AIR VEHIC .E PERFORMANCE CHARACTERISTICS

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UNITED STATES FEDERAL AVIATION AGENCY
Washington 25, D. C. June 1959

UNITED STATES
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AIR VEHICLE PERFORMANCE CHARACTERISTICS

Volume IX

LANDING

FOR:

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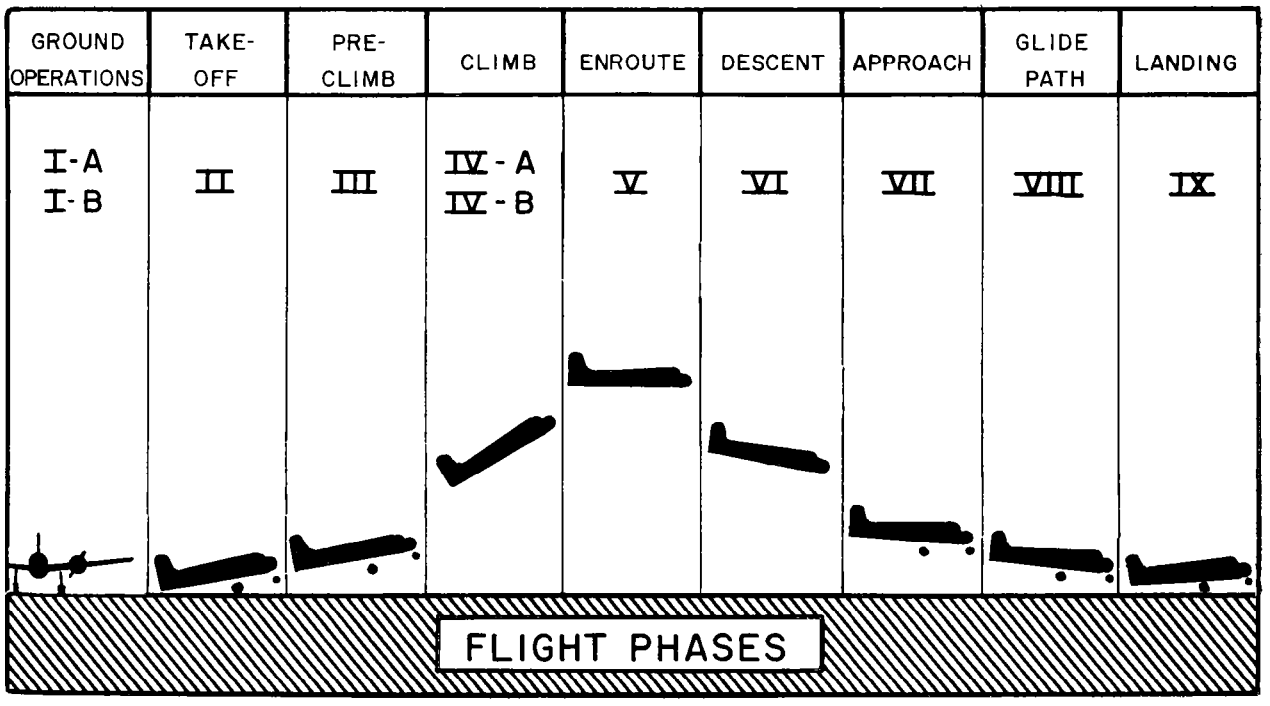
AIR VEHICLE PERFORMANCE CHARACTERISTICS

This is a fourteen volume study,
containing the following:

	Volume I-A	Ground Operations
	Volume I-B	Ground Operations
	Volume II	Take-Off
	Volume III	Pre-Climb
	Volume IV-A	Climb
	Volume IV-B	Climb
	Volume V	Enroute
	Volume VI	Descent
	Volume VII	Approach
	Volume VIII	Glide Path
	Volume IX	Landing
*	Volume X-A	Classified Military Aircraft (S)
*	Volume X-B	Classified Military Aircraft (S)
*	Volume XI	Future Aircraft (S)

* Volumes I-A through IX contain flight phase data on current aircraft, except those classified by the military. The latter are in Volumes X-A and X-B, and future aircraft in Volume XI. These three volumes have a security classification of secret.



UNITED STATES FEDERAL AVIATION AGENCY
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AIR VEHICLE PERFORMANCE CHARACTERISTICS

MASTER INDEX

The following is a complete listing of the 122 aircraft reported and their location by volume.

UNITED STATES FEDERAL AVIATION AGENCY
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MASTER INDEX - (Cont'd.)

AIR VEHICLE PERFORMANCE CHARACTERISTICS

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(date of latest revision: September 1, 1959)

UNITED STATES FEDERAL AVIATION AGENCY
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AIR VEHICLE PERFORMANCE CHARACTERISTICS

Volumes I-A through IX

SECTION 1

MILITARY AIRCRAFT

containing data on:

Beechcraft T-34A
Bell H-13H (47G-2)
Bell H-40
Boeing B-47B/B-47E
Boeing KC-97G
Boeing KC-135A
Cessna L-19 A/E (OE-1)
Cessna TL-19D
Cessna T-37A
Convair C-131A
Convair R4Y-1
Convair T-29C
Curtiss C-46R
Douglas C-124C
Douglas C-133A
Douglas RB/WB-66B
Fairchild C-119G
Fairchild C-123B
Goodyear ZPG-2
Goodyear ZPG-3W
Grumman SA-16A-GR (UF-1)
Hayes-Boeing KB-50J/KB-50K
Hiller H-23D
Lockheed C-121 C/G
Lockheed C-130A
Lockheed T2V-1
Lockheed T-33A-1
Martin B-57B
North American F-86L
North American TB-25M
North American T-28A
North American T-28B
North American T2J-1
Northrop F-89H
Republic F-84F Series
Sikorsky H-19D
Sikorsky H-34A (S-58) (HSS-1)
Sikorsky H-37A
Vertol H-21C (44-B)

(date of latest revision: September 1, 1959)

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NARRATIVE SUMMARY

Sequence of Operations

The landing configuration is gear down and flaps fully extended. From flare-out, with throttle at idle rpm, normal landing procedures and techniques are applied.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum: 44
Maximum: 60
Operationally desirable: 55

Distance (from touchdown to stop)

Minimum: 420 feet
Maximum: 1,000 feet
Operationally desirable: 600 feet

Time (from touchdown to stop)

Minimum: 0.2 minute
Maximum: 0.3 minute
Operationally desirable: 0.2 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day						Dev. for Non-Standard Day	
	Touchdown Speed		Dist.	Time	Dev. per 100 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
	IAS Knots	Dev. per 100 Lbs. G.W.	(Feet)	(Min.)				
2,700 pounds	55	1.8%	600	0.2	2.7%	Not available from manufacturer or operator.	2.2%	2.2%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal helicopter configuration is clean. Power is set at 3,100 rpm with manifold pressure as required. From flareout, airspeed and altitude are decreased simultaneously to arrive at *10 feet (hover) altitude at zero airspeed. Final touchdown is accomplished vertically at zero airspeed.

Alternate Landing (Roll-On)

Normal helicopter configuration is clean. Power is set at 3,100 rpm with manifold pressure as required. From flareout airspeed and altitude are decreased simultaneously. Touchdown is accomplished in a level attitude with a minimum rate of sink at ground contact. Main rotor pitch angle is used for deceleration. This type of landing is utilized for emergency high altitude and overload conditions.

Table I presents power-off landing data (roll-on).

Speed (knots IAS at touchdown)

Minimum allowable: 0
Maximum allowable: 20 (roll-on)
Operationally desirable: 0

Distance (from touchdown)

Minimum: 0 feet
Maximum: 20 feet (roll-on)
Operationally desirable: 0 feet

Time (from touchdown)

Minimum: 0 second
Maximum: 5 seconds (roll-on)
Operationally desirable: 0 second

*Time consumed from hover altitude to touchdown: 5 seconds

TABLE I, LANDING
(Roll-On)

Normal Gross Weight	N.A.S.A. Sea Level Standard Day: Touchdown Speed IAS Knots	Touchdown Speed Dev. per 250 Lbs. G.W.	Dist. (Feet)	Time (Sec.)	Dev. per 250 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day: Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
2,150 pounds	20	none	20	5.0	none	none	none	none

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal helicopter configuration is clean with power set at maximum rpm (6, 400) and torque pressure as required. From flareout, airspeed and altitude are decreased simultaneously to arrive at *10 feet (hover) altitude at zero airspeed. Final touchdown is accomplished vertically at zero airspeed.

Alternate Landing (Roll-on)

Normal helicopter configuration is clean with power and torque pressure set as required From flareout, airspeed and altitude are decreased simultaneously Touchdown is accomplished in a level attitude with a minimum rate of sink at ground contact. Main rotor pitch angle is used for deceleration. This type of landing is utilized for emergency high altitude and overload conditions.

Table I presents power-off landing data (roll-on).

Speed (knots IAS at touchdown)

Minimum allowable: 0
Maximum allowable: 20 (roll-on)
Operationally desirable: 0

Distance (from touchdown)

Minimum: 0 feet
Maximum: 50 feet (roll-on)
Operationally desirable: 0 feet

Time (from touchdown)

Minimum: 0 second
Maximum: 3 seconds (roll-on)
Operationally desirable: 0 second

*(Time consumed from hover altitude to touchdown: 5 seconds)

TABLE I, LANDING
(Roll-On)

Normal Gross Weight	N.A.S.A. Sea Level Standard Day: Touchdown Speed IAS Knots	Touchdown Speed Dev. per 500 Lbs. G.W.	Dist. (Feet)	Time (Sec.)	Dev. per 500 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day: Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
5,300 pounds	20	none	50	3.0	none	none	none	none

(The values above are to be substituted in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is gear down (including outriggers), and flaps fully extended. From flareout, with power set at idle rpm, normal landing procedures and techniques are applied. The brake chute is normally deployed immediately after touchdown. The brake chute is released before initiating turn-off from active runway to taxi exit; or it may be released anywhere on landing roll if a strong cross wind is encountered. Brakes are normally applied with brake chute after the aircraft has decelerated to 40 knots. If brake chute is not deployed, brakes are applied at 80% touchdown speed.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum: 113
Maximum: 154
Operationally desirable: 122

Distance (from touchdown to stop)

Minimum: 5,850 feet
Maximum: 10,400 feet
Operationally desirable: 6,000 feet

Time (from touchdown to stop)

Minimum: 0.9 minute
Maximum: 1.3 minutes
Operationally desirable: 1.0 minute

TABLE I, LANDING

With Brake Chute
N.A.S.A. Sea Level Standard Day

Normal Gross Weight	Touchdown Speed IAS Knots	Touchdown Speed Dev. per 10,000 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 10,000 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day Dev. w/ Temp. per 10° C	Dev. for Non-Standard Day Dev. w/ Press. Alt. per 1,000 Ft.
105,000	122	4.9%	6,000	1.0	10.0%	Not available from operators	2.7%	3.3%

Without Brake Chute
N.A.S.A. Sea Level Standard Day

			Dist. (Feet)	Time (Min.)	Dev. per 10,000 Lbs. G.W.	Dev. w G per 1% Slope	Dev. for Non-Standard Day Dev. w/ Temp. per 10° C	Dev. for Non-Standard Day Dev. w/ Press. Alt. per 1,000 Ft.
105,000	122	4.9%	7,300	1.2	7.5%	14%	2.1%	2.3%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down, flaps extended 45 degrees and power set at 2,350 rpm and manifold pressure as required. From flareout, normal touchdown is main gear first, gradually lowering the nose gear as speed decreases. Propeller and wheel braking are used as required.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum. 82
Maximum. 90
Operationally desirable: 82

Distance (from touchdown to stop)

Minimum: 2,000 feet
Maximum: 2,400 feet
Operationally desirable: 2,000 feet

Time (from touchdown to stop)

