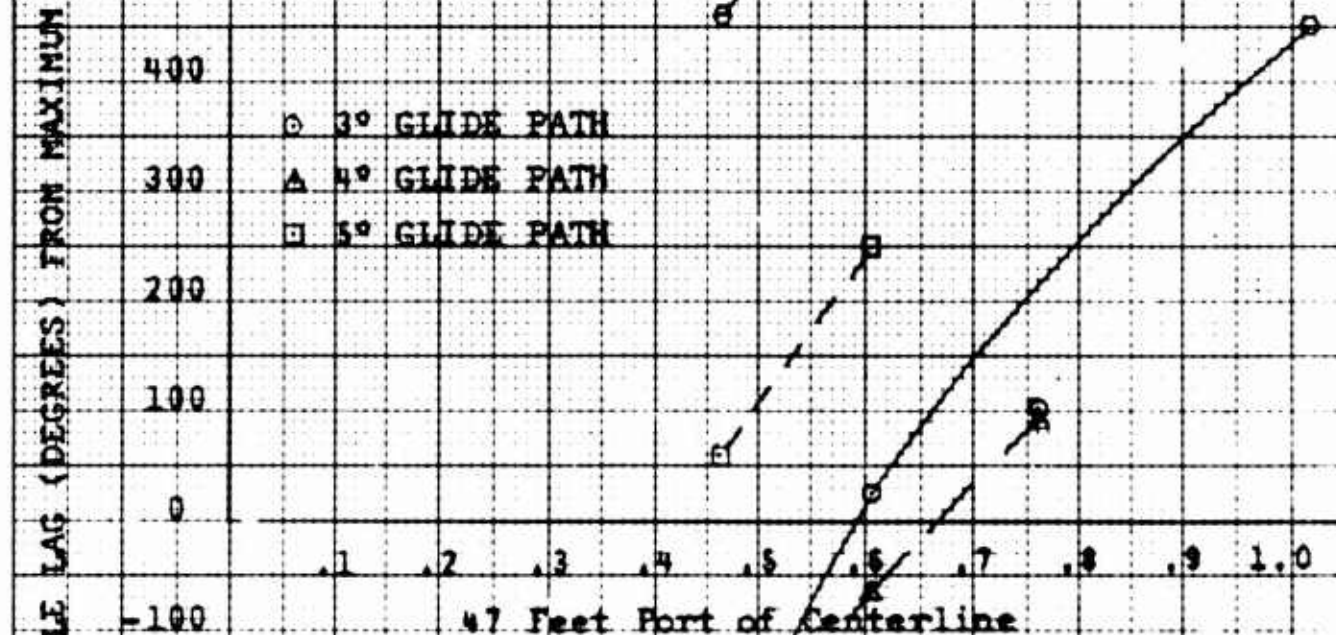
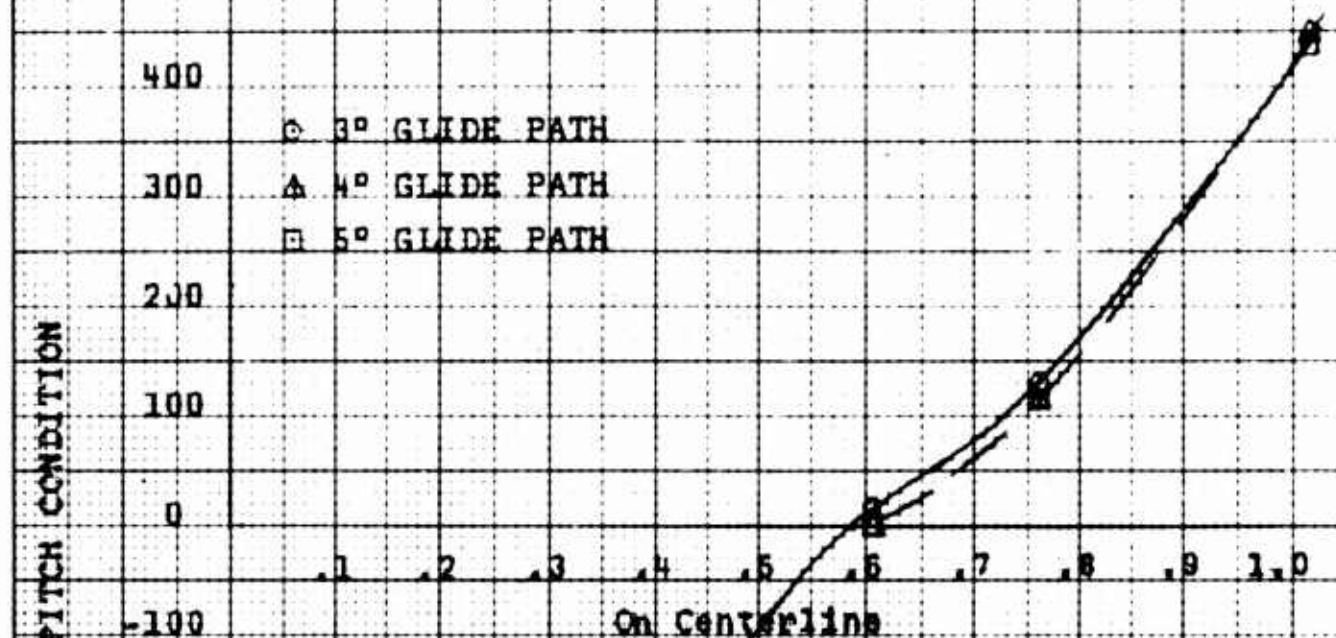
1.0

47 Feet Starboard of Centerline

G2 FULL SCALE

OCEANICS

VERTICAL VELOCITY - PITCH TRANSFER FUNCTION PHASE
 764 FEET AFT OF TOUCHDOWN
 WIND 3° PORT



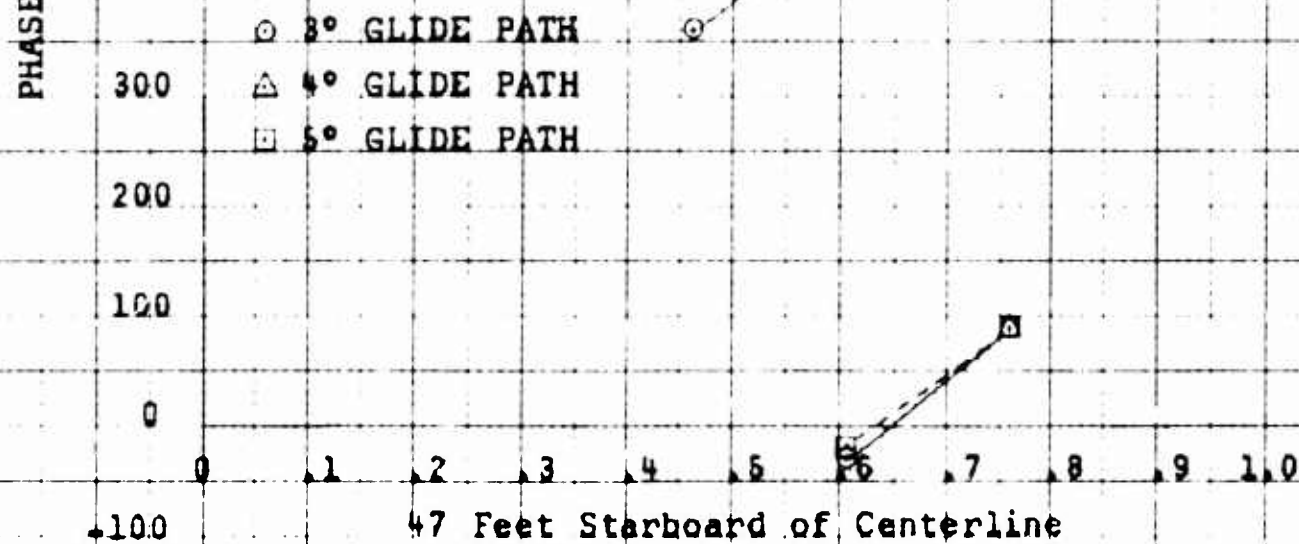
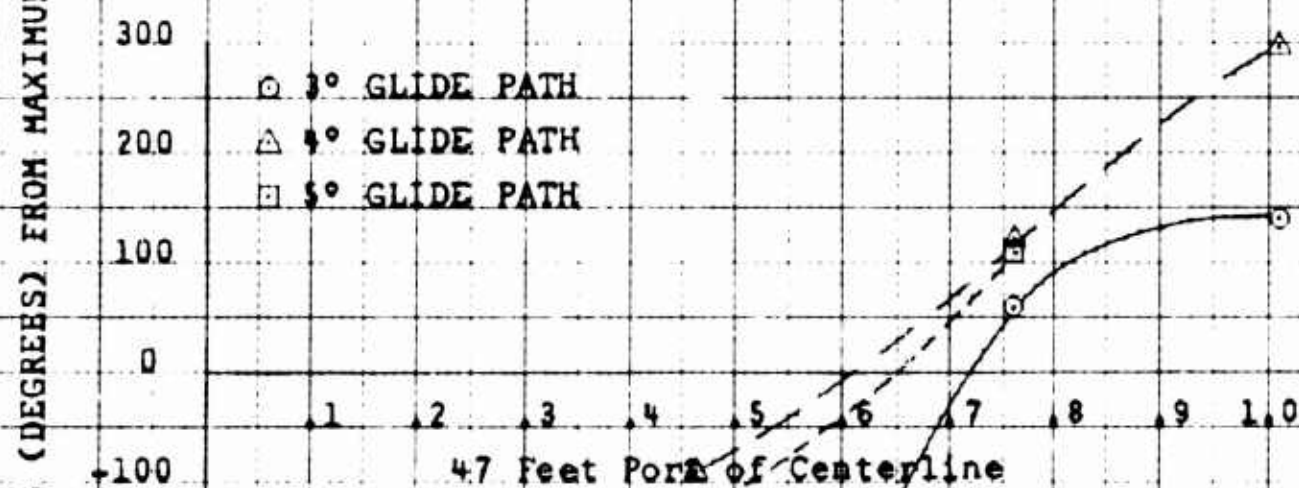
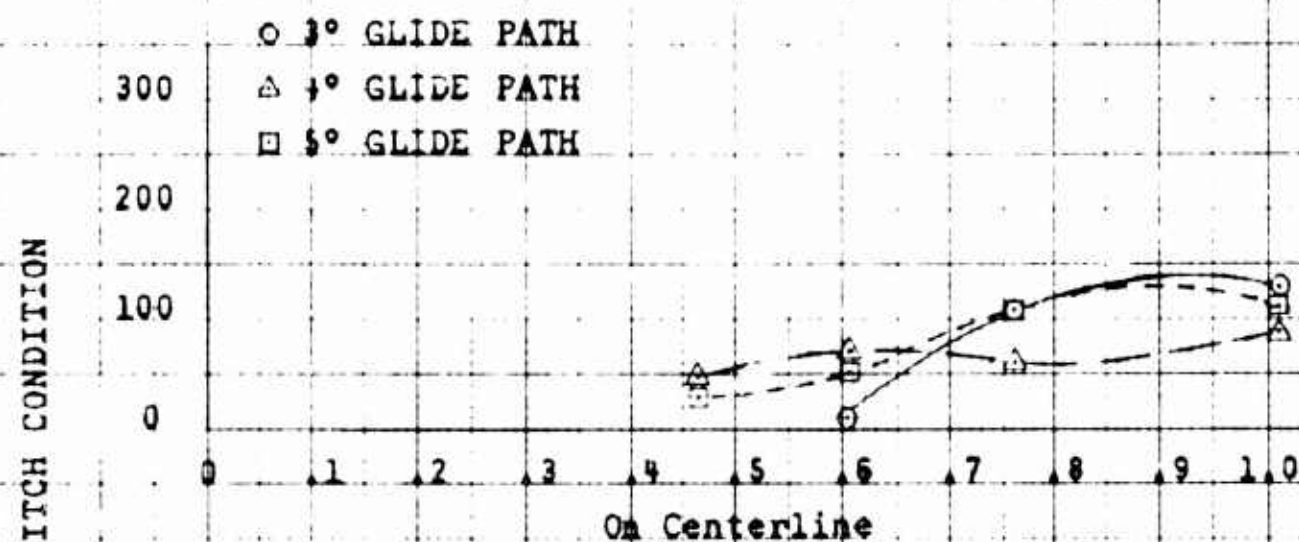
1.0 FULL SCALE

OCEANICS

VERTICAL VELOCITY - PITCH TRANSFER PHASE

1040 FEET AFT OF TOUCHDOWN

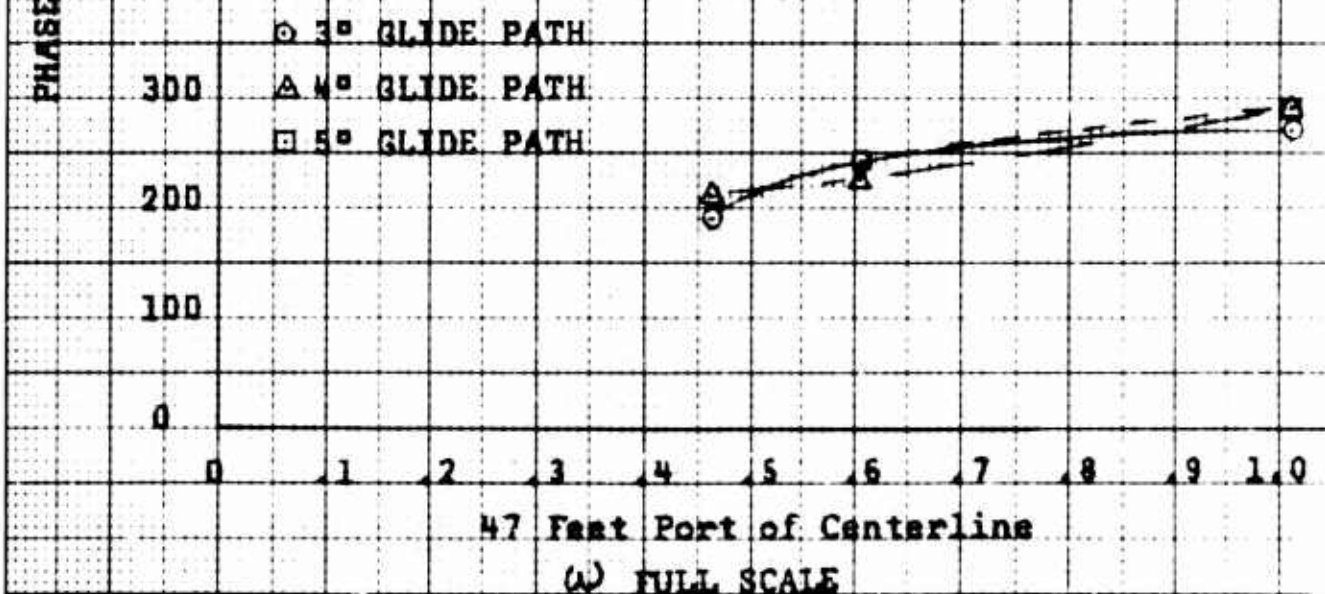
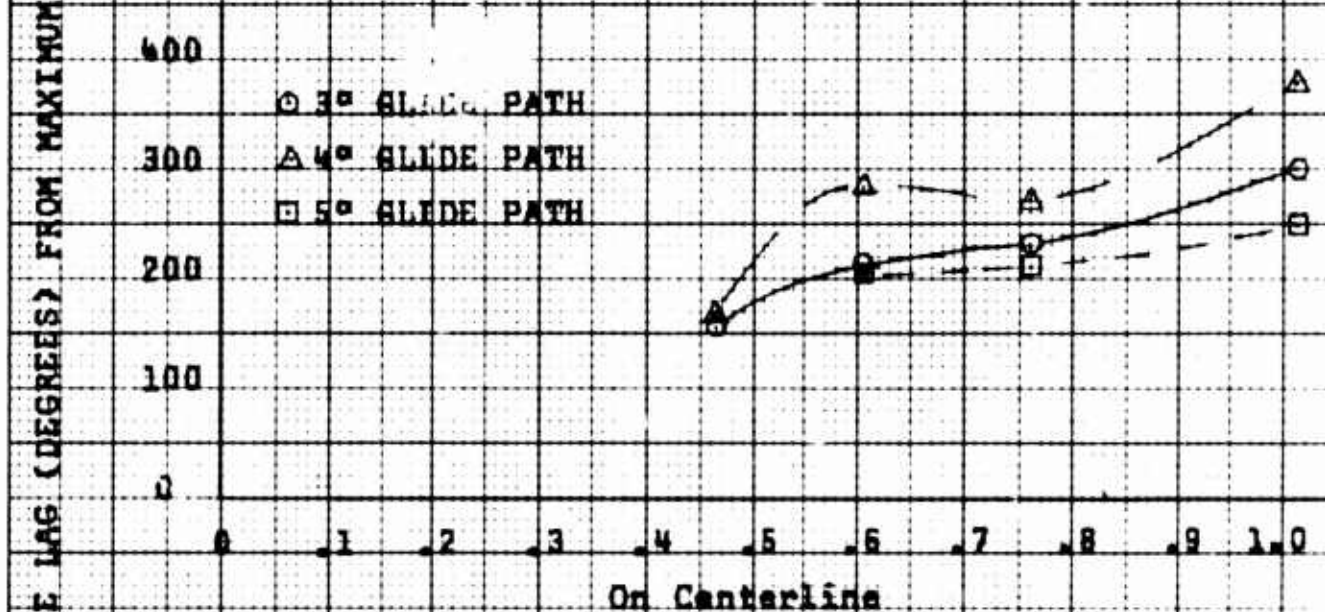
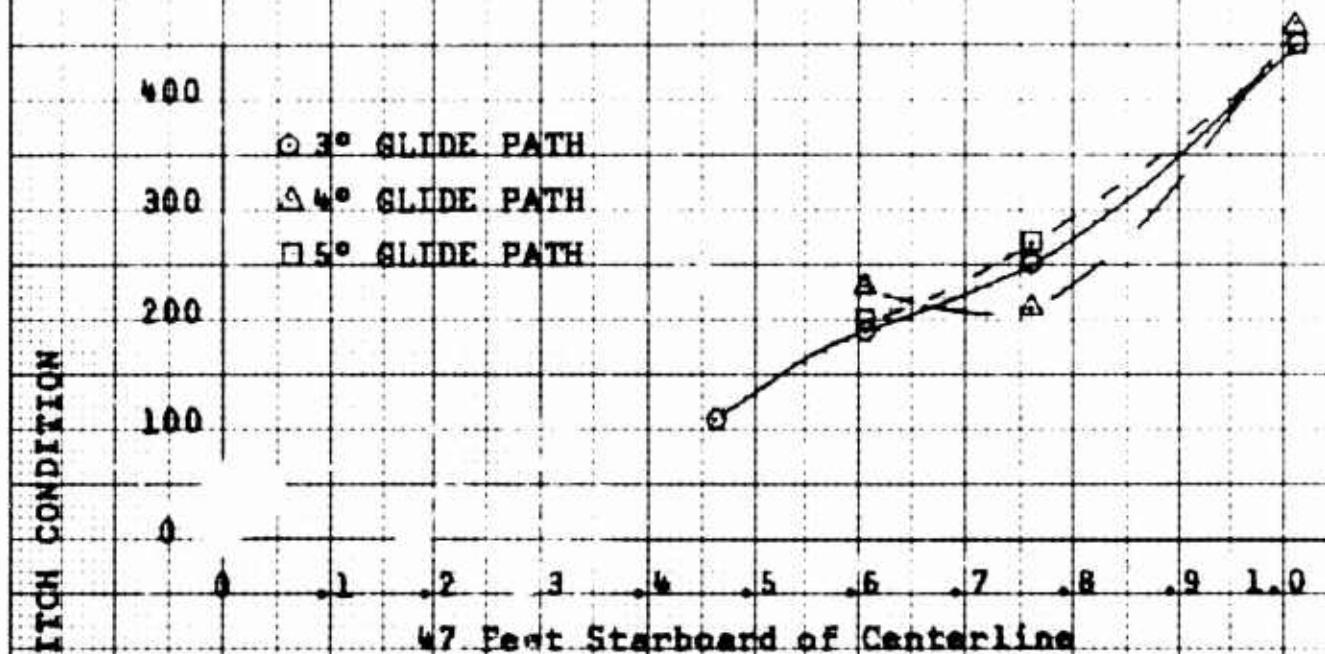
WIND 3° PORT



ω FULL SCALE

OCEANICS

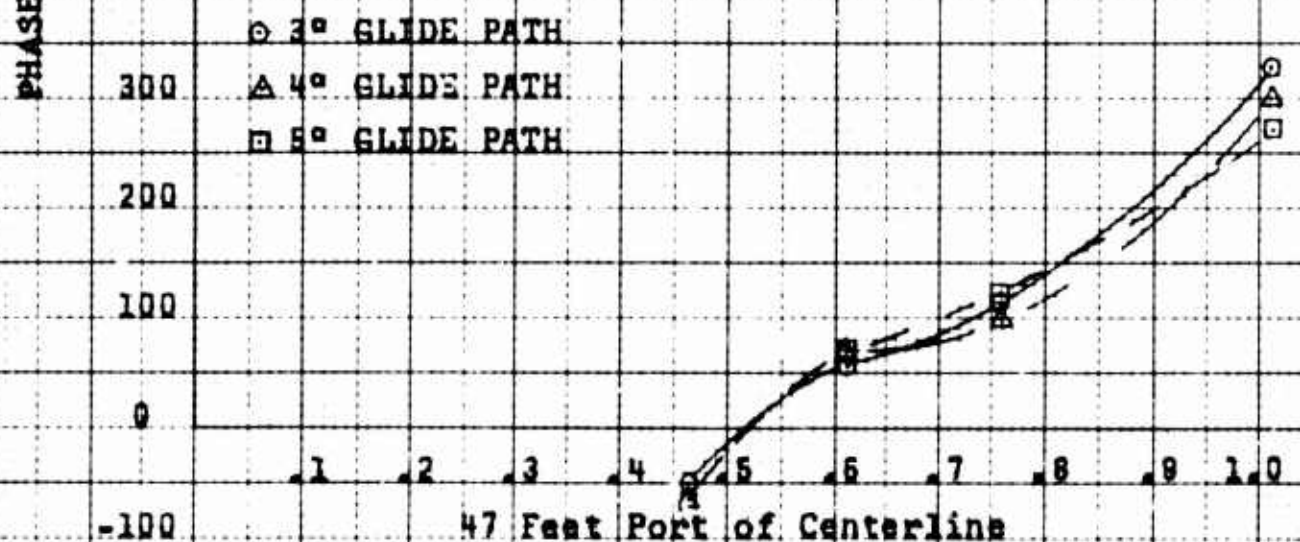
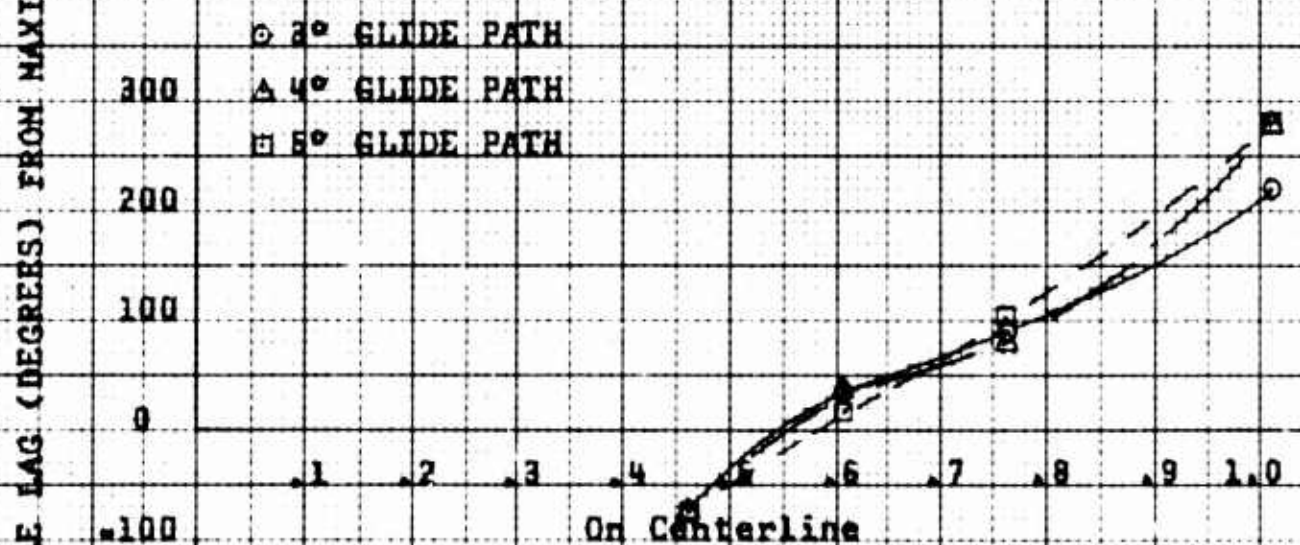
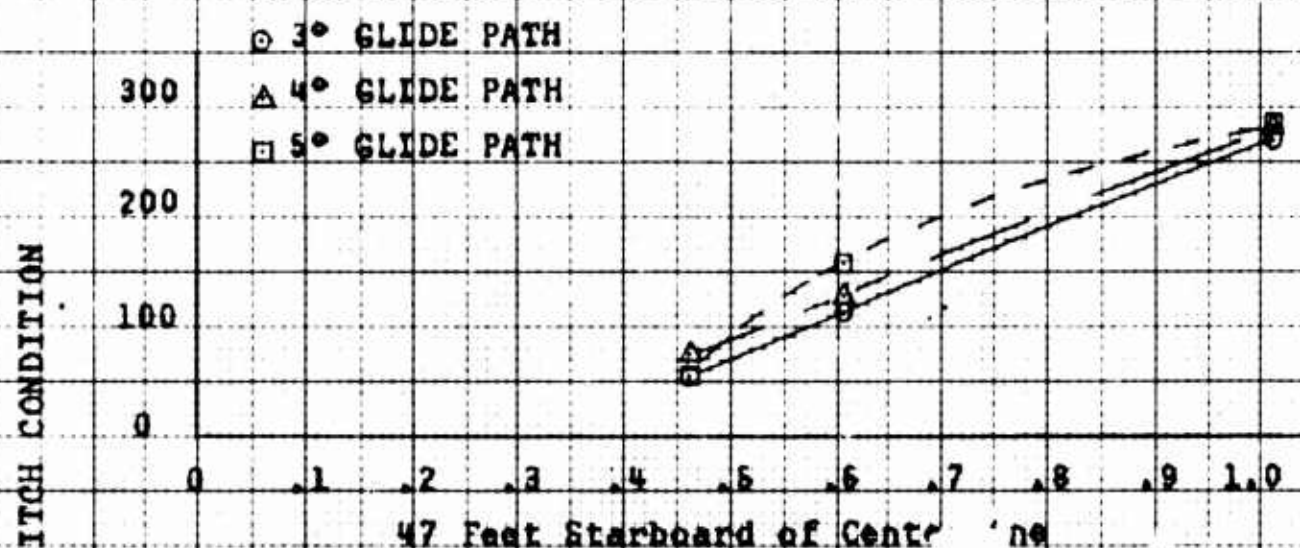
VERTICAL VELOCITY - PITCH TRANSFER FUNCTION PHASE
 226 FEET AFT OF TOUCHDOWN
 WIND 10° PORT