Minimum: 0.5 minute
Maximum: 0.6 minute
Operationally desirable: 0.5 minute

TABLE I, LANDING

N.A.S.A. Sea Level Standard Day						Dev. for Non-Standard Day		
Normal Gross Weight	Touchdown Speed IAS Knots	Dev. per 10,000 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 10,000 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
90,000	82	5%	2,000	0.5	5%	4%	Not available from operator	7%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down and flaps extended 50 degrees. Power is set at idle rpm. Touchdown is made with main gear first, wheel brakes are applied and the nose gear is rapidly lowered to the runway. Speed brakes may be employed to reduce ground roll.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum: 99
Maximum: 171
Operationally desirable: 110

Distance (from touchdown to stop)

Minimum: 1, 800 feet
Maximum: 6, 200 feet
Operationally desirable: 3, 100 feet

Time (from touchdown to stop)

Minimum: 0 4 minutes
Maximum: 0. 7 minutes
Operationally desirable: 0. 6 minutes

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day: Touchdown Speed IAS Knots	Touchdown Speed Dev. per 10,000 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 10,000 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day: Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
(Normal - Flaps 50°, no speed brakes)								
127,000 pounds	110	3.9%	3,100	0.6	6.7%	3.6%	2.8%	3.2%
(Flaps 50° with speed brakes)								
127,000 pounds	110	3.9%	2,200	0.4	6.9%	2.3%	2.8%	3.0%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with flaps extended 60 degrees and power set at idle rpm. From flareout the normal touchdown is executed in a tail-low attitude. The brakes are applied intermittently to prevent skidding.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum allowable: 42
Maximum allowable: 50
Operationally desirable: 42

Distance (from touchdown to stop)

Minimum: 300 feet
Maximum: 350 feet
Operationally desirable: 300 feet

Time (from touchdown to stop)

Minimum: 8 seconds
Maximum: 10 seconds
Operationally desirable: 8 seconds

TABLE I, LANDING

Gross Weight (Lbs.)	N.A.S.A. Sea Level Standard Day: Touchdown Speed IAS Knots	Touchdown Speed Dev. per 300 Lbs. G.W.	Dist. (Feet)	Time (Sec.)	Dev. per 300 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day: Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
2,100	42	7.5%	300	8	15.0%	Not available from operator.	10.0%	10.0%

(The values above are to be substituted in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down, flaps as required and power set at idle rpm. From flareout the normal touchdown is executed in a tail-low attitude. The brakes are applied intermittently to prevent skidding.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum allowable: 47
Maximum allowable: 61
Operationally desirable: 51

Distance (from touchdown to stop)

Minimum: 300 feet
Maximum: 490 feet
Operationally desirable: 490 feet

Time (from touchdown to stop)

Minimum: 0.1 minute
Maximum: 0.2 minute
Operationally desirable: 0.2 minute

TABLE I, LANDING

Maximum Gross Weight	N.A.S.A. Sea Level Standard Day Touchdown Speed IAS Knots	Touchdown Speed Dev. per 200 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 200 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
2,400 pounds	51	5.5%	490	0.2	8.0%	Not available from operators.	3.3%	3.3%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down, flaps fully extended, and power set at idle rpm. From flareout, normal touchdown is with the main gear first.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum: 60
Maximum: 90
Operationally desirable: 80

Distance (from touchdown to stop)

Minimum: 1,200 feet
Maximum: 1,500 feet
Operationally desirable: 1,500 feet

Time (from touchdown to stop)

Minimum: 0.4 minute
Maximum: 1.0 minute
Operationally desirable: 1.0 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day Touchdown Speed IAS Knots	Touchdown Speed Dev. per 400 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 500 Lbs. G.W.	Dev. for Non-Standard Day Dev. w/ G per 1% Slope	Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
5,900	80	3.8%	1,500	0.4	14.0%	Not available from operators	3.3%	Not available from operators

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down, flaps fully extended (39°) and power as required. From flareout the normal touchdown is with main gear first. Reverse thrust may be employed immediately after touchdown and brakes are applied intermittently to prevent skidding.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum: 94
Maximum: 123
Operationally desirable: 99

Distance (from touchdown to stop)

Minimum: 1,350 feet
Maximum: 2,460 feet
Operationally desirable: 1,510 feet

Time (from touchdown to stop)

Minimum: 0.3 minute
Maximum: 0.4 minute
Operationally desirable: 0.3 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day: Touchdown Speed IAS Knots	Touchdown Speed Dev. per 2,000 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 2,000 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day: Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
34,000 pounds	99	2.5%	1,510	0.3	5.0%	Pos. "G" 2.2% Neg. "G" 2.5%	Not available from operator	2.5%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down and flaps extended 40 degrees. From flareout the normal touchdown is with main gear first. Reverse thrust and wheel braking are applied after full touchdown.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum: 85
Maximum: 115
Operationally desirable: 90

Distance (from touchdown to stop)

Minimum: 1,250 feet
Maximum: 2,100 feet
Operationally desirable: 1,370 feet

Time (from touchdown to stop)

Minimum: 0.3 minute
Maximum: 0.4 minute
Operationally desirable: 0.3 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day: Touchdown Speed IAS Knots	Touchdown Speed Dev. per 2,000 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 2,000 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day: Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
40,000	90	1.4%	1,370	0.3	4.0%	Not available	2.5%	3.0%

NOTE: To obtain distances and times without reverse thrust, increase the above values by 65%.

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down and flaps extended 28 degrees, and power as required. From flareout the normal touchdown is with main gear first. Reverse propeller and wheel braking used as required.

Speed (knots IAS at touchdown)

Minimum allowable: 92
Maximum allowable: 101
Operationally desirable: 95

Distance (from touchdown to stop)

Minimum: 3, 280 feet
Maximum: 4, 643 feet
Operationally desirable: 3, 440 feet

Time (from touchdown to stop)

Minimum: 0.7 minute
Maximum: 0.9 minute
Operationally desirable: 0.7 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day						Dev. for Non-Standard Day	
	Touchdown Speed		*Dist.	*Time	Dev. per 1,000 Lbs.	Dev. w/ G per	Dev. w/ Temp. per	Dev. w/ Press. Alt.
	IAS Knots	Dev. per Lbs. G.W.	(Feet)	(Min.)	G.W.	1% Slope	10° C	per 1,000 Ft.
38,000 pounds	95	1.0%	3,440	0.7	3.0%	Not available from operator.	3.6%	3.7%

*Reduce distance and time values by 40 percent if reverse thrust is used.

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down and flaps fully extended. Power is set at idle rpm. From flareout, the normal touchdown is with main gear first. After tail is lowered, the brakes are applied intermittently to prevent skidding.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum allowable: 70
Maximum allowable: 100
Operationally desirable: 85

Distance (from touchdown to stop)

Minimum: 1,600 feet
Maximum: 3,500 feet
Operationally desirable: 3,200 feet

Time (from touchdown to stop)

Minimum: 0.5 minute
Maximum: 0.8 minute
Operationally desirable: 0.7 minute

TABLE I, LANDING

Maximum Gross Weight (Lbs.)	N.A.S.A. Sea Level Standard Day: Touchdown Speed IAS Knots	Touchdown Speed Dev. per 1,000 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 1,000 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day: Dev. w/ Temp. per 10^{o} C	Dev. w/ Press. Alt. per 1,000 Ft.
48,000	85	Not available from operator	3,200	0.7	Not available from operator			

(The above values are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down and flaps extended as required. Power is set at 2,350 rpm and 14 inches manifold pressure. From flareout the normal touchdown is made with main gear first. The brakes are applied intermittently to prevent skidding. Thrust reversal may be used.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum: 95
Maximum: 132
Operationally desirable: 106

Distance (from touchdown to stop)

Minimum: 1,910 feet
Maximum: 3,960 feet
Operationally desirable: 2,660 feet

Time (from touchdown to stop)

Minimum: 0.3 minute
Maximum: 0.6 minute
Operationally desirable: 0.5 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day Touchdown Speed IAS Knots	Touchdown Speed Dev. per 10,000 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 10,000 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
150,000	106	3.5%	2,660	0.5	6.4%	Not available from operators	3.6%	4.0%

(The values above are to be substituted in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down, and flaps extended 35 degrees. Full reverse thrust is applied after touchdown.

Table I presents landing data.

Speed (knots IAS)

Minimum: 97
Maximum: 120
Operationally desirable: 100

Distance (from touchdown to stop)

Minimum: 1, 400 feet
Maximum: 2, 500 feet
Operationally desirable: 1, 620 feet

Time (from touchdown to stop)

Minimum: 0. 3 minute
Maximum: 0. 5 minute
Operationally desirable: 0. 3 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day						Dev. for Non-Standard Day	
	Touchdown Speed		Dist.	Time	Dev. per	Dev. w/	Dev. w/	Dev. w/
	IAS Knots	Dev. per 10,000 Lbs. G.W.	(Feet)	(Min.)	10,000 Lbs. G.W.	G per 1% Slope	Temp. per 10^{o} C	Press. Alt. per 1,000 Ft.
180,000 pounds	100	2.7%	1,620	0.3	5.9%	Not available from operator	2.5%	3.0%

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear and flaps down, and speed brakes open. Throttles are at idle. From flareout the normal touchdown is made with main gear first. The nose wheel is lowered to the runway immediately after touchdown. In a normal landing, a drag chute is deployed immediately after touchdown. The brakes are applied intermittently to prevent skidding.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum: 114
Maximum. 153
Operationally desirable: 125 (at 55, 000 pounds)

Distance (from touchdown to stop - with drag chute)

Minimum· 2, 500 feet
Maximum: 5, 400 feet
Operationally desirable: 2, 950 feet

Time (from touchdown to stop)

Minimum: 0. 4 minute
Maximum: 0. 7 minute
Operationally desirable: 0. 5 minute

TABLE I, LANDING

(100% Flaps, Drag Chute Deployed)

	N.A.S.A. Sea Level Standard Day						Dev. for Non-Standard Day	
Normal Gross Weight	Touchdown Speed IAS Knots	Dev. per 5,000 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 5,000 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. w/ Temp. per 10^{o} C	Dev. w/ Press. Alt. per 1,000 Ft.
55,000 pounds	125	4.0%	2,950	0.5	7.6%	3.4%	3.4%	3.1%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is gear down, flaps 40 degrees, and reverse thrust as needed.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum: 85
Maximum: 106
Operationally desirable: 93

Distance (from touchdown to stop)

Minimum: 1, 350 feet
Maximum: 2, 700 feet
Operationally desirable: 1, 500 feet

Time (from touchdown to stop)

Minimum: 0. 3 minute
Maximum: 0. 5 minute
Operationally desirable: 0. 3 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day						Dev. for Non-Standard Day	
	Touchdown Speed		Dist.	Time	Dev. per	Dev. w/	Dev. w/	Dev. w/
	IAS Knots	Dev. per 5,000 Lbs. G.W.	(Feet)	(Min.)	5,000 Lbs. G.W.	G per 1% Slope	Temp. per 10^{o} C	Press. Alt. per 1,000 Ft.
55,000 pounds	93	4.3%	1,500	0.3	8.3%	6.7%	4.0%	4.3%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down and flaps extended 45 degrees. Power is set at 2,400 rpm and manifold pressure as required to control rate of descent. From flareout, the normal touchdown is with main gear first. Reverse thrust is applied immediately upon full touchdown.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum: 69
Maximum: 82
Operationally desirable: 73

Distance (from touchdown to stop)

Minimum: 950 feet
Maximum: 1,620 feet
Operationally desirable: 1,000 feet

Time (from touchdown to stop)

Minimum: 0.3 minute
Maximum: 0.4 minute
Operationally desirable: 0.3 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day Touchdown Speed IAS Knots	Touchdown Speed Dev. per 5,000 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 5,000 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
42,000	73	5.5%	1,000	0.3	13.5%	Not available from operator	4.5%	4.5%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal airship configuration is with gear down, throttles at idle rpm and propellers at low pitch. From flareout the normal touchdown is made at 35 knots IAS. Ground speed is adjusted by means of reverse thrust to reach the line handling party at a speed of 5 to 10 knots, and then power is maintained as necessary to hold steady (against the prevailing wind) while the mobile mooring mast is positioned and the mooring operation completed. Engines are not stopped until the airship is firmly attached to the mast. At any time prior to masting, a wind shift may necessitate a take-off by the airship; therefore, other flight operations should not be cleared until the airship reports "on the mast."

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum: 25
Maximum: 55
Operationally desirable: 35

Distance (from touchdown to masting)

Minimum: Not available from operator
Maximum: Not available from operator
Operationally desirable: 1,000 feet

Time (from touchdown to masting)

5.0 minutes (fairly constant due to masting operations)

TABLE I, LANDING
(Using Reverse Thrust)

Normal Gross Weight	N.A.S.A. Sea Level Standard Day					Dev. for Non-Standard Day		
	Touchdown Speed		Dist.	Time	Dev. per 1,000 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. w/ Temp. per 10^{o} C	Dev. w/ Press. Alt. per 1,000 Ft.
	IAS Knots	Dev. per 1,000 Lbs. G.W.	(Feet)	(Min.)				
62,800	35	7.0%	1,000	5.0	10.0%	Not available from operator	10.0%	10.0%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal airship configuration is with gear down, throttles at idle and propellers at low pitch. From flareout the normal touchdown is made at 35 knots IAS. Ground speed is adjusted to reach the handling party at a speed of 5 to 10 knots, and then power is maintained as necessary to hold steady (against the prevailing wind) while the mobile mooring mast is positioned and the mooring operation is completed. Engines are not stopped until the airship is firmly attached to the mast. At any time prior to masting, a wind shift may necessitate a take-off, therefore other flight operations should not be cleared until the airship reports "on the mast".

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum: 25
Maximum: 45
Operationally desirable: 35

Distance (from touchdown)

Minimum: Not available from operator*
Maximum: Not available from operator*
Operationally desirable: 500

Time (from touchdown to masting)

5 minutes (fairly constant due to masting operations)

*Airship undergoing tests. Distances not available.

TABLE I, LANDING

ormal Gross Weight	N.A.S.A. Sea Level Standard Day Touchdown Speed IAS Knots	Touchdown Speed Dev. per Lbs. G. W.	Dist. (Feet)	Time (Min.)	Dev. per Lbs. G. W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day Dev. w/ Temp. per 10^{o} C	Dev. w/ Press. Alt. per 1,000 Ft.
3,000	35	Not available from operator	500	5	Not available from operator			

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down and flaps extended 15 degrees. From flareout, with throttles at idle rpm, normal landing procedures and techniques are employed. Brakes are applied as necessary. Reverse thrust may be used immediately after touchdown.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum: 70
Maximum: 95
Operationally desirable: 82

Distance (from touchdown to stop)

Minimum: 1, 190 feet
Maximum: 1, 600 feet
Operationally desirable: 1, 240 feet

Time (from touchdown to stop)

Minimum: 0. 3 minute
Maximum: 0. 4 minute
Operationally desirable: 0. 3 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day Touchdown Speed IAS (Knots)	Touchdown Speed Dev. per 1,000 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 1,000 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
26,000	82	1.8%	1,240	0.3	3.6%	Not available from operator	3.2%	4.0%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear and flaps down, and reciprocating engine throttles at idle. Jet engines are normally not in operation. From flareout the normal touchdown is made with main gear first. The brakes are applied intermittently to prevent skidding. Two engine or four engine thrust reversal is available.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum allowable: 96
Maximum allowable: 117
Operationally desirable: 96

Distance (from touchdown to stop)

Minimum at gross weight of 120,000 pounds: 1,350 feet
Maximum at gross weight of 120,000 pounds: 4,160 feet
Operationally desirable at gross weight of 120,000 pounds: 2,600 feet

Time (from touchdown to stop)

Minimum: 0.3 minute
Maximum: 0.9 minute
Operationally desirable: 0.55 minute

TABLE I, LANDING

(45°Flaps, Brakes only)

Normal Gross Weight	N.A.S.A. Sea Level Standard Day Touchdown Speed IAS Knots	Touchdown Speed Dev. per 10,000 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 10,000 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
120,000 (pounds)	96	4.7%	2,600	0.55	9.6%	Not available from operator	3.9%	3.9%

NARRATIVE SUMMARY

Sequence of Operations

Normal helicopter configuration is clean, with power set at 3,200 rpm and manifold pressure as required. From flareout, airspeed and altitude are decreased simultaneously to arrive at *10 feet (hover) altitude at zero airspeed. Final touchdown is accomplished vertically at zero airspeed.

Alternate Landing (Roll-On)

Normal helicopter configuration is clean. Power is set at 3,200 rpm with manifold pressure as required. From flareout, airspeed and altitude are decreased simultaneously. Touchdown is accomplished in a level attitude with a minimum rate of sink at ground contact. Main rotor pitch angle is used for deceleration. This type of landing is utilized for emergency high altitude and overload conditions.

Table I presents power-off landing data (roll-on).

Speed (knots IAS at touchdown)

Minimum allowable: 0
Maximum allowable: 20 (roll-on)
Operationally desirable: 0

Distance (from touchdown)

Minimum: 0 feet
Maximum: 20 feet (roll-on)
Operationally desirable: 0 feet

Time (from touchdown)

Minimum: 0 second
Maximum: 5 seconds
Operationally desirable: 0 second

*Time consumed from hover altitude to touchdown. 5 seconds

TABLE I, LANDING
(Roll-On)

	N.A.S.A. Sea Level Standard Day						Dev. for Non-Standard Day	
Normal Gross Weight	Touchdown Speed IAS Knots	Dev. per 250 Lbs. G.W.	Dist. (Feet)	Time (Sec.)	Dev. per 250 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
2,500 lbs.	20	none	20	5	none	none	none	none

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down, flaps fully extended and throttles set at idle rpm. From flareout, the normal touchdown is with the main gear first. Reverse thrust is normally applied.

Speed (knots IAS at touchdown)

Minimum allowable: 87
Maximum allowable: 105
Operationally desirable: 100

Distance (from touchdown to stop)

Minimum: 2,110 feet
Maximum: 3,000 feet
Operationally desirable: 2,460 feet

Time (from touchdown to stop)

Minimum: 0.5 minute
Maximum: 0.6 minute
Operationally desirable: 0.5 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day Touchdown Speed IAS Knots	Touchdown Speed Dev. per 10,000 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 10,000 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
110,000 pounds	100	4.1%	2,460	0.5	8.1%	4.1%	2.3%	2.5%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down and flaps extended 18 degrees, power set at idle. From flareout the normal touchdown is with the main gear first. Full brakes and four engines full reverse thrust are applied after nose wheel touchdown.

Speed (knots IAS at touchdown)

Minimum allowable: 95
Maximum allowable: 112
Operationally desirable: 105

Distance (from touchdown to stop)

Minimum: 1,000 feet
Maximum: 2,000 feet
Operationally desirable: 1,500 feet

Time (from touchdown to stop)

Minimum: 0.2 minute
Maximum: 0.4 minute
Operationally desirable: 0.3 minute

TABLE I, LANDING

N.A.S.A. Sea Level Standard Day							Dev. for Non-Standard Day	
Normal Gross Weight	Touchdown Speed IAS Knots	Dev. per 10,000 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 10,000 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
100,000	105	3.3%	1,500	0.3	21.0%	Not available from operators	3.5%	4.5%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal landing configuration is with gear down, flaps fully extended, speed brakes as required and power set at idle rpm. From flareout normal landing procedures and techniques are used. Speed brakes and wheel brakes are utilized as required for deceleration after touchdown.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum allowable: 100
Maximum allowable: 125
Operationally desirable: 105

Distance (from touchdown to stop)

Minimum: 4, 500 feet
Maximum: 7, 000 feet
Operationally desirable: 5, 000 feet

Time (from touchdown to stop)

Minimum: 0. 9 minute
Maximum: 1. 4 minutes
Operationally desirable: 1. 0 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day						Dev. for Non-Standard Day	
	Touchdown Speed		Dist.	Time	Dev. per 1,000 Lbs.	Dev. w/ G per	Dev. w/ Temp. per	Dev. w/ Press. Alt.
	IAS Knots	Dev. per Lbs. G.W.	(Feet)	(Min.)	G.W.	1% Slope	10° C	per 1,000 Ft.
12,000 pounds	105	3.8%	5,000	1.0	7.3%	5.0%	2.7%	3.0%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

The landing configuration is gear down, flaps fully extended and speed brakes as required. From flareout, with power set at 50 percent rpm, normal landing procedures and techniques and applied.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum: 90
Maximum: 150
Operationally desirable: 100

Distance (from touchdown to stop)

Minimum: 2, 300 feet
Maximum: 4, 500 feet
Operationally desirable. 2, 520 feet

Time (from touchdown to stop)

Minimum: 0.4 minute
Maximum: 0.6 minute
Operationally desirable: 0.5 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day						Dev. for Non-Standard Day	
	Touchdown Speed		Dist.	Time	Dev. per Lbs.	Dev. w/ G per	Dev. w/ Temp. per	Dev. w/ Press. Alt.
	IAS Knots	Dev. per 1,000 Lbs. G.W.	(Feet)	(Min.)	G.W.	1% Slope	10° C	per 1,000 Ft.
11,100 pounds	100	5.0%	2,520	0.5	9.7%	4.0%	4.0%	4.0%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down and flaps fully extended. From flare-out, with throttles set at idle rpm, normal landing procedures and techniques are applied. Wheel braking is used as required.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum allowable: 98
Maximum allowable: 118
Operationally desirable: 110

Distance (from touchdown to stop)

Minimum: 2, 500 feet
Maximum: 4, 500 feet
Operationally desirable: 3, 000 feet

Time (from touchdown to stop)

Minimum: 0. 5 minute
Maximum: 0. 7 minute
Operationally desirable: 0. 6 minute

TABLE I, LANDING

N.A.S.A. Sea Level Standard Day							Dev. for Non-Standard Day	
Normal Gross Weight	Touchdown Speed IAS Knots	Dev. per 5,000 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 5,000 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
42,500 pounds	110	6.7%	3,000	0.6	9.1%	Not available from operator.	7.3%	3.7%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

From flareout, power is set at idle rpm and normal landing procedures and techniques are applied. The brake chute is not normally deployed after touchdown except for minimum run or heavy weight landing.

Brakes are used as little and as lightly as possible for stopping.