VERTICAL VELOCITY - PITCH TRANSFER FUNCTION PHASE

485 FEET AFT OF TOUCHDOWN

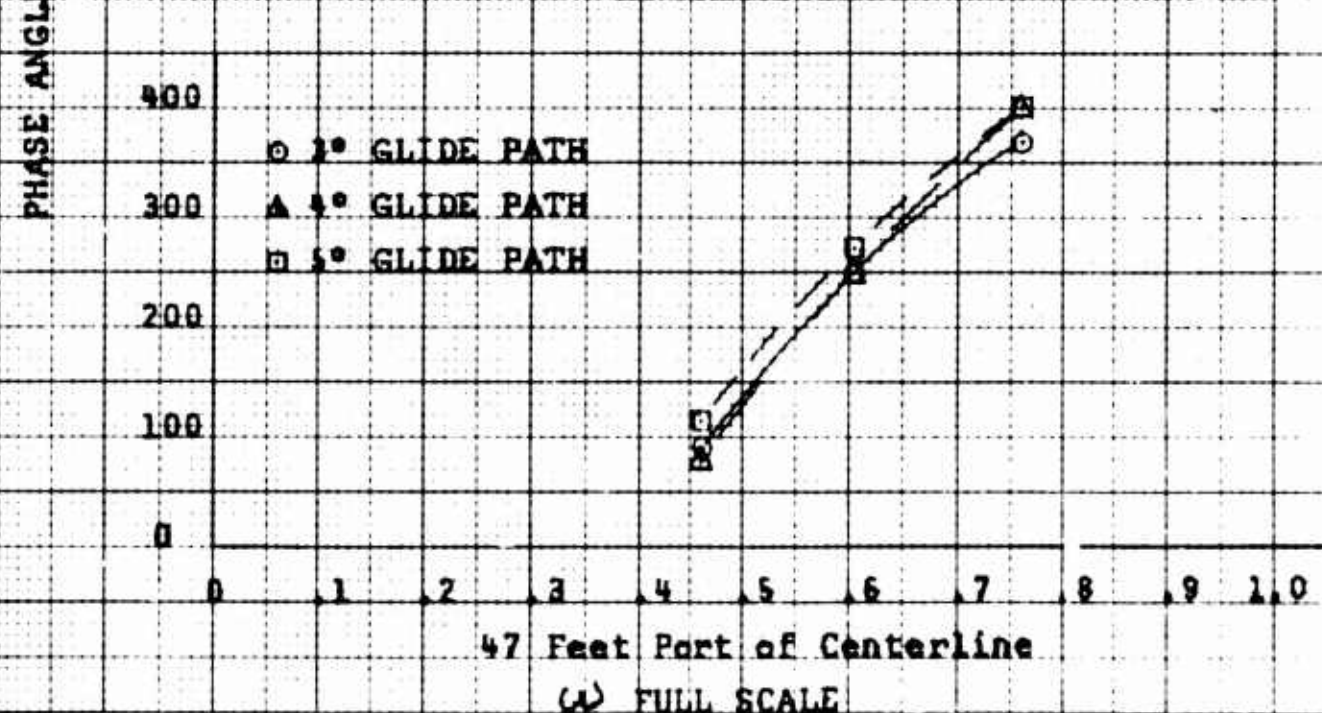
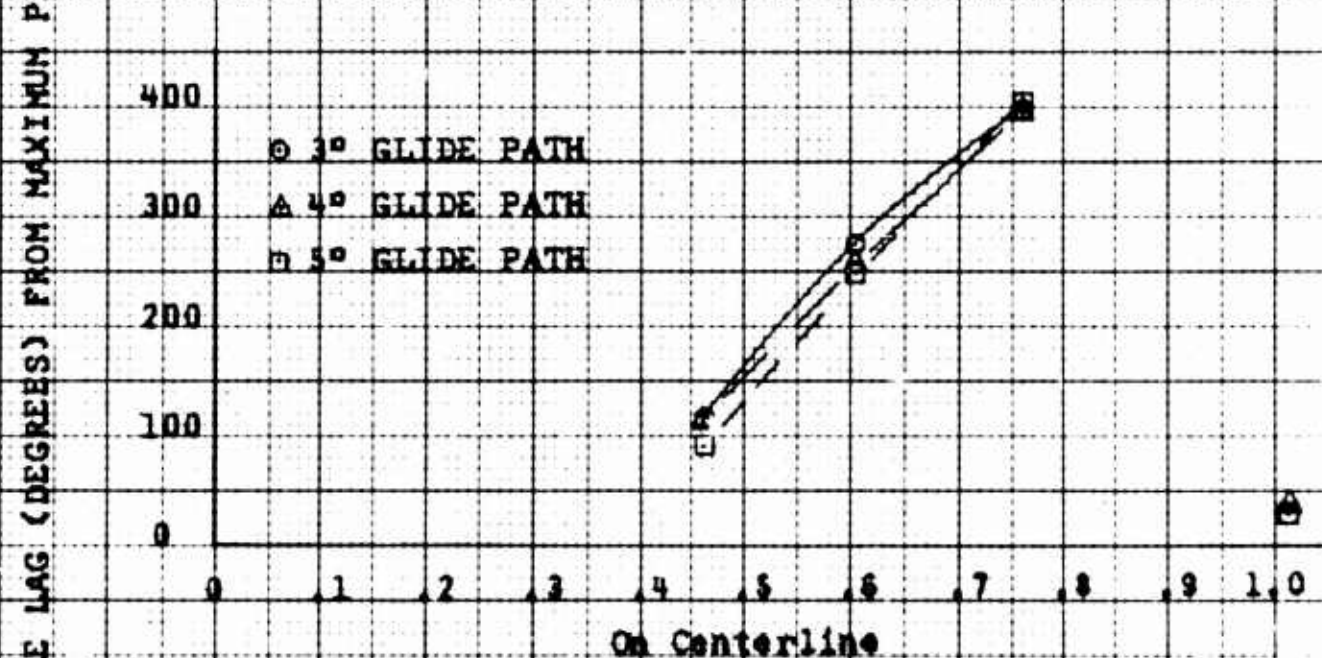
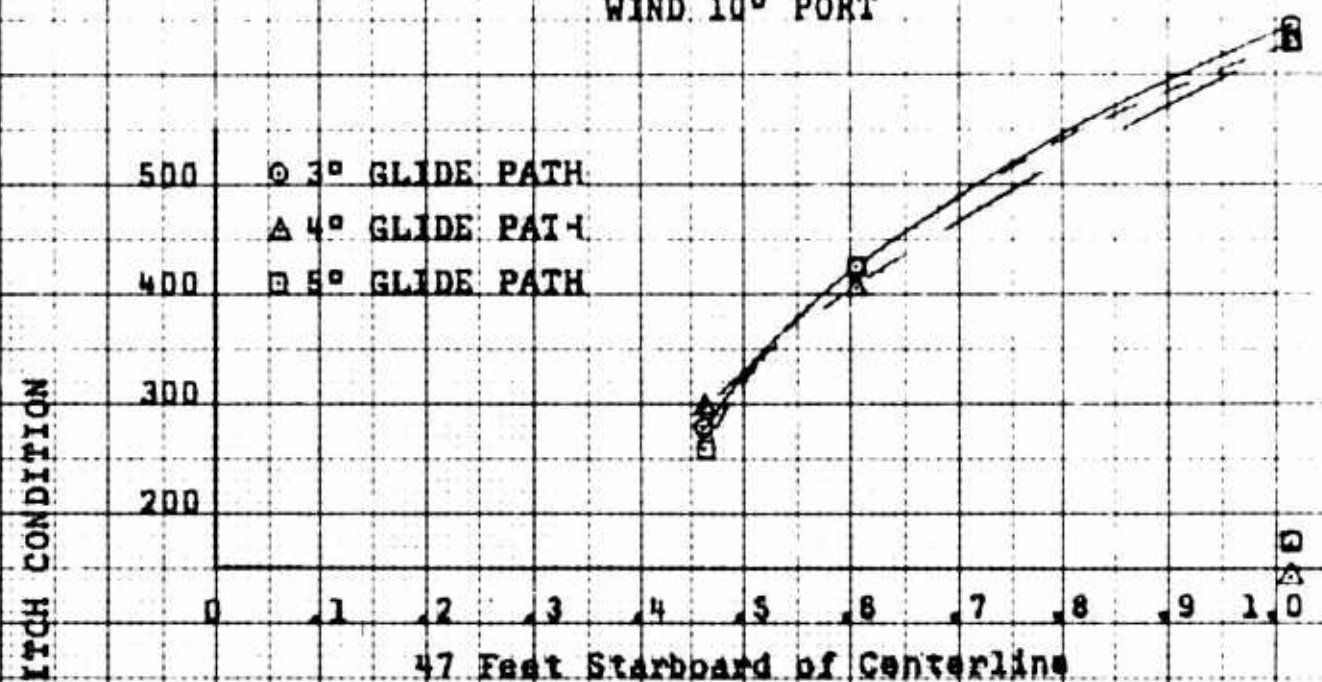
WIND 10° PORT

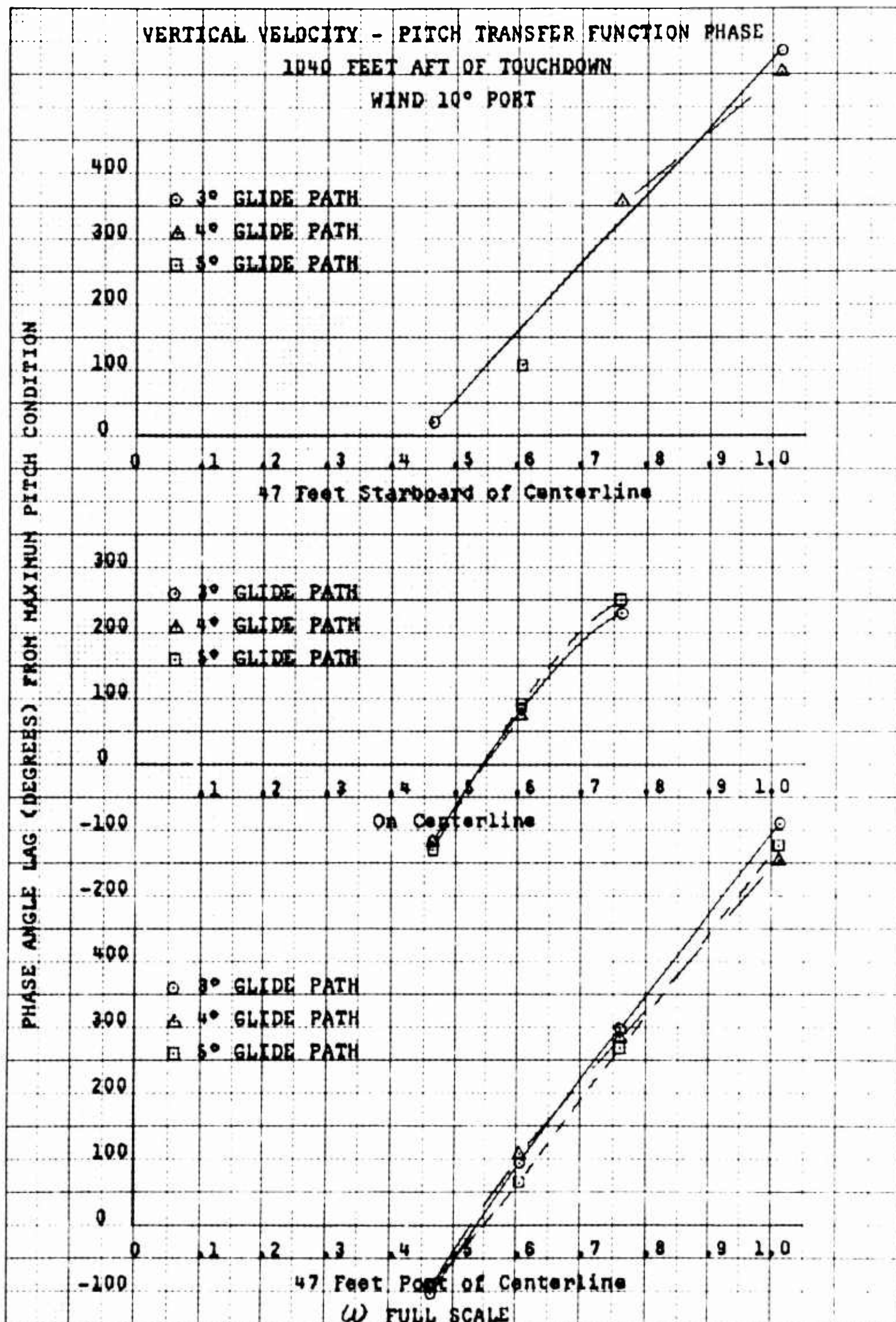


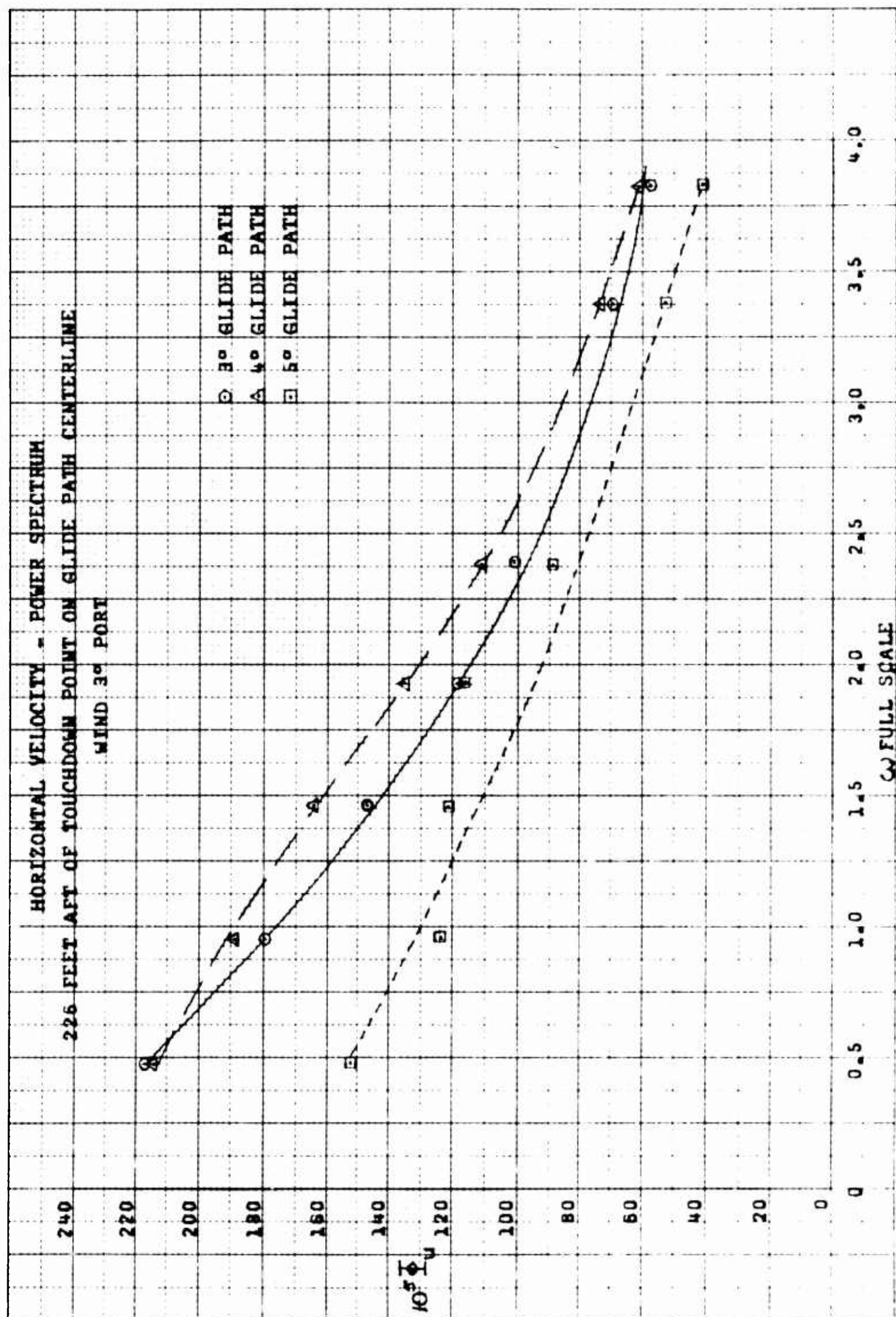
(ω) FULL SCALE

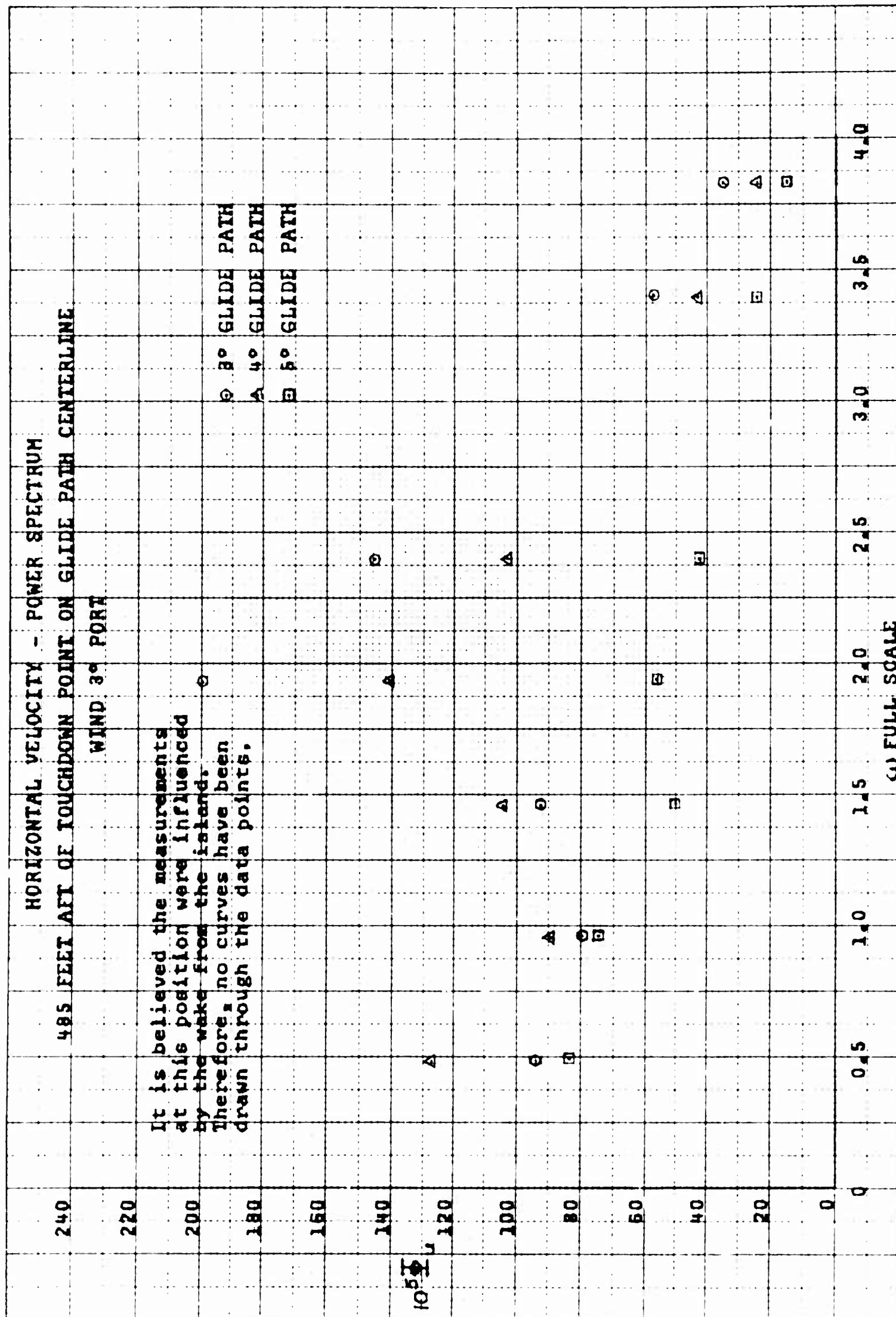
OCEANICS

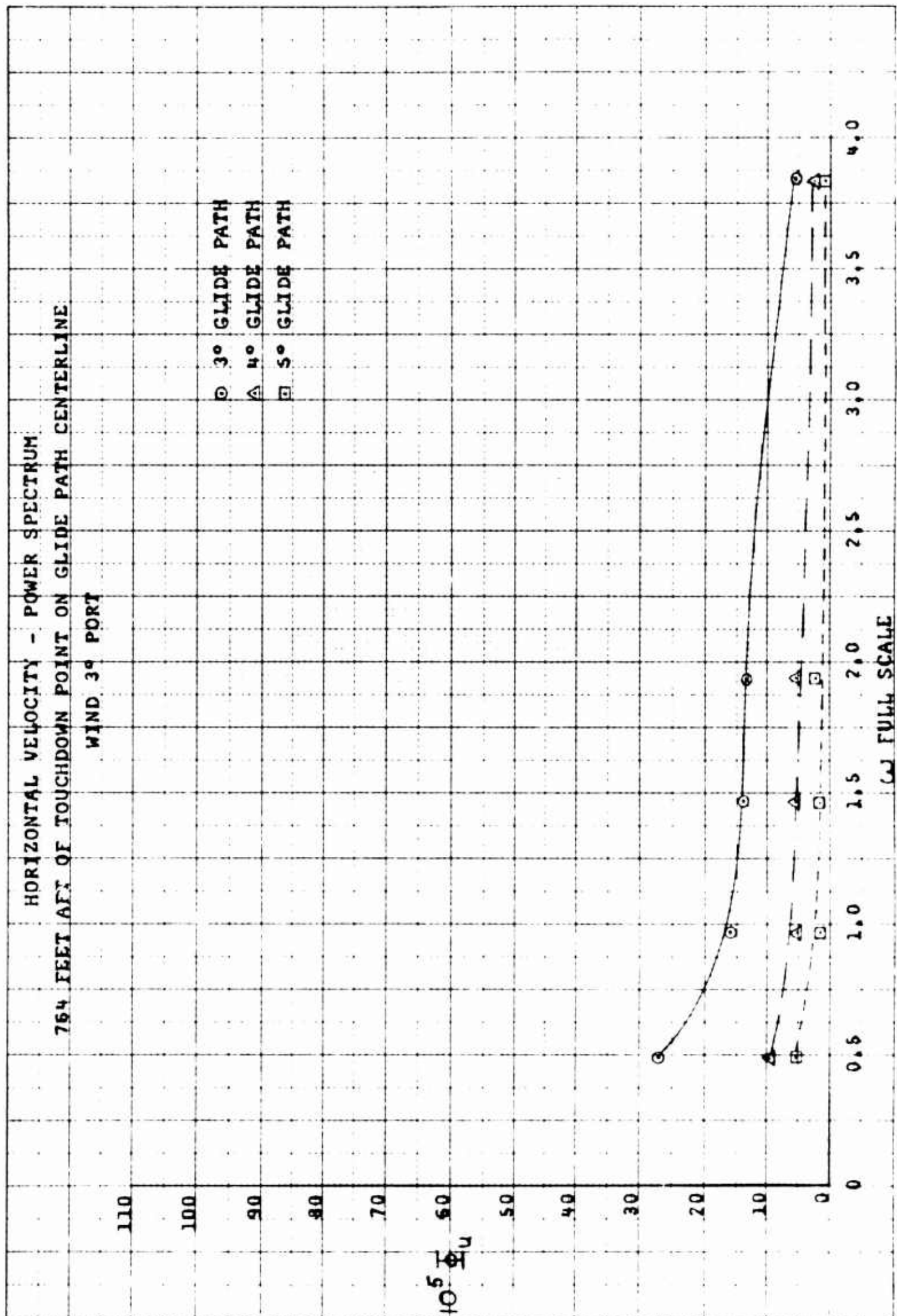
VERTICAL VELOCITY - PITCH TRANSFER FUNCTION PHASE
 764 FEET AFT OF TOUCHDOWN
 WIND 10° PORT