The landing configuration is gear down, flaps extended and speed brakes as required.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum: 110
Maximum: 170
Operationally desirable: 130

Distance (from touchdown to stop)

Minimum: 2,500 feet
Maximum: 9,000 feet
Operationally desirable: 5,500 feet

Time (from touchdown to stop)

Minimum: 0.5 minute
Maximum: 1.1 minutes
Operationally desirable: 0.8 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day: Touchdown Speed IAS Knots	Touchdown Speed Dev. per 1,000 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 1,000 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day: Dev. w/ Temp. per 10^{o} C	Dev. w/ Press. Alt. per 1,000 Ft.
15,000 pounds	130	2.7%	5,500	0.8	5.0%	Not available from operator	3.6%	3.6%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down and flaps extended 45 degrees. Power is set at 2,200 rpm and manifold pressure as required to maintain airspeed and rate of descent. From flareout the normal touchdown is made with main gear first. After nose wheel touchdown, brakes are applied intermittently to prevent skidding.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum: 73
Maximum: 103
Operationally desirable: 82

Distance (from touchdown to stop)

Minimum: 1,300 feet
Maximum: 4,400 feet
Operationally desirable: 2,600 feet

Time (from touchdown to stop)

Minimum: 0.4 minute
Maximum: 0.8 minute
Operationally desirable: 0.6 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day					Dev. for Non-Standard Day		
	Touchdown Speed		Dist.	Time	Dev. per	Dev. w/	Dev. w/	Dev. w/
	IAS Knots	Dev. per 1,000 Lbs. G.W.	(Feet)	(Min.)	1,000 Lbs. G.W.	G per 1% Slope	Temp. per 10° C	Press. Alt. per 1,000 Ft.
26,000 pounds	82	1.5%	2,600	0.6	7.0%	Not available from operator	Negligible	1.0%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal landing configuration is with gear down and flaps fully extended. From flare-out, with throttles at idle rpm, normal landing procedures and technique are applied. Brakes are applied after nose wheel contact with runway.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum: 65
Maximum: 90
Operationally desirable: 75

Distance (from touchdown to stop)

Minimum: 900 feet
Maximum: 1,375 feet
Operationally desirable: 1,050 feet

Time (from touchdown to stop)

Minimum: 0.2 minute
Maximum: 0.3 minute
Operationally desirable: 0.3 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day Touchdown Speed IAS Knots	Touchdown Speed Dev. per 200 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 200 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day Dev. w/ Temp. per 10^{o} C	Dev. w/ Press. Alt. per 1,000 Ft.
7,000 lbs.	75	2.7%	1,050	0.3	3.0%	Not available from operator	3.8%	4.0%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal landing configuration is with gear down and flaps fully extended. From flareout, with throttle at idle rpm, normal landing procedures and techniques are applied. Brakes may be applied after nose wheel contact with runway.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum: 70
Maximum: 95
Operationally desirable: 80

Distance (from touchdown to stop)

Minimum: 950 feet
Maximum: 1,500 feet
Operationally desirable: 1,200 feet

Time (from touchdown to stop)

Minimum: 0.2 minute
Maximum: 0.3 minute
Operationally desirable: 0.3 minute

TABLE I, LANDING

N.A.S.A. Sea Level Standard Day							Dev. for Non-Standard Day	
Normal Gross Weight	Touchdown Speed IAS Knots	Dev. per 500 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 500 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. w/ Temp. per 10^{o} C	Dev. w/ Press. Alt. per 1,000 Ft.
7,500	80	3.8%	1,200	0.3	72%	Not available from manufacturer	3.4%	4.1%

(The above values are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal landing configuration is gear down, flaps fully extended and speed brakes as required.

From flareout, with throttle at idle rpm, normal landing procedures and techniques are applied Brakes are employed as required after nose wheel touchdown.

Table I presents landing data

Speed (knots IAS at touchdown)

Minimum: 80
Maximum: 90
Operationally desirable: 85

Distance (from touchdown to stop)

Minimum: 1, 700 feet
Maximum. 3, 000 feet
Operationally desirable: 2, 000 feet

Time (from touchdown to stop)

Minimum: 0. 4 minute
Maximum 0. 7 minute
Operationally desirable: 0. 5 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day: Touchdown Speed IAS Knots	Touchdown Speed Dev. per 1,000 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 1,000 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day: Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
8,000 lbs.	85	5.9%	2,000	0.5	8.6%	Not available from operator	2.6%	2.6%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal landing configuration is gear down and flaps fully extended. From flareout, with power set at idle rpm, the normal touchdown is with main gear first. Brakes are applied intermittently to prevent locking wheels.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum: 105
Maximum: 125
Operationally desirable: 112

Distance (from touchdown to stop)

Minimum: 2,750 feet
Maximum: 3,600 feet
Operationally desirable: 2,900 feet

Time (from touchdown to stop)

Minimum: 0.4 minute
Maximum: 0.6 minute
Operationally desirable: 0.5 minute

TABLE I, LANDING

N.A.S.A. Sea Level Standard Day							Dev. for Non-Standard Day	
Normal Gross Weight	Touchdown Speed IAS Knots	Dev. per 1,000 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 1,000 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. w/ Temp. per 10^{o} C	Dev. w/ Press. Alt. per 1,000 Ft.
32,000	112	1.5%	2,900	0.5	3.0%	Not available from operators.	6.9%	3.9%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is gear down, flaps fully extended (40 degrees), and speed brakes closed. From flareout, normal landing procedures and techniques are employed. Brakes are applied intermittently, to prevent wheel and brake seizure.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum: 141
Maximum: 160
Operationally desirable. 145

Distance (from touchdown to stop)

Minimum: 4,000 feet
Maximum: 5,150 feet
Operationally desirable: 4,250 feet

Time (from touchdown to stop)

Minimum: 0.5 minute
Maximum: 0.7 minute
Operationally desirable· 0.6 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day Touchdown Speed IAS Knots	Touchdown Speed Dev. per 1,000 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 1,000 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
17,000 pounds	145	2.8%	4,250	0.6	5.3%	Not available from operator	3.5%	3.5%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal helicopter configuration is clean with power set at 2, 400 rpm and manifold pressure as required. From flareout, airspeed and altitude are decreased simultaneously to arrive at *10 feet (hover) altitude at zero airspeed. Final touchdown is accomplished vertically at zero airspeed, touching down all landing wheels simultaneously.

Alternate Landing (Roll-on)

Normal helicopter configuration is clean with power set at 2, 400 rpm and manifold pressure as required. From flareout, airspeed and altitude are decreased simultaneously. Touchdown is accomplished in a level attitude with a minimum rate of sink at ground contact. Main rotor pitch angle, and light wheel braking are used for deceleration. This type landing is utilized for emergency, high altitude and overload conditions.

Table I presents power-off landing data (roll-on).

Speed (knots IAS at touchdown)

Minimum allowable: 0
Maximum allowable: 15 (roll-on)
Operationally desirable: 0

Distance (from touchdown)

Minimum: 0 feet
Maximum: 165 feet (roll-on)
Operationally desirable: 0 feet

Time (from touchdown)

Minimum: 0 seconds
Maximum: 13 seconds (roll-on)
Operationally desirable: 0 seconds

*(Time consumed from hover position to touchdown: 5 seconds)

TABLE I, LANDING
(Roll-On)

Normal Gross Weight	IAS Knots	Dev. per 1,000 Lbs. G.W.	Dist. (Feet)	Time (Sec.)	Dev. per 1,000 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day Dev. w/ Temp. per 10^{o} C	Dev. w/ Press. Alt. per 1,000 Ft.
7,300	15	none	165	13	15%	none	3%	3%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal helicopter configuration is clean, with power set at a minimum of 22 inches manifold pressure at 2, 500 rpm. From flareout, airspeed and altitude are decreased simultaneously to arrive at *10 feet (hover) altitude at zero airspeed. Final touchdown is accomplished vertically at zero airspeed, touching down all landing wheels simultaneously.

Alternate Landing (Roll-on)

Normal helicopter configuration is clean with power set at a minimum of 22 inches manifold pressure at 2, 500 rpm. From flareout, airspeed and altitude are decreased simultaneously. Touchdown is accomplished in a level attitude with a minimum rate of sink at ground contact. Main rotor pitch angle, and light wheel braking are used for deceleration. This type of landing is utilized for emergency high altitude an overload conditions.

Table I presents power-off landing data (roll-on).

Speed (knots IAS at touchdown)

Minimum allowable: 0
Maximum allowable: 20 (roll-on)
Operationally desirable: 0

Distance (from touchdown)

Minimum: 0 feet
Maximum: 150 feet (roll-on)
Operationally desirable: 0 feet

Time (from touchdown)

Minimum: 0 second
Maximum: 10 seconds (roll-on)
Operationally desirable: 0 second

*(Time consumed from hover altitude to touchdown: 5 seconds)

TABLE I, LANDING
(Roll-On)

N.A.S.A. Sea Level Standard Day							Dev. for Non-Standard Day	
Normal Gross Weight	Touchdown Speed IAS Knots	Dev. per 1,000 Lbs. G.W.	Dist. (Feet)	Time (Sec.)	Dev. per 1,000 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
11,000	20	none	150	10	11%	none	3%	4%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal helicopter configuration consists of gear down with power set at 2, 600 rpm and manifold pressure as required. From flareout, airspeed and altitude are decreased simultaneously to arrive at *10 feet (hover) altitude at zero airspeed. Final touchdown is accomplished vertically at zero airspeed, touching down all landing wheels simultaneously.

Alternate Landing (Roll-On)

Normal helicopter configuration consists of gear down. Power is set at 2, 600 rpm and manifold pressure as required. From flareout, airspeed and altitude are decreased simultaneously Touchdown is accomplished in a level attitude with a minimum rate of sink at ground contact Main rotor pitch angle, and light wheel braking are used for deceleration. This type of landing is utilized for emergency high altitude and overload conditions

Table I presents power-off landing data (roll-on)

Speed (knots IAS at touchdown)

Minimum allowable: 0
Maximum allowable: 40 (roll-on)
Operationally desirable: 0

Distance (from touchdown)

Minimum: 0 feet
Maximum: 220 feet (roll-on)
Operationally desirable: 0 feet

Time (from touchdown)

Minimum: 0 second
Maximum: 8 seconds (roll-on)
Operationally desirable: 0 second

* (Time consumed from hover position to touchdown: 5 seconds)

TABLE I, LANDING
(Roll-On)

Normal Gross Weight	N.A.S.A. Sea Level Standard Day: Touchdown Speed IAS Knots	Touchdown Speed Dev. per 2,000 Lbs. G.W.	Dist. (Feet)	Time (Sec.)	Dev. per 2,000 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day: Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
26,000 pounds	40	none	220	8	7%	Not available from operator.	4%	4%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal helicopter configuration is clean. Power is set at a minimum of 22 inches manifold pressure at 2,500 rpm. From flareout, airspeed and altitude are decreased simultaneously to arrive at *10 feet (hover) altitude at zero airspeed. Final touchdown is accomplished vertically at zero airspeed, touching down all landing wheels simultaneously.

Alternate Landing (Roll-on)

Normal helicopter configuration is clean. Power is set at a minimum of 22 inches manifold pressure at 2,500 rpm. From flareout, airspeed and altitude are decreased simultaneously. Touchdown is accomplished in a level attitude with a minimum rate of sink at ground contact. Main rotor pitch angle and light wheel braking are used for deceleration. This type of landing is utilized for emergency high altitude and overload conditions.

Table I presents power-off landing data (roll-on).

Speed (knots IAS at touchdown)

Minimum allowable: 0
Maximum allowable: 30 (roll-on)
Operationally desirable: 0

Distance (from touchdown)

Minimum: 0 feet
Maximum: 200 feet (roll-on)
Operationally desirable: 0 feet

Time (from touchdown)

Minimum: 0 seconds
Maximum: 10 seconds (roll-on)
Operationally desirable: 0 seconds

*Time consumed from hover altitude to touchdown: 5 seconds

TABLE I, LANDING
(Roll-On)

Normal Gross Weight	N. A. S. A. Sea Level Standard Day						Dev. for Non-Standard Day	
	Touchdown Speed IAS knots	Dev. per 2,000 Lbs. GW	Dist. (Feet)	Time (Sec.)	Dev. per 2,000 Lbs. GW	Dev. w/ G per 1% Slope	Dev. w/ Temp. per 20° C	Dev. w/ Press. Alt. per 2,000 Ft.
12,100	30	none	200	10	7.5%	Not available from operators	2.5%	5.0%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

AIR VEHICLE PERFORMANCE CHARACTERISTICS

Volumes I-A through IX

SECTION 2

COMMERCIAL AIRCRAFT

containing data on:

Boeing B-377

Boeing 707-121

Convair 340/440

de Havilland Comet 4

Douglas DC-3 (C-47, R4D)

Douglas DC-4 (C-54)

Douglas DC-6

Douglas DC-6B

Douglas DC-7

Douglas DC-7B

Douglas DC-7C

Fairchild F-27B

Lockheed Electra 188

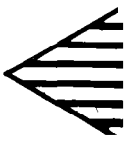
Lockheed 1049G

Lockheed 1649A

Martin 404

Vickers Viscount 745D

Vickers Viscount 812



(date of latest revision: September 1, 1959)

UNITED STATES FEDERAL AVIATION AGENCY
Bureau of Research & Development Washington 25, D. C.