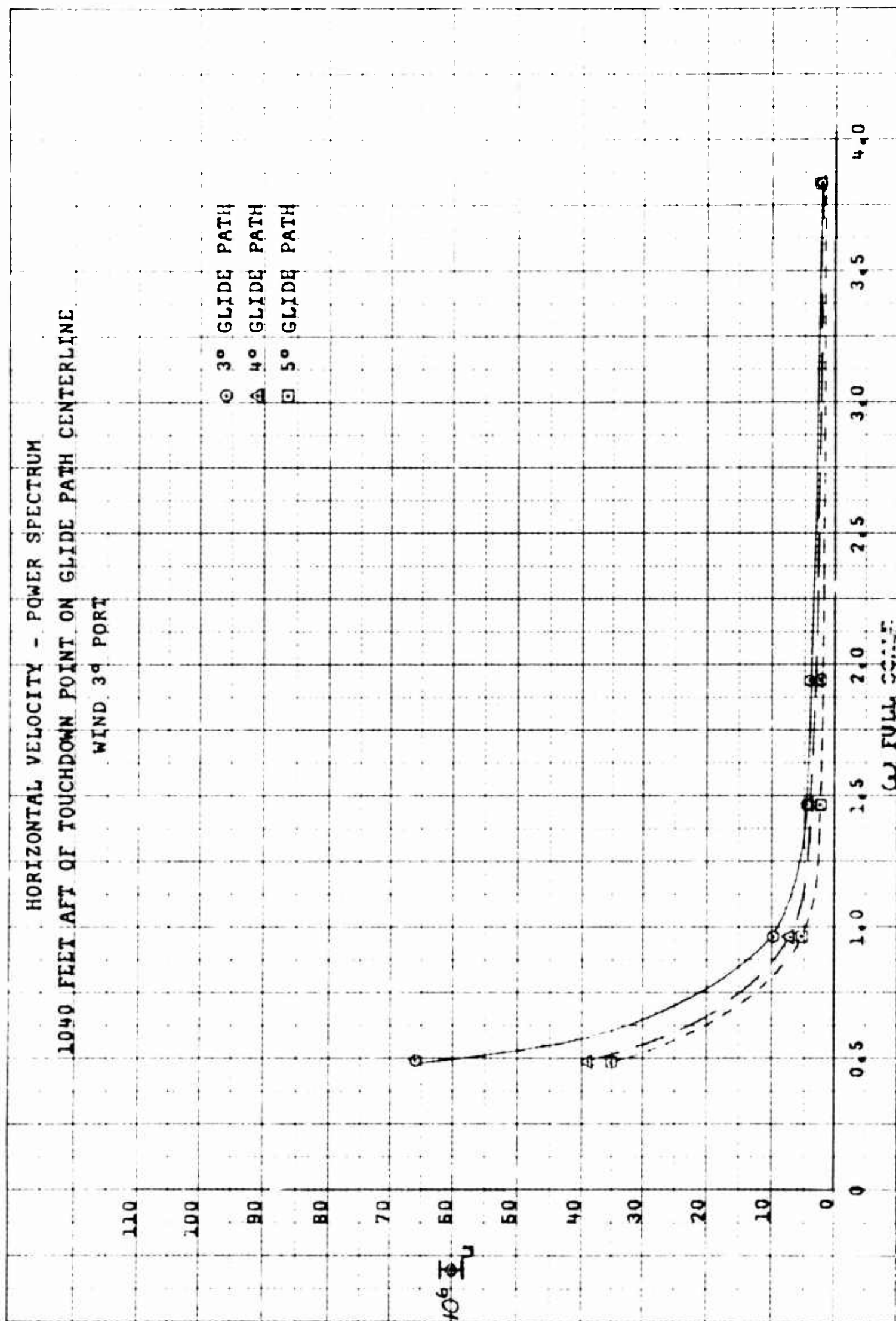


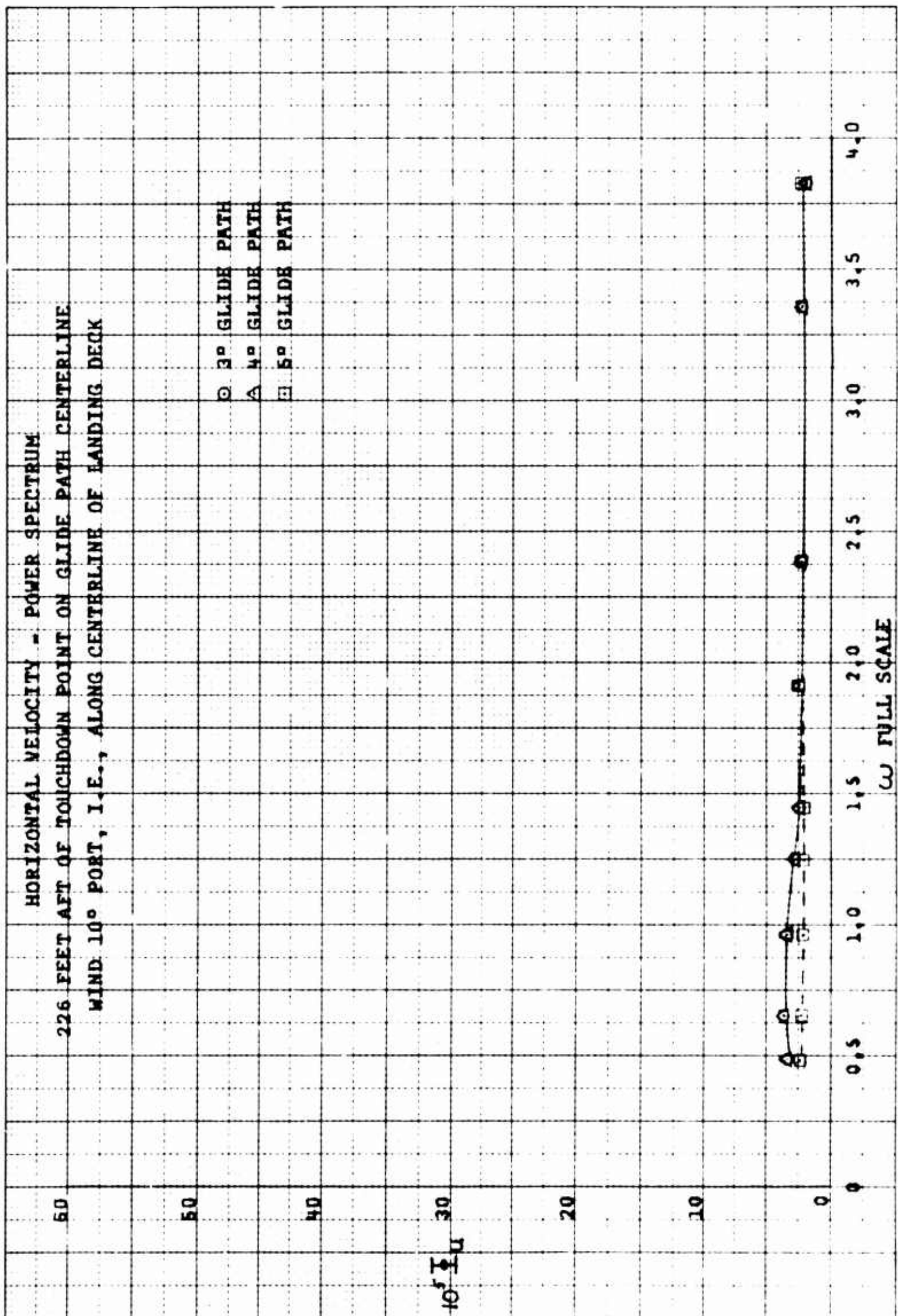


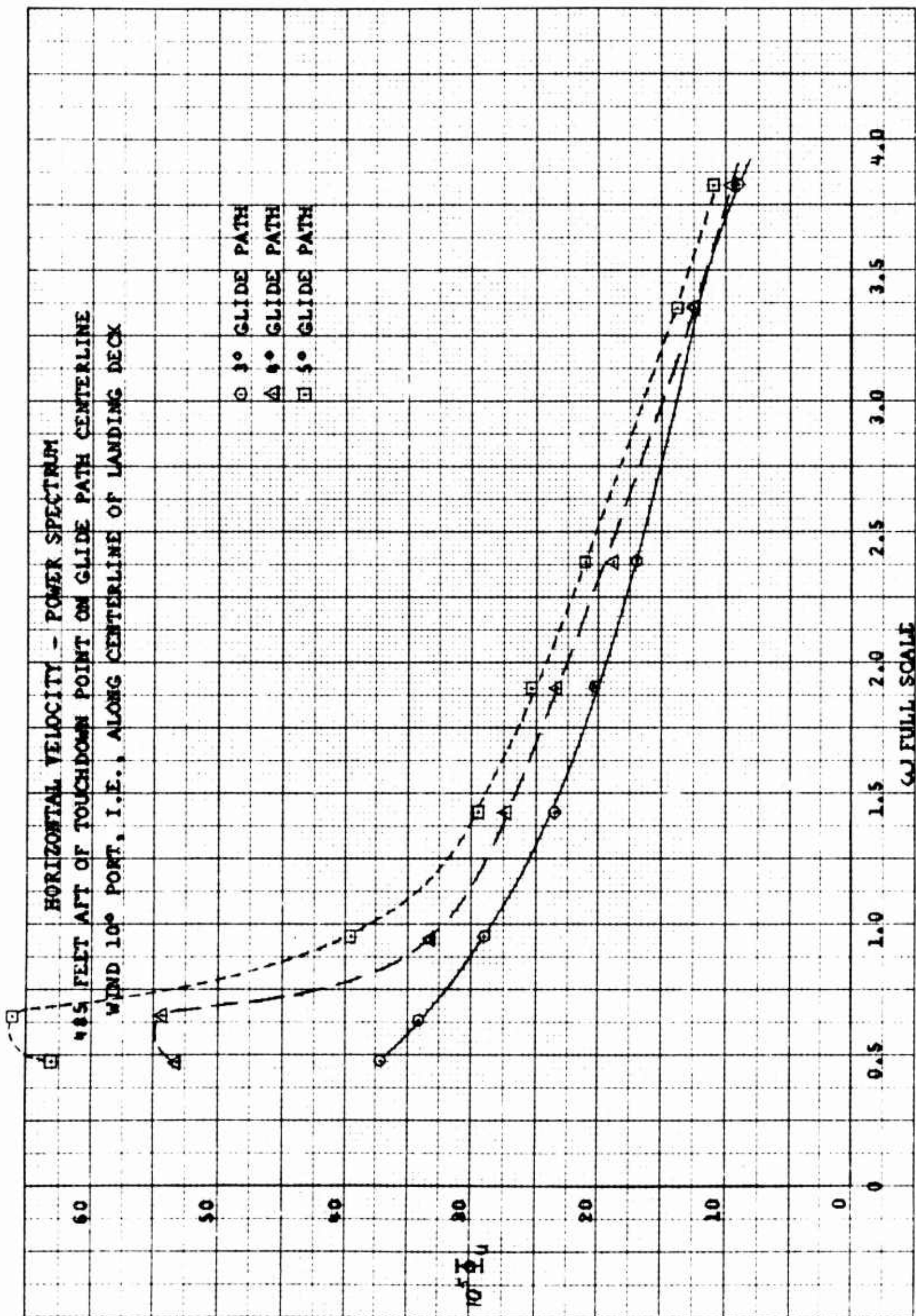


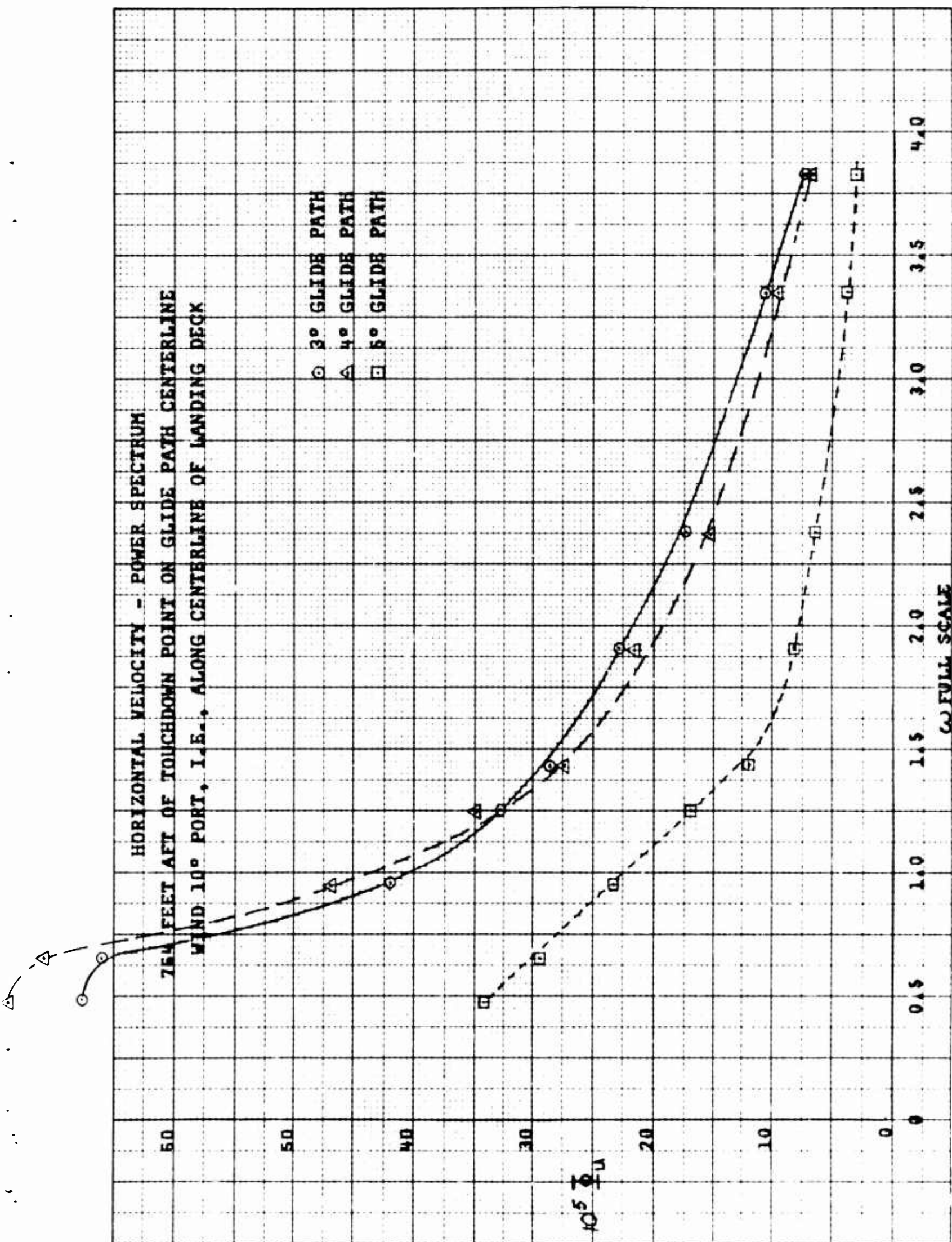


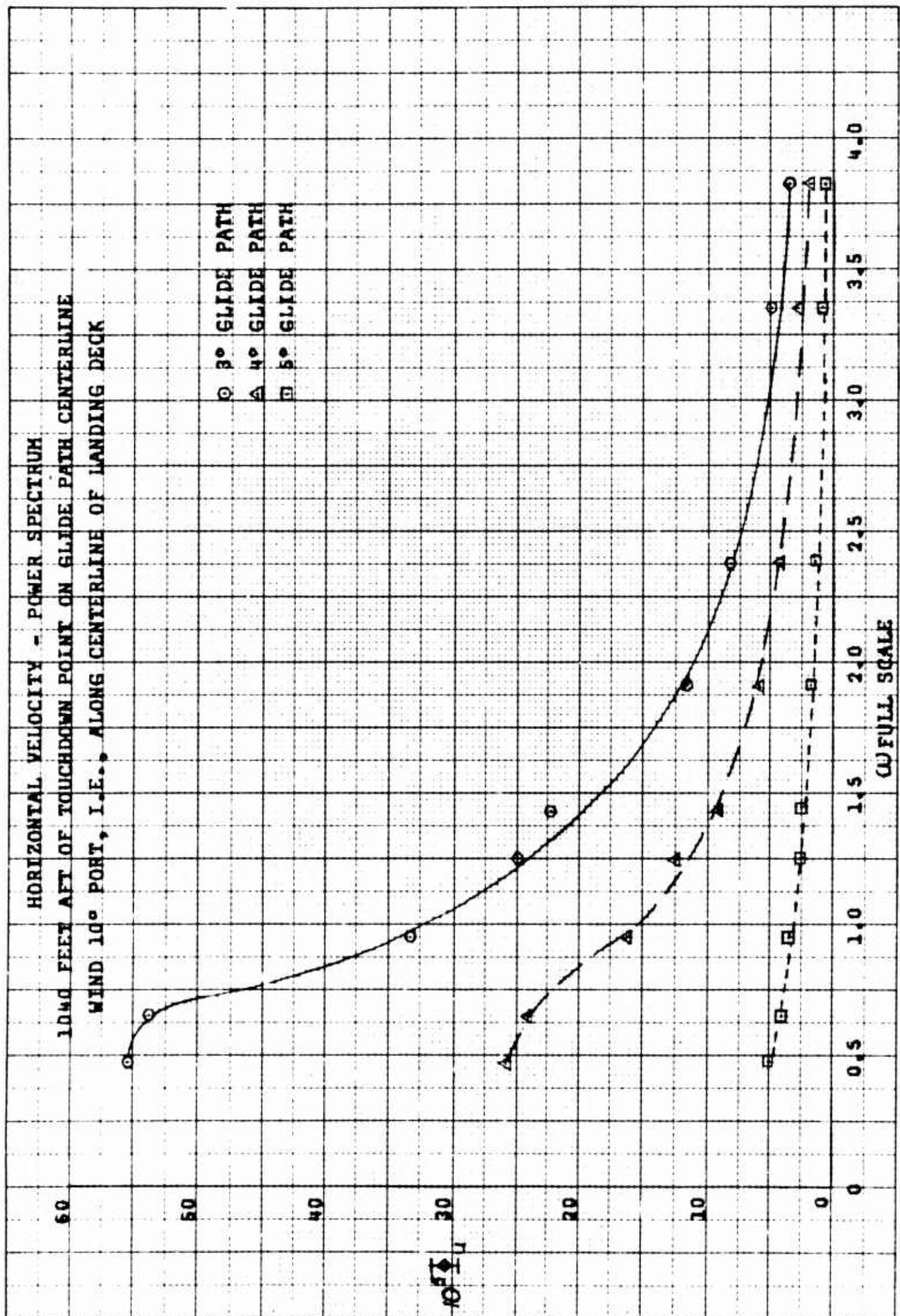




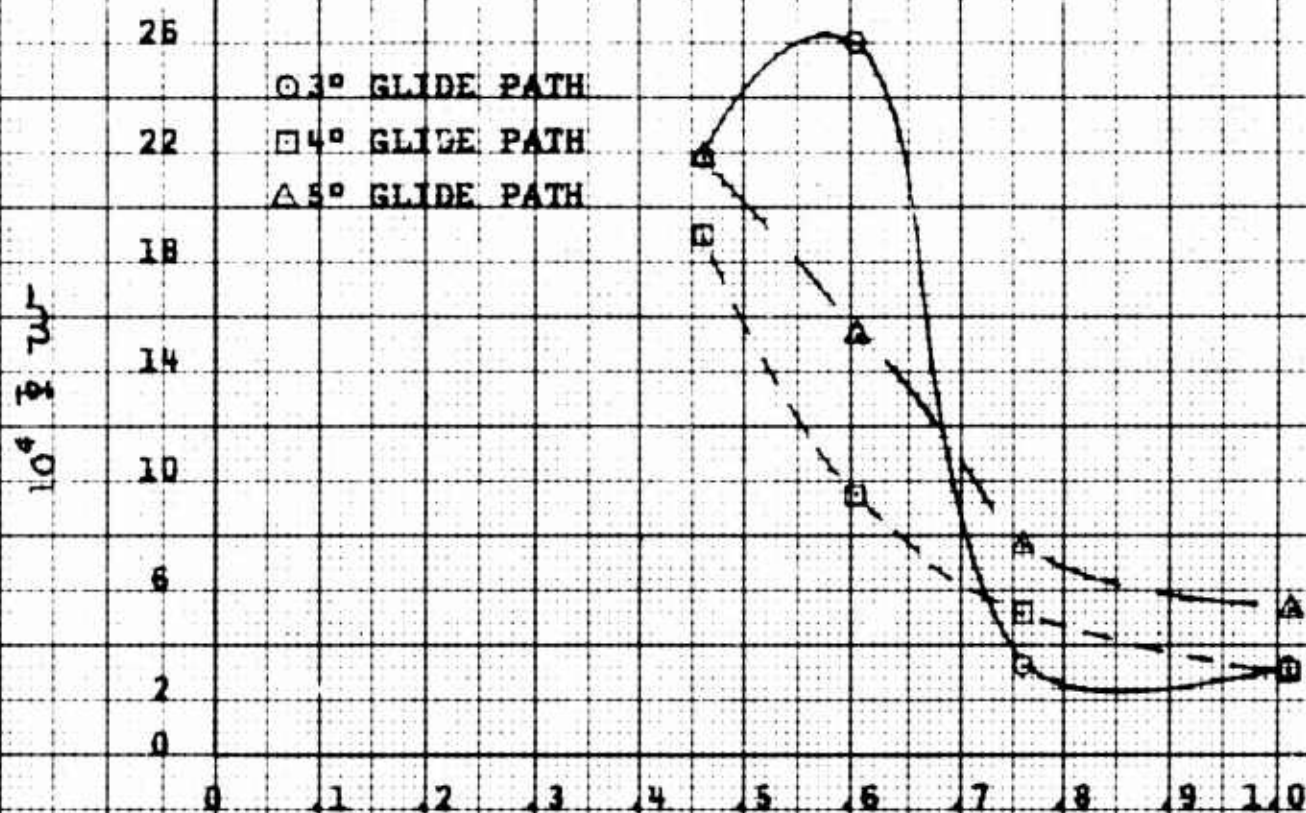






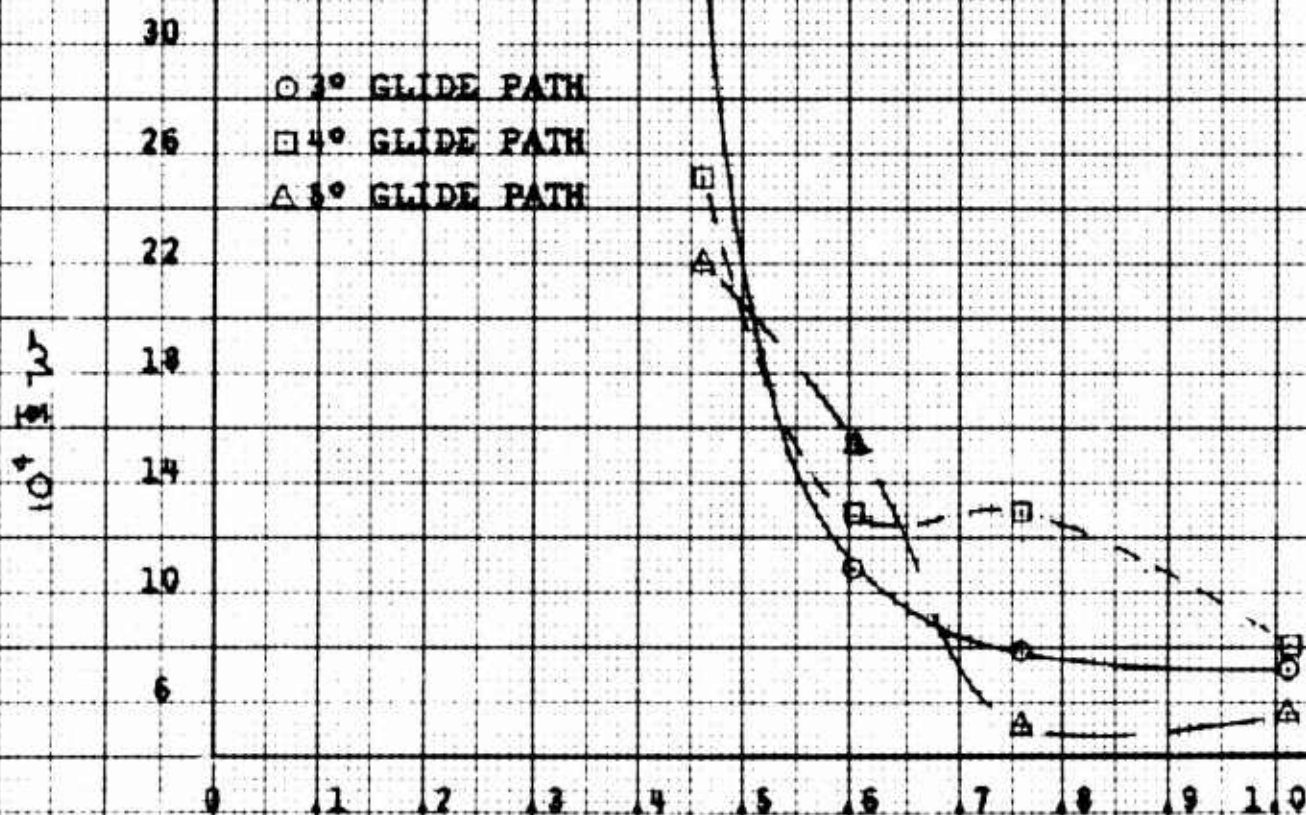


VERTICAL VELOCITY - POWER SPECTRUM
WIND 3° PORT



(A) FULL SCALE

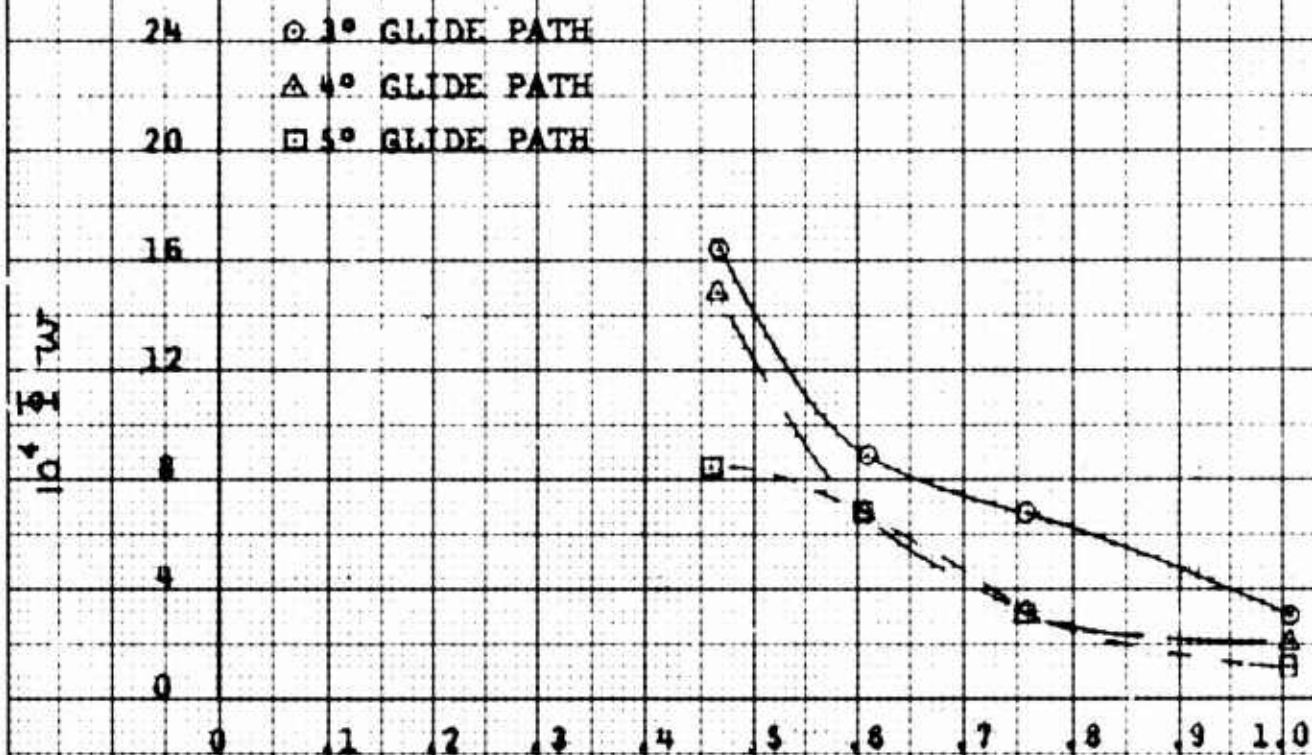
226 FEET AFT OF TOUCHDOWN POINT ON GLIDE PATH CENTERLINE



(A) FULL SCALE

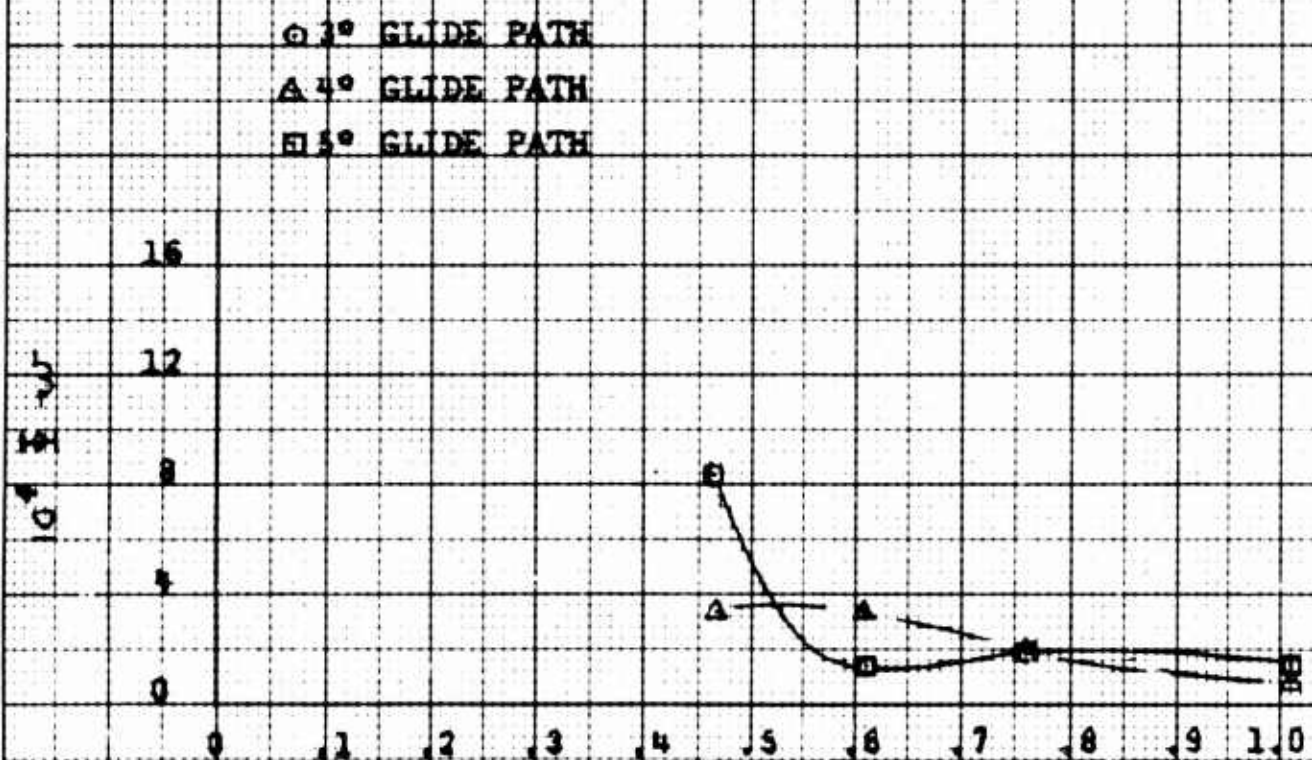
485 FEET AFT OF TOUCHDOWN POINT ON GLIDE PATH CENTERLINE

VERTICAL VELOCITY - POWER SPECTRUM
WIND 3° PORT



(a) FULL SCALE