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down and flaps fully extended with power set at idle rpm. From flareout the normal touchdown is with main gear first. Reverse thrust and wheel braking are used for deceleration.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum allowable: 85
Maximum allowable: 110
Operationally desirable: 90

Distance (from touchdown to stop)

Minimum: 2, 560
Maximum: 4, 300
Operationally desirable: 2, 900 feet

Time (from touchdown to stop)

Minimum: 0. 5 minute
Maximum: 0. 8 minute
Operationally desirable: 0. 6 minute

TABLE I, LANDING

N.A.S.A. Sea Level Standard Day							Dev. for Non-Standard Day	
Normal Gross Weight	Touchdown Speed IAS Knots	Dev. per 1,000 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 1,000 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. w/ Temp. per 10^{o} C	Dev. w/ Press. Alt. per 1,000 Ft.
120,000	90	5%	2,900	0.6	Not available from operators		Not available from operators	

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down, flaps extended 50 degrees, and speed brakes out. Power is set as required to maintain airspeed. Touchdown is made with main gear first, wheel brakes are applied and the nose gear is rapidly lowered to the runway. Reverse thrust is applied after touchdown of nose gear.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum: 120
Maximum: 161
Operationally desirable: 125

Distance (from touchdown to stop)

Minimum: 4, 700 feet
Maximum: 6, 400 feet
Operationally desirable: 5, 900 feet

Time (from touchdown to stop)

Minimum: 0. 8 minute
Maximum: 1. 0 minute
Operationally desirable: 0. 9 minute

TABLE I, LANDING

N.A.S.A. Sea Level Standard Day							Dev. for Non-Standard Day	
Normal Gross Weight	Touchdown Speed IAS Knots	Dev. per 10,000 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 10,000 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
130,000 pounds	125	4.0%	5,900	0.9	Not available from operators.			

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down, flaps extended 28 degrees, and power as required. From flareout, the normal touchdown is with the main gear first. Reverse thrust is used immediately after touchdown and brakes are applied intermittently to prevent skidding.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum: 80
Maximum: 100
Operationally desirable: 90

Distance (from touchdown to stop)

Minimum: 1,600 feet
Maximum: 3,000 feet
Operationally desirable: 2,310 feet

Time (from touchdown to stop)

Minimum: 0.4 minute
Maximum: 0.6 minute
Operationally desirable: 0.5 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day						Dev. for Non-Standard Day	
	Touchdown Speed		Dist.	Time	Dev. per	Dev. w/	Dev. w/	Dev. w/
	IAS Knots	Dev. per 1,000 Lbs. G.W.	(Feet)	(Min.)	1,000 Lbs. G.W.	G per 1% Slope	Temp. per 10^{o} C	Press. Alt. per 1,000 Ft.
40,000 pounds	90	1.0%	2,310	0.5	1.0%	Pos. "G" 2.2% Neg. "G" 2.5%	Not available from operator	2.0%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down and flaps extended 60 degrees plain and 80 degrees split. After full touchdown, wheel braking is utilized for deceleration.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum allowable: 93
Maximum allowable: 110
Operationally desirable: 100

Distance (from touchdown to stop)

Minimum: 2,750 feet
Maximum: 3,500 feet
Operationally desirable: 3,060 feet

Time (from touchdown to stop)

Minimum: 0.5 minute
Maximum: 0.7 minute
Operationally desirable: 0.6 minute

TABLE I, LANDING

N.A.S.A. Sea Level Standard Day						Dev. for Non-Standard Day		
Normal Gross Weight	Touchdown Speed IAS Knots	Dev. per 10,000 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 10,000 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
100,000 (pounds)	100	2%	3,060	0.6	17%	Not available from manufacturer		3%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down, flaps fully extended, power is set at 2,700 rpm and manifold pressure as required. From flareout, the normal touchdown is with main gear first, tail gear is gradually lowered as speed decreases. Brakes are applied intermittently to prevent skidding.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum allowable: 70
Maximum allowable: 80
Operationally desirable: 70

Distance (from touchdown to stop)

Minimum: 1,200 feet
Maximum: 1,600 feet
Operationally desirable: 1,200 feet

Time (from touchdown to stop)

Minimum: 0.3 minute
Maximum: 0.4 minute
Operationally desirable: 0.3 minute

TABLE I, LANDING

Gross Weight (Lbs.)	N. A. S. A. Sea Level Standard Day Touchdown Speed IAS Knots	Touchdown Speed Dev. per 3,000 Lbs. G. W.	Dist. (Feet)	Time (Min.)	Dev. per 3,000 Lbs. G. W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
22,000	70	Not available from operators	1,200	0.3	12%	Not available from operators		4%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down, flaps extended 45 degrees and power set at idle.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum: 79
Maximum: 86
Operationally desirable: 81

Distance (from touchdown to stop)

Minimum: 2, 320 feet
Maximum: 2, 770 feet
Operationally desirable: 2, 430 feet

Time (from touchdown to stop)

Minimum: 0.6 minute
Maximum: 0.7 minute
Operationally desirable: 0.6 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day					Dev. for Non-Standard Day		
	Touchdown Speed		Dist.	Time	Dev. per 1,000 Lbs.	Dev. w/ G per	Dev. w/ Temp. per	Dev. w/ Press. Alt.
	IAS Knots	Dev. per 1,000 Lbs. G.W.	(Feet)	(Min.)	G.W.	1% Slope	10° C	per 1,000 Ft.
55,000 pounds	81	0.8%	2,430	0.6	1.6%	Not available from operator.		4.9%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down and flaps fully extended. From flareout the normal touchdown is made with main gear first. Reverse thrust is applied immediately after touchdown. Wheel brakes are applied intermittently to prevent skidding.

Speed (knots IAS at touchdown)

Minimum: 88
Maximum: 95
Operationally desirable: 95

Distance (from touchdown to stop)

Minimum: 2, 560 feet
Maximum: 2, 850 feet
Operationally desirable: 2, 850 feet

Time (from touchdown to stop)

Minimum. 0.5 minute
Maximum: 0.6 minute
Operationally desirable: 0.6 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day					Dev. for Non-Standard Day		
	Touchdown Speed		Dist.	Time	Dev. per 10,000 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
	IAS Knots	Dev. per 10,000 Lbs. G.W.	(Feet)	(Min.)				
80,000 pounds	95	6.2%	2,850	0.6	12.2	Not available from operator	4.0%	3.1%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down, flaps extended 30 degrees, power set at 2,500 rpm and manifold pressure as required. From flare-out the normal touchdown is made with main gear first. Reverse thrust is applied immediately after touchdown. The brakes are applied intermittently to prevent skidding.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum: 88
Maximum: 99
Operationally desirable: 95

Distance (from touchdown to stop)

Minimum: 1,600 feet
Maximum: 3,950 feet
Operationally desirable: 2,850 feet

Time (from touchdown to stop)

Minimum: 0.3 minute
Maximum: 0.8 minute
Operationally desirable: 0.6 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day: Touchdown Speed IAS Knots	Touchdown Speed Dev. per 10,000 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 10,000 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day: Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
80,000	95	6.2%	2,850	0.6	12.2%	Not available from operators.	4.0%	3.1%

(The values above are to be substituted directly in the landing equation in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down and flaps extended 50 degrees. Power is set at 2,400 rpm and manifold pressure as required. From flareout the normal touchdown is made with main gear first. Wheel brakes are applied intermittently to prevent skidding. Reverse thrust may be used if necessary.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum: 98
Maximum: 112
Operationally desirable: 106

Distance (from touchdown to stop)

Minimum: 2,700 feet
Maximum: 3,360 feet
Operationally desirable: 3,100 feet

Time (from touchdown to stop)

Minimum: 0.5 minute
Maximum: 0.7 minute
Operationally desirable: 0.6 minute

TABLE I, LANDING
(Using Wheel Brakes Only)

Normal Gross Weight	N.A.S.A. Sea Level Standard Day Touchdown Speed IAS Knots	Touchdown Speed Dev. per 10,000 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 10,000 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
86,000	106	4.7%	3,100	0.6	7.8%	Not available from operator.	3.2%	3.4%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down and flaps extended 50 degrees. Power is set at 2, 400 rpm and manifold pressure as required. From flareout the normal touchdown is made with main gear first. Wheel brakes are applied intermittently to prevent skidding. Reverse thrust may be used if necessary.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum: 95
Maximum: 110
Operationally desirable: 100

Distance (from touchdown to stop)

Minimum: 2, 300 feet
Maximum: 3, 360 feet
Operationally desirable: 3, 100 feet

Time (from touchdown to stop)

Minimum: 0. 5 minute
Maximum: 0. 7 minute
Operationally desirable: 0. 6 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day Touchdown Speed IAS Knots	Touchdown Speed Dev. per 5,000 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 5,000 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
95,000	100	2.3%	3,100	0.6	4.0%	Not available from operators.		3.3%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down and flaps extended 50 degrees. From flareout, with throttles at idle rpm, normal landing procedures and techniques are applied. Reverse thrust is applied immediately after touchdown.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum: 94
Maximum: 103
Operationally desirable: 99

Distance (from touchdown to stop)

Minimum: 2,500 feet
Maximum: 3,050 feet
Operationally desirable: 2,830 feet

Time (from touchdown to stop)

Minimum: 0.4 minute
Maximum: 0.6 minute
Operationally desirable: 0.6 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day					Dev. for Non-Standard Day		
	Touchdown Speed		Dist.	Time	Dev. per	Dev. w/	Dev. w/	Dev. w/
	IAS Knots	Dev. per 10,000 Lbs. G.W.	(Feet)	(Min.)	10,000 Lbs. G.W.	G per 1% Slope	Temp. per 10° C	Press. Alt. per 1,000 Ft.
100,000 pounds	99	4.3%	2,830	0.6	8.5%	Not avaialble from operators		4.2%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down, flaps fully extended and power set as required. From flareout the normal touchdown is with main gear first. Propeller and wheel braking are applied as required.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum allowable: 80
Maximum allowable: 100
Operationally desirable: 83

Distance (from touchdown to stop)

Minimum: 1,900 feet
Maximum: 2,470 feet
Operationally desirable: 2,070 feet

Time (from touchdown to stop)

Minimum: 0.4 minute
Maximum: 0.6 minute
Operationally desirable: 0.5 minute

TABLE I, LANDING

Normal Gross Weight (Lbs.)	N.A.S.A. Sea Level Standard Day						Dev. for Non-Standard Day	
	Touchdown Speed		Dist.	Time	Dev. per Lbs.	Dev. w/ G per	Dev. w/ Temp. per	Dev. w/ Press. Alt.
	IAS Knots	Dev. per Lbs. G.W.	(Feet)	(Min.)	G.W.	1% Slope	10° C	per 1,000 Ft.
32,000	83	2%	2,070	0.5	2%	3%	3%	3%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down, flaps fully extended, and throttles set at idle rpm. Wheel and propeller braking are applied two seconds after touchdown.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum: 95
Maximum: 110
Operationally desirable: 100

Distance (from touchdown to stop)

Minimum: 2,000 feet
Maximum: 3,000 feet
Operationally desirable: 2,600 feet

Time (from touchdown to stop)

Minimum: 0.4 minute
Maximum: 0.6 minute
Operationally desirable: 0.5 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day					Dev. for Non-Standard Day		
	Touchdown Speed		Dist.	Time	Dev. per 10,000 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
	IAS Knots	Dev. per 10,000 Lbs. G.W.	(Feet)	(Min.)				
85,000 pounds	100	6.0%	2,600	0.5	13.6%	Not available from operators		3.3%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down and flaps fully extended. Power is set at 2,400 rpm and manifold pressure as required. From flareout the normal touchdown is with the main gear first gradually easing the nose gear down. Propeller and wheel braking are used as required.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum allowable: 88
Maximum allowable: 110
Operationally desirable: 95

Distance (from touchdown to stop)

Minimum: 2,670 feet
Maximum: 3,600 feet
Operationally desirable: 3,600 feet

Time (from touchdown to stop)

Minimum: 0.6 minute
Maximum: 0.8 minute
Operationally desirable: 0.8 minute

TABLE I, LANDING

Gross Weight (Lbs.)	N.A.S.A. Sea Level Standard Day: Touchdown Speed IAS Knots	Touchdown Speed Dev. per 10,000 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 10,000 Lbs. G.W.	Dev. for Non-Standard Day: Dev. w/ G per 1% Slope	Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
113,000	95	5%	3,600	0.8	10%	Not available from operator		

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down and flaps fully extended. Power is set at 2, 400 rpm and manifold pressure as required. From flareout the normal touchdown is with the main gear first. Propeller and wheel braking are used as required.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum allowable. 88
Maximum allowable: 110
Operationally desirable: 102

Distance (from touchdown to stop)

Minimum: 2, 670 feet
Maximum: 3, 760 feet
Operationally desirable: 3, 760 feet

Time (from touchdown to stop)

Minimum: 0. 6 minute
Maximum: 0. 7 minute
Operationally desirable: 0. 7 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day						Dev. for Non-Standard Day	
	Touchdown Speed		Dist.	Time	Dev. per	Dev. w/	Dev. w/	Dev. w/
	IAS Knots	Dev. per 10,000 Lbs. G.W.	(Feet)	(Min.)	10,000 Lbs. G.W.	G per 1% Slope	Temp. per 10° C	Press. Alt. per 1,000 Ft.
123,000	102	5%	3,760	0.7	10%	Not available from operators		

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down and flaps extended 45 degrees. From flareout, the normal touchdown is with the main gear first. Reverse thrust and wheel braking are utilized for deceleration.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum: 80
Maximum: 95
Operationally desirable: 85

Distance (from touchdown to stop)

Minimum: 2, 100 feet
Maximum: 2, 700 feet
Operationally desirable: 2, 440 feet

Time (from touchdown to stop)

Minimum: 0. 5 minute
Maximum: 0. 7 minute
Operationally desirable: 0. 6 minute

TABLE I, LANDING

Maximum Gross Weight (Lbs.)	N.A.S.A. Sea Level Standard Day						Dev. for Non-Standard Day	
	Touchdown Speed		Dist.	Time	Dev. per	Dev. w/	Dev. w/	Dev. w/
	IAS Knots	Dev. per 1,000 Lbs. G.W.	(Feet)	(Min.)	1,000 Lbs. G.W.	G per 1% Slope	Temp. per 10^{o} C	Press. Alt. per 1,000 Ft.
43,000	85	0.7%	2,440	0.6	2.1%	Not available from operators.	2.6%	2.8%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down and flaps extended 47 degrees. Power is set at 14,000 rpm and torque pressure as required from flareout. Touchdown is with main gear first. Propeller and wheel braking are applied as required.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum: 105
Maximum: 120
Operationally desirable: 112

Distance (from touchdown to stop)

Minimum: 2,505 feet
Maximum: 3,400 feet
Operationally desirable: 2,900 feet

Time (from touchdown to stop)

Minimum: 0.4 minute
Maximum: 0.6 minute
Operationally desirable: 0.5 minute

TABLE I, LANDING

N.A.S.A. Sea Level Standard Day							Dev. for Non-Standard Day	
Normal Gross Weight	Touchdown Speed IAS Knots	Dev. per 2,000 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 2,000 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
50,000	112	2.0%	2,900	0.5	4.6%	7.0%	Not available from operators	3.4%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down and flaps extended 40 degrees. Power is set at 14,000 rpm and torque pressure as required. From flareout touchdown is with the main gear first. Propeller fine pitch braking and wheel braking are applied as required.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum allowable: 90
Maximum allowable: 110
Operationally desirable: 100

Distance (from touchdown to stop)

Minimum: 3,050 feet
Maximum: 4,100 feet
Operationally desirable: 3,400 feet

Time (from touchdown to stop)

Minimum: 0.5 minute
Maximum: 0.8 minute
Operationally desirable: 0.7 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day: Touchdown Speed IAS Knots	Touchdown Speed Dev. per 5,000 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 5,000 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day: Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
52,000	100	5.7%	3,400	0.7	13%	17%	Not available from operator	4.5%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

AIR VEHICLE PERFORMANCE CHARACTERISTICS

Volumes I-A through IX

SECTION 3

GENERAL AVIATION

containing data on:

Aero Commander 500

Aero Commander 680 (L-26C)

Aero Commander 720

Beechcraft "Bonanza" K-35

Beechcraft "Twin Bonanza" (L-23D)

Beechcraft Model 95

Beechcraft Super 18

Cessna 150

Cessna 172

Cessna 175

Cessna 180 (Amphibian)

Cessna 182

Cessna 310A (L-27A)

Cessna 310C

de Havilland "Beaver" (L-20A)

de Havilland "Otter" (U-1A)

Mooney Mark 20A

Piper "Tri-Pacer" PA-22

Piper "Apache"" PA-23

Piper "Comanche" PA-24-180

(date of latest revision: September 1, 1959)

UNITED STATES FEDERAL AVIATION AGENCY
Bureau of Research & Development Washington 25, D. C.

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down and flaps as required and throttles at idle rpm. From flareout the normal touchdown is with main gear first. The brakes are applied intermittently to prevent skidding.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum allowable: 63
Maximum allowable: 80
Operationally desirable: 68

Distance (from touchdown to stop)

Minimum: 1,000 feet
Maximum: 1,400 feet
Operationally desirable: 1,400 feet

Time (from touchdown to stop)

Minimum: 0.2 minute
Maximum: 0.4 minute
Operationally desirable: 0.4 minute

TABLE I, LANDING

N.A.S.A. Sea Level Standard Day							Dev. for Non-Standard Day	
Maximum Gross Weight	Touchdown Speed IAS Knots	Dev. per Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 200 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. w/ Temp. per 10^{o} C	Dev. w/ Press. Alt. per 1,000 Ft.
6,000 pounds	68	none	1,400	0.4	Not available from manufacturer.			

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down, flaps as required and power set at idle rpm. From flareout the normal touchdown is with the main gear first. The brakes are applied intermittently to prevent skidding.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum allowable: 60
Maximum allowable: 95
Operationally desirable: 95

Distance (from touchdown to stop)

Minimum: 900 feet
Maximum: 1,300 feet
Operationally desirable: 1,058 feet

Time (from touchdown to stop)

Minimum: 0.2 minute
Maximum: 0.3 minute
Operationally desirable: 0.2 minute

TABLE I, LANDING

Maximum Gross Weight (Lbs)	N.A.S.A. Sea Level Standard Day						Dev. for Non-Standard Day	
	Touchdown Speed IAS Knots	Dev. per 100 Lbs. G. W.	Dist. (Feet)	Time (Min.)	Dev. per 100 Lbs. G. W.	Dev. w/ G per 1% Slope	Dev. w/ Temp. per 10^{o} C	Dev. w/ Press. Alt. per 1,000 Ft.
7,000	95	Not available from operator.	1,058	0.2	Not available from operator.		3.7%	4.0%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down, flaps as required, and power at idle rpm. From flareout, the normal touchdown is with main gear first. The brakes are applied intermittently to prevent skidding.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum allowable: 80
Maximum allowable: 95
Operationally desirable: 82

Distance (from touchdown to stop)

Minimum: 1,060 feet
Maximum: 1,500 feet
Operationally desirable: 1,200 feet

Time (from touchdown to stop)

Minimum: 0.2 minute
Maximum: 0.4 minute
Operationally desirable: 0.3 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day Touchdown Speed IAS Knots	Touchdown Speed Dev. per 500 Lbs. G. W.	Dist. (Feet)	Time (Min.)	Dev. per 500 Lbs. G. W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
6,000	82	Not available from manufacturer.	1,200	0.3	Not available from manufacturer.		3%	3%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down and flaps as required. Throttles are set at sufficient power to maintain an airspeed of 80 knots IAS to flareout. Touchdown is made with main gear first. As ground speed decreases, the aircraft is allowed to roll forward onto the nose wheel.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum: 52
Maximum: 87
Operationally desirable: 56

Distance (from touchdown to stop)

Minimum: 1, 125 feet
Maximum: 1, 530 feet
Operationally desirable: 1, 530 feet

Time (from touchdown to stop)

Minimum: 0. 4 minute
Maximum: 0. 6 minute
Operationally desirable: 0. 5 minute

TABLE I, LANDING

Maximum Gross Weight	N.A.S.A. Sea Level Standard Day						Dev. for Non-Standard Day	
	Touchdown Speed		Dist.	Time	Dev. per 100 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
	IAS Knots	Dev. per 100 Lbs. G.W.	(Feet)	(Min.)				
2,950 pounds	56	Not available from manufacturer.	1,530	0.5	Not available from manufacturer.		2.4%	2.3%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down, flaps extended as required and throttles at idle rpm. From flareout, the normal touchdown is with the main gear first. The brakes are applied intermittently to prevent skidding.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum allowable: 70
Maximum allowable: 100
Operationally desirable: 80

Distance (from touchdown to stop)

Minimum: 940 feet
Maximum: 1,500 feet
Operationally desirable: 1,320 feet

Time (from touchdown to stop)

Minimum: 0.2 minute
Maximum 0.5 minute
Operationally desirable: 0.3 minute

TABLE I, LANDING

Gross Weight (Lbs.)	N.A.S.A. Sea Level Standard Day Touchdown Speed IAS Knots	Touchdown Speed Dev. per 500 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 500 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
7,000	80	3.7%	1,320	0.3	7.6%	Not available from operators.	2%	3%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage figures by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down and flaps fully extended. Throttles are set at idle rpm. From flareout the normal touchdown is with main gear first. Brakes are applied intermittently to prevent skidding.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum allowable: 61
Maximum allowable: 87
Operationally desirable: 65

Distance (from touchdown to stop)

Minimum: 940 feet
Maximum: 1,660 feet
Operationally desirable: 1,100 feet

Time (from touchdown to stop)

Minimum: 0.3 minute
Maximum 0.5 minute
Operationally desirable: 0.4 minute

TABLE I, LANDING

Maximum Gross Weight	N.A.S.A. Sea Level Standard Day Touchdown Speed IAS Knots	Touchdown Speed Dev. per 100 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 100 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
4,000	65	Not available from manufacturer.	1,100	0.4	Not available from manufacturer.		4%	2%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down, flaps fully extended and power at 2,000 rpm with 22 inches manifold pressure. From flareout, the normal touchdown is with the main gear first. The brakes are applied intermittently to prevent skidding.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum allowable: 73
Maximum allowable: 95
Operationally desirable: 80

Distance (from touchdown to stop)

Minimum: 1,550 feet
Maximum: 2,020 feet
Operationally desirable: 1,700 feet

Time (from touchdown to stop)

Minimum: 0.3 minute
Maximum: 0.5 minute
Operationally desirable: 0.4 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day: Touchdown Speed IAS Knots	Touchdown Speed Dev. per 100 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 100 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day: Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
9,300 pounds	80	Not available from manufacturer	1,700	0.4	Not available from manufacturer		3.0%	3.2%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with flaps as required and power set at idle rpm. From flareout, normal touchdown is with main gear first with nose gear touchdown as speed diminishes. Brakes are applied as required.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum allowable: 45
Maximum allowable: 86
Operationally desirable: 50

Distance (from touchdown to stop)

Minimum: 680 feet
Maximum: 800 feet
Operationally desirable: 800 feet

Time (from touchdown to stop)