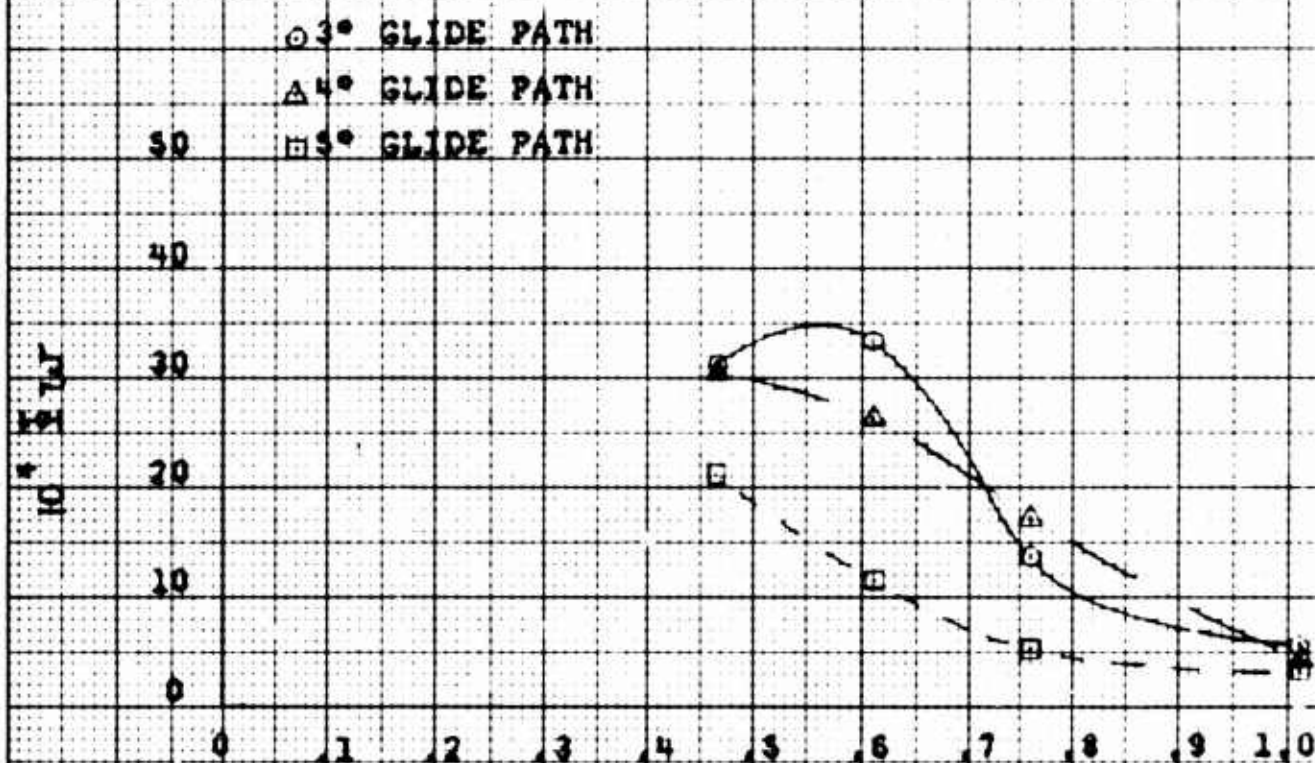
754 FEET AFT OF TOUCHDOWN POINT ON GLIDE PATH CENTERLINE



(b) FULL SCALE

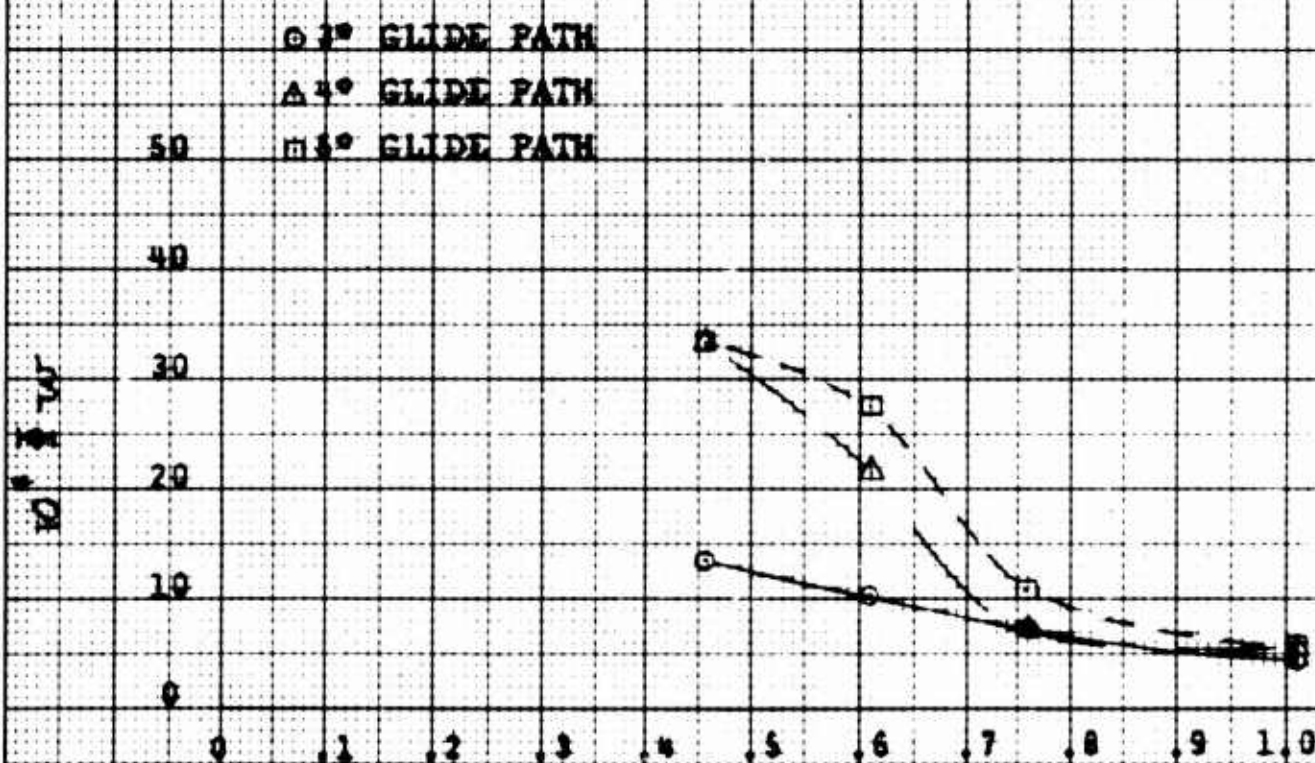
1040 FEET AFT OF TOUCHDOWN POINT ON GLIDE PATH CENTERLINE

VERTICAL VELOCITY - POWER SPECTRUM WIND 10° PORT



(a) FULL SCALE

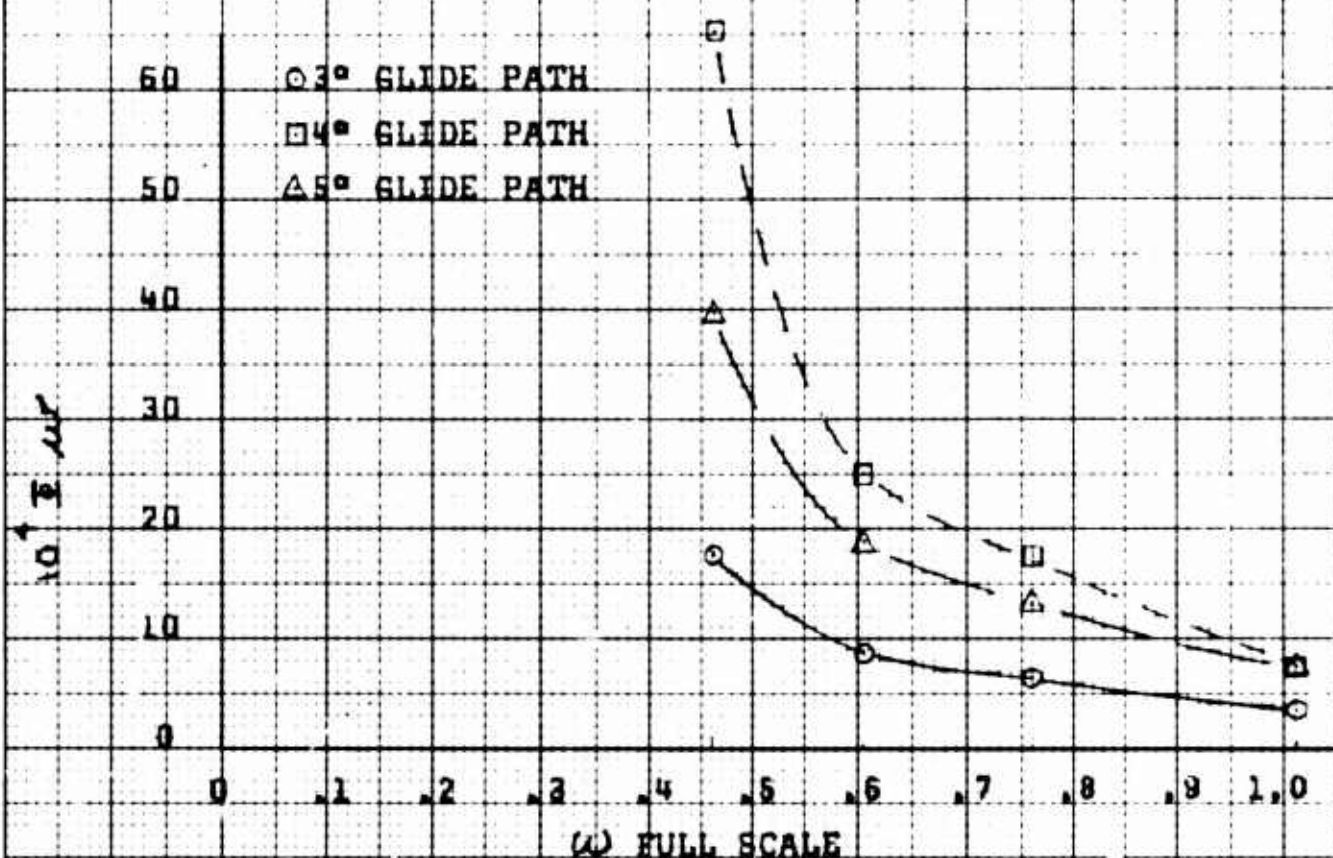