Minimum: 0.2 minute
Maximum: 0.3 minute
Operationally desirable: 0.3 minute

TABLE I, LANDING

Maximum Gross Weight (Lbs.)	N.A.S.A. Sea Level Standard Day						Dev. for Non-Standard Day	
	Touchdown Speed		Dist.	Time	Dev. per Lbs.	Dev. w/ G per	Dev. w/ Temp. per	Dev. w/ Press. Alt.
	IAS Knots	Dev. per Lbs. G.W.	(Feet)	(Min.)	G.W.	1% Slope	10° C	per 1,000 Ft.
2,200	50	Not available from manufacturer	800	0.3	11.0%	Not available from manufacturer	2.8%	3.1%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with flaps as required. Power is set at idle rpm. From flareout the normal touchdown is main gear first. The nose gear is eased down as speed decreases, and brakes are applied intermittently to prevent skidding.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum: 46
Maximum: 61
Operationally desirable: 46

Distance (from touchdown)

Minimum: 590 feet
Maximum: 979 feet
Operationally desirable: 590 feet

Time (from touchdown)

Minimum: 0.3 minute
Maximum: 0.4 minute
Operationally desirable: 0.3 minute

TABLE I, LANDING

N.A.S.A. Sea Level Standard Day							Dev. for Non-Standard Day	
Maximum Gross Weight	Touchdown Speed IAS Knots	Dev. per 100 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 100 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. w/ Temp. per 10^{o} C	Dev. w/ Press. Alt. per 1,000 Ft.
2,350	46	2.6%	590	0.3	3.3%	Not available from manufacturer.	2.4%	2.6%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with flaps extended 40 degrees. Power is set at 2, 450 rpm and manifold pressure as required. From flareout the normal touchdown is with a slight nose-high attitude, touching down on the aft section of the floats first.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum allowable: 50
Maximum allowable: 70
Operationally desirable: 60

Distance (from touchdown to stop)

Minimum: 570 feet
Maximum: 710 feet
Operationally desirable: 640 feet

Time (from touchdown to stop)

Minimum: 0 3 minute
Maximum: 0. 5 minute
Operationally desirable: 0. 4 minute

TABLE I, LANDING
(Water)

Maximum Gross Weight	N.A.S.A. Sea Level Standard Day: Touchdown Speed IAS Knots	Touchdown Speed Dev. per 250 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 100 Lbs. G.W.	Dev. for Non-Standard Day: Dev. w/ G per 1% Slope	Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
2,850	60	3%	640	0.4	3%	Not applicable	Not available from manufacturer	4%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is flaps extended 40 degrees and power set at 2,600 rpm. From flareout the normal touchdown is with main gear first. The brakes are applied intermittently to prevent skidding.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum allowable: 45
Maximum allowable: 87
Operationally desirable: 50

Distance (from touchdown to stop)

Minimum: 445 feet
Maximum: 700 feet
Operationally desirable: 560 feet

Time (from touchdown to stop)

Minimum: 0.2 minute
Maximum: 0.4 minute
Operationally desirable: 0.3 minute

TABLE I, LANDING

Maximum Gross Weight	N.A.S.A. Sea Level Standard Day					Dev. for Non-Standard Day		
	Touchdown Speed IAS Knots	Touchdown Speed Dev. per 100 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 100 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
2,650 pounds	50	1.8%	560	0.3	3.6%	Not available from manufacturer		3.0%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down, flaps fully extended, and power as required. From flareout the normal touchdown is with the main gear first. The brakes are applied intermittently to prevent skidding.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum allowable: 80
Maximum allowable. 140
Operationally desirable: 95

Distance (from touchdown to stop)

Minimum: 1,000 feet
Maximum: 1,650 feet
Operationally desirable: 1,200 feet

Time (from touchdown to stop)

Minimum: 0.2 minute
Maximum: 0.4 minute
Operationally desirable: 0.3 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day Touchdown Speed IAS Knots	Touchdown Speed Dev. per 400 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 400 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
4,400	95	5.0%	1,200	0.3	6.7%	Not available from manufacturer or operators	3.3%	2.7%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down, flaps as required. Power is set at idle rpm. From flareout, the normal touchdown is with the main gear first. The brakes are applied intermittently to prevent skidding.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum allowable: 63
Maximum allowable: 87
Operationally desirable: 70

Distance (from touchdown to stop)

Minimum: 550 feet
Maximum: 700 feet
Operationally desirable: 620 feet

Time (from touchdown to stop)

Minimum: 0.2 minute
Maximum: 0.3 minute
Operationally desirable: 0.2 minute

TABLE I, LANDING

Maximum Gross Weight (Lbs.)	N.A.S.A. Sea Level Standard Day						Dev. for Non-Standard Day	
	Touchdown Speed		Dist.	Time	Dev. per 300 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. w/ Temp. per 10^{o} C	Dev. w/ Press. Alt. per 1,000 Ft.
	IAS Knots	Dev. per 300 Lbs. G.W.	(Feet)	(Min.)				
4,600	70	5.0%	620	0.2	5.7%	Not available from manufacturer.	2.4%	2.6%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage figures by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with flaps fully extended. Throttle is set for sufficient power to execute landing. From flareout the normal landing techniques and procedures are applied. Brakes are used intermittently to prevent skidding.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum allowable: 60
Maximum allowable: 75
Operationally desirable: 70

Distance (from touchdown to stop)

Minimum: 420 feet
Maximum: 1,200 feet
Operationally desirable: 500 feet

Time (from touchdown)

Minimum: 0.2 minute
Maximum: 0.3 minute
Operationally desirable: 0.2 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day Touchdown Speed IAS Knots	Touchdown Speed Dev. per 400 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 400 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day Dev. w/ Temp. per 10^{o} C	Dev. w/ Press. Alt. per 1,000 Ft.
4,800	70	14.3%	500	0.2	9.0%	Not available from operators.	7.7%	8.3%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with flaps fully extended. Touchdown is executed in a three-point attitude. Wheel braking is utilized for deceleration.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum allowable: 46
Maximum allowable: 65
Operationally desirable: 51

Distance (from touchdown to stop)

Minimum: 500 feet
Maximum: 606 feet
Operationally desirable: 544 feet

Time (from touchdown to stop)

Minimum: 0.2 minute
Maximum: 0.2 minute
Operationally desirable: 0.2 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day: Touchdown Speed IAS Knots	Touchdown Speed Dev. per 1,000 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 1,000 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day: Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
7,000 pounds	51	8.0%	544	0.2	11.0%	Negligible	2.0%	7.0%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down, flaps as required, and power set at idle rpm. From flareout, the normal touchdown is with main gear first. The brakes are applied as needed.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum allowable: 50
Maximum allowable: 65
Operationally desirable: 50

Distance (from touchdown to stop)

Minimum: 600 feet
Maximum: 800 feet
Operationally desirable: 600 feet

Time (from touchdown to stop)

Minimum: 0.2 minute
Maximum: 0.3 minute
Operationally desirable: 0.2 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day Touchdown Speed IAS Knots	Touchdown Speed Dev. per 50 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 50 Lbs. G.W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
2,150	50	Not available from manufacturer	600	0.2	Not available from manufacturer		Not available from manufacturer	

(The values above are to be substituted directly in the landing equations in the appendix. In substituting divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with flaps fully extended and power set at idle rpm. From flareout, the normal touchdown is with main gear first. Brakes are applied as required.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum: 47
Maximum: 61
Operationally desirable: 47

Distance (from touchdown to stop)

Minimum: 500 feet
Maximum: 650 feet
Operationally desirable: 500 feet

Time (from touchdown to stop)

Minimum: 0.2 minute
Maximum: 0.2 minute
Operationally desirable: 0.2 minute

TABLE I, LANDING

Maximum Gross Weight	N.A.S.A. Sea Level Standard Day Touchdown Speed IAS Knots	Touchdown Speed Dev. per 100 Lbs. G. W.	Dist. (Feet)	Time (Min.)	Dev. per Lbs. G. W.	Dev. w/ G per 1% Slope	Dev. for Non-Standard Day Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
2,000 lbs.	47	Not available from manufacturer.	500	0.2	Not available from manufacturer.		Not available from manufacturer.	

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down and flaps fully extended. Power is set at idle rpm. From flareout, the normal touchdown is with main gear first. Wheel braking is employed as required.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum allowable: 48
Maximum allowable: 70
Operationally desirable: 60

Distance (from touchdown to stop)

Minimum: 600 feet
Maximum: 750 feet
Operationally desirable: 700 feet

Time (from touchdown to stop)

Minimum: 0.2 minute
Maximum: 0.3 minute
Operationally desirable: 0.2 minute

TABLE I, LANDING

Normal Gross Weight	N.A.S.A. Sea Level Standard Day					Dev. for Non-Standard Day		
	Touchdown Speed		Dist.	Time	Dev. per Lbs.	Dev. w/ G per	Dev. w/ Temp. per	Dev. w/ Press. Alt.
	IAS Knots	Dev. per 100 Lbs. G.W.	(Feet)	(Min.)	G.W.	1% Slope	10° C	per 1,000 Ft.
3,600 pounds	60	Not available from manufacturer	700	0.2	3.6%	Not available from manufacturer		3.6%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

NARRATIVE SUMMARY

Sequence of Operations

Normal aircraft configuration is with gear down and flaps as required, throttles at idle rpm. From flareout the normal touchdown is with the main gear first. The brakes are applied intermittently to prevent skidding.

Table I presents landing data.

Speed (knots IAS at touchdown)

Minimum allowable: 55
Maximum allowable: 108
Operationally desirable: 65

Distance (from touchdown to stop)

Minimum: 500 feet
Maximum: 650 feet
Operationally desirable: 600 feet

Time (from touchdown to stop)

Minimum: 0.2 minute
Maximum: 0.3 minute
Operationally desirable: 0.2 minute

TABLE I, LANDING

Maximum Gross Weight	N.A.S.A. Sea Level Standard Day Touchdown Speed IAS Knots	Touchdown Speed Dev. per 100 Lbs. G.W.	Dist. (Feet)	Time (Min.)	Dev. per 100 Lbs. G.W.	Dev. for Non-Standard Day Dev. w/ G per 1% Slope	Dev. w/ Temp. per 10° C	Dev. w/ Press. Alt. per 1,000 Ft.
2,550 pounds	65	Not available from manufacturer	600	0.2	3.0%	Not available from manufacturer		4.0%

(The values above are to be substituted directly in the landing equations in the appendix. In substituting, divide all percentage values by 100.)

AIR VEHICLE PERFORMANCE CHARACTERISTICS

APPENDIX

(Containing Definitions and Reference Data)

UNITED STATES FEDERAL AVIATION AGENCY
Bureau of Research & Development Washington 25. D. C.

DEFINITIONS

PHASES OF OPERATION

1. GROUND OPERATIONS: All ground activity from intent to start engines to and including pre-take-off preparations.

2. TAKE-OFF: The complete action of getting an air vehicle into the air from the point of brake release through lift-off point.

3. PRE-CLIMB: The flight path from the point of lift-off to the point where climb schedule is established.

4. CLIMB: The flight path from the point where climb schedule is established to enroute or operational altitude.

5. ENROUTE: Flight path from top of climb to beginning of descent.

6. DESCENT. The flight path from beginning of descent to level-off for approach.

7. APPROACH PATTERN: The flight path from the end of descent to glide path interception.

8. GLIDE PATH: The flight path from the glide path interception to landing flareout.

9. LANDING: Landing flareout to turn-off.

DISTANCES

ABORT DISTANCE. The remaining runway distance required to stop aircraft after attaining V1 speed.

REFUSAL DISTANCE. The distance at which the aircraft will reach refusal speed assuming normal acceleration.

SPEEDS

FLARE SPEED (also see flareout): The transitional airspeed that is established at the completion of the glide path phase to bring the aircraft down in a smooth curve, preparatory for touchdown.