226 FEET AFT OF TOUCHDOWN POINT ON GLIDE PATH CENTERLINE



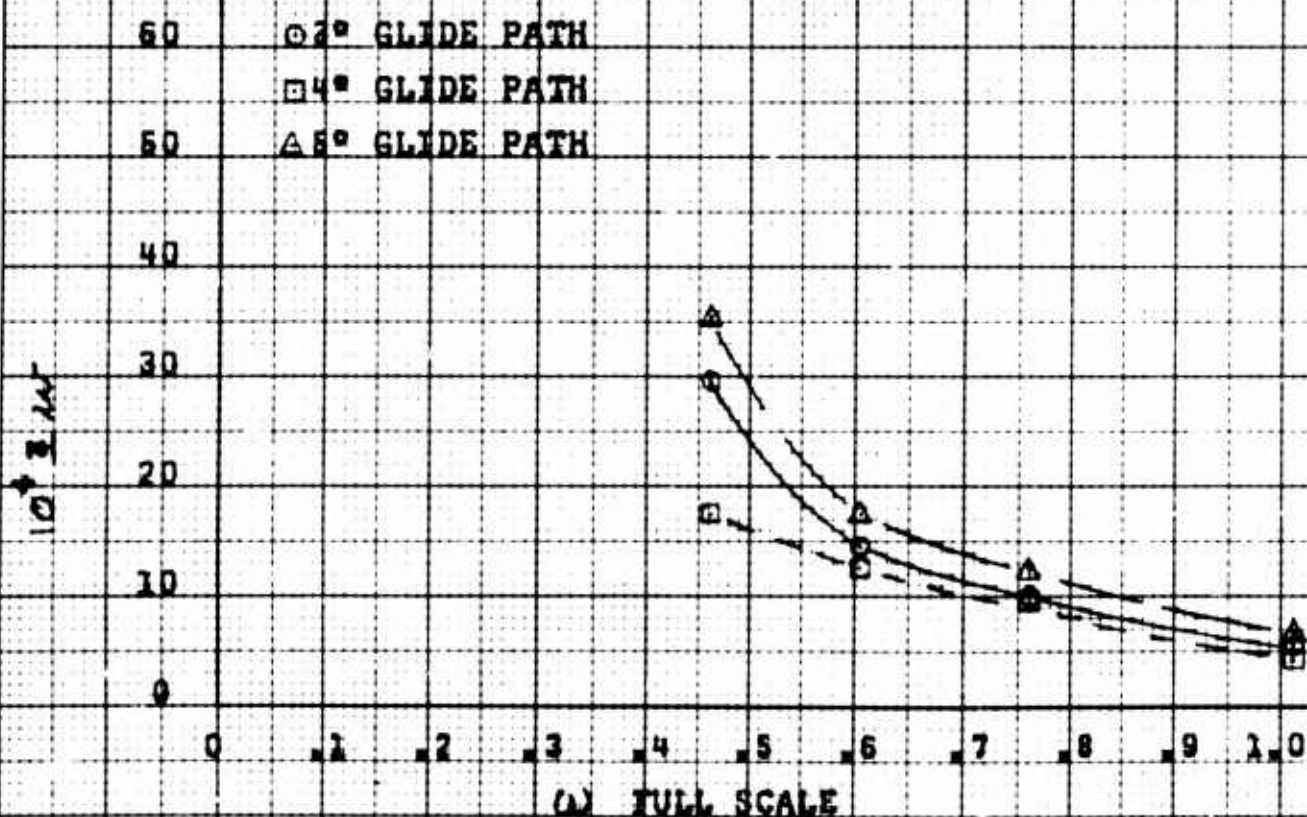
(b) FULL SCALE

485 FEET AFT OF TOUCHDOWN POINT ON GLIDE PATH CENTERLINE

VERTICAL VELOCITY - POWER SPECTRUM
WIND 10° PORT



764 FEET AFT OF TOUCHDOWN POINT ON GLIDE PATH CENTERLINE



1040 FEET AFT OF TOUCHDOWN POINT ON GLIDE PATH CENTERLINE