MAXIMUM (FLAP RETRACTION) SPEED: The highest allowable airspeed at which the aircraft can be flown, with flaps extended.

MINIMUM (FLAP RETRACTION) SPEED: The lowest airspeed at which the flaps may be retracted without an undesirable loss of altitude.

MACH NUMBER: The ratio of the speed of air, or of a moving body through the air, to the speed of sound in the air.

REFUSAL SPEED: The highest speed to which an aircraft can be accelerated, assuming normal acceleration, and still be stopped on the remaining runway.

WEIGHTS

BASIC OPERATING WEIGHT: The maximum gross weight of the aircraft less cargo, crew, passengers, fuel and oil.

NORMAL GROSS WEIGHT: Typical operating weight selected as most probable at any given phase of flight.

MAXIMUM GROSS WEIGHT: Maximum operating weight, essentially the same as maximum take-off weight.

MAXIMUM RAMP WEIGHT: Maximum weight of the loaded aircraft which can be expected at the ramp; generally this will be the maximum take-off weight plus weight of fuel needed for starting, taxiing, and engine warm-up.

MAXIMUM TAKE-OFF WEIGHT: Maximum allowable weight at take-off limited by performance and/or regulations.

MAXIMUM LANDING WEIGHT: Maximum allowable weight at landing limited by structural capability and/or regulations.

ZERO FUEL WEIGHT: Maximum ramp weight minus usable fuel.

MISCELLANEOUS

MAXIMUM AND MINIMUM ACCEPTABLE (as used with respect to enroute airspeeds and altitudes): These minimum and maximum values are the acceptable tolerance on the operationally desirable values given. They are not necessarily limits imposed by performance capabilities or by regulations.

OPERATIONALLY DESIRABLE: Value or condition given by operators or manufacturers as the most preferable, (speeds, altitudes, etc.)

DRY POWER: Power with engine water/methanol system inoperative.

WET POWER: Power with engine water/methanol system operative.

FLAREOUT (also see flare speed): The act of bringing an airplane down in a smooth curve, preparatory to touching down.

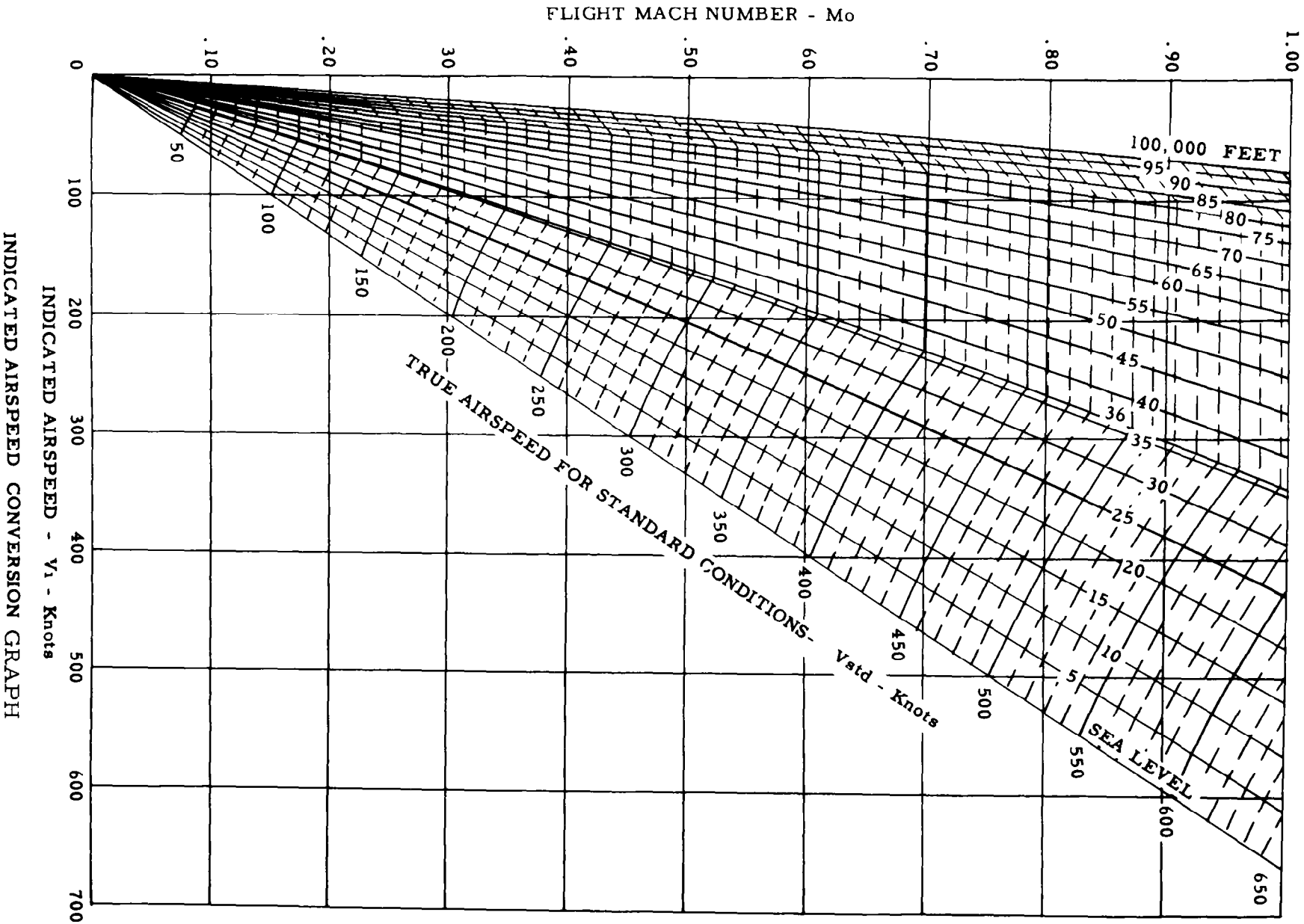
SPEED BRAKES: Any aerodynamic device designed for slowing down an airplane in flight.

HOVER (relating to helicopters or VTOL): To remain in a stationary position at a given altitude above the surface.

TRANSLATIONAL LIFT: The lift force exerted on the rotor blades of a helicopter when increased speed is imparted to the blades or when their angle of attack is changed in going from one type of flight to another, such as from hovering to horizontal flight.

SYMBOLS AND ABBREVIATIONS

ADI	Anti-Detonation Injection
AEW	Airborne Early Warning
ASW	Anti-submarine Warfare
ATO	Assisted Take-Off
bhp	Brake Horsepower
BLC	Boundary Layer Control
BMEP	Brake Mean Effective Pressure
ECM	Electronic Countermeasures
EGT	Exhaust Gas Temperature
eshp	Equivalent Shaft Horsepower
fpm	Feet Per Minute
IAS	Indicated Airspeed
JPT	Jet Pipe Temperature
MEA	Minimum Enroute Altitude
METO	Maximum Except Take-Off
N. A. S. A.	National Aeronautics and Space Administration
psi	Pounds Per Square Inch
RCD/MAD	Radar Countermeasures - Magnetic Airborne Detection
shp	Shaft Horsepower
rpm	Revolutions Per Minute
TAS	True Airspeed
T/O	Take-Off
V1	Critical Engine Failure Speed
V2 (Vlof)	Take-Off Safety Speed - Actual Lift-Off Speed



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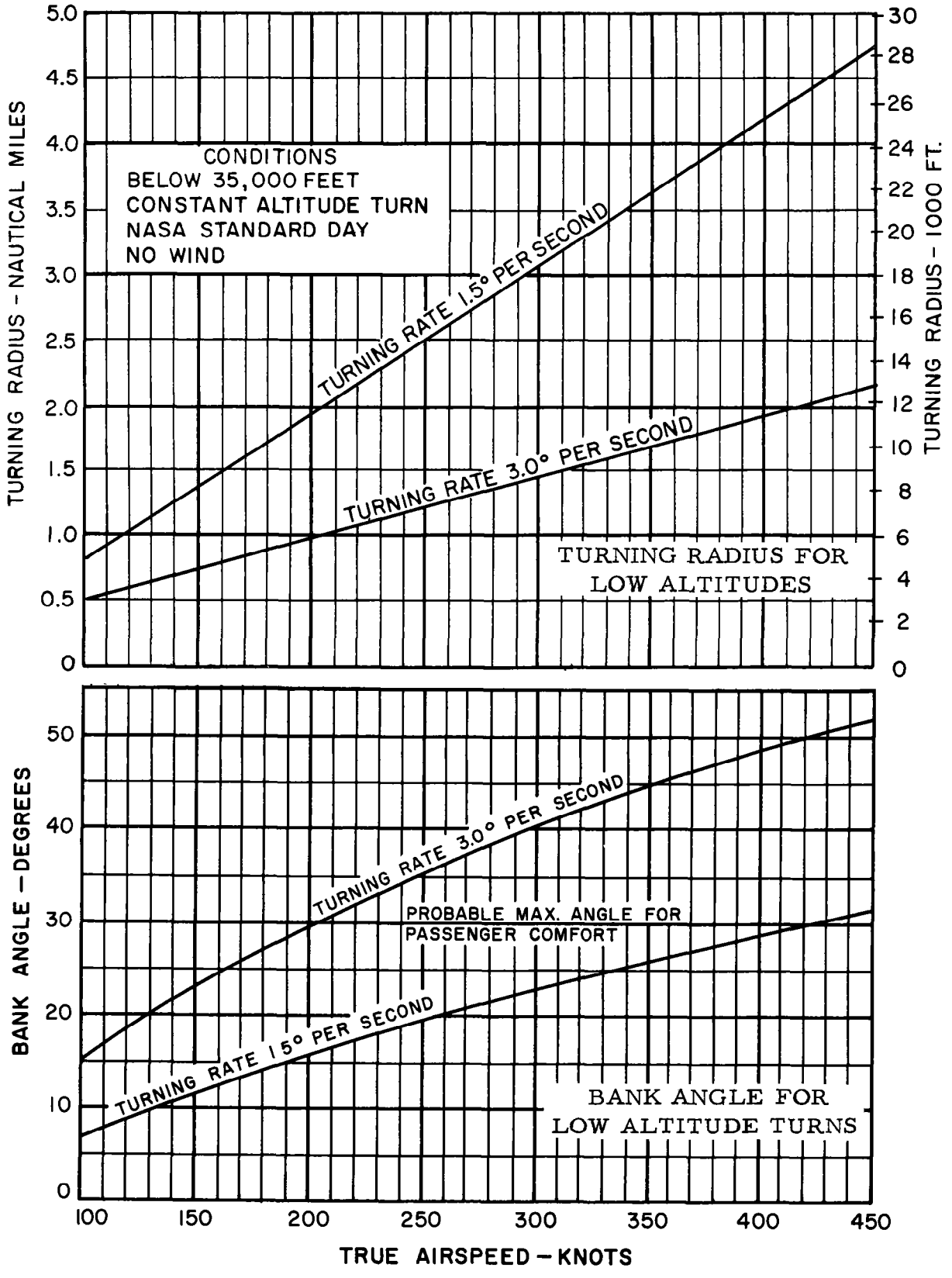
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TURNING RADIUS - 1000 FT.
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4.5
4.0
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1.0
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0
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
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CONDITIONS
BELOW 35,000 FEET
CONSTANT ALTITUDE TURN
NASA STANDARD DAY
NO WIND
TURNING RATE 1.5° PER SECOND
TURNING RATE 3.0° PER SECOND
TURNING RADIUS FOR
LOW ALTITUDES
BANK ANGLE - DEGREES
50
40
30
20
10
0
TURNING RATE 3.0° PER SECOND
PROBABLE MAX. ANGLE FOR
PASSENGER COMFORT
TURNING RATE 1.5° PER SECOND
BANK ANGLE FOR
LOW ALTITUDE TURNS
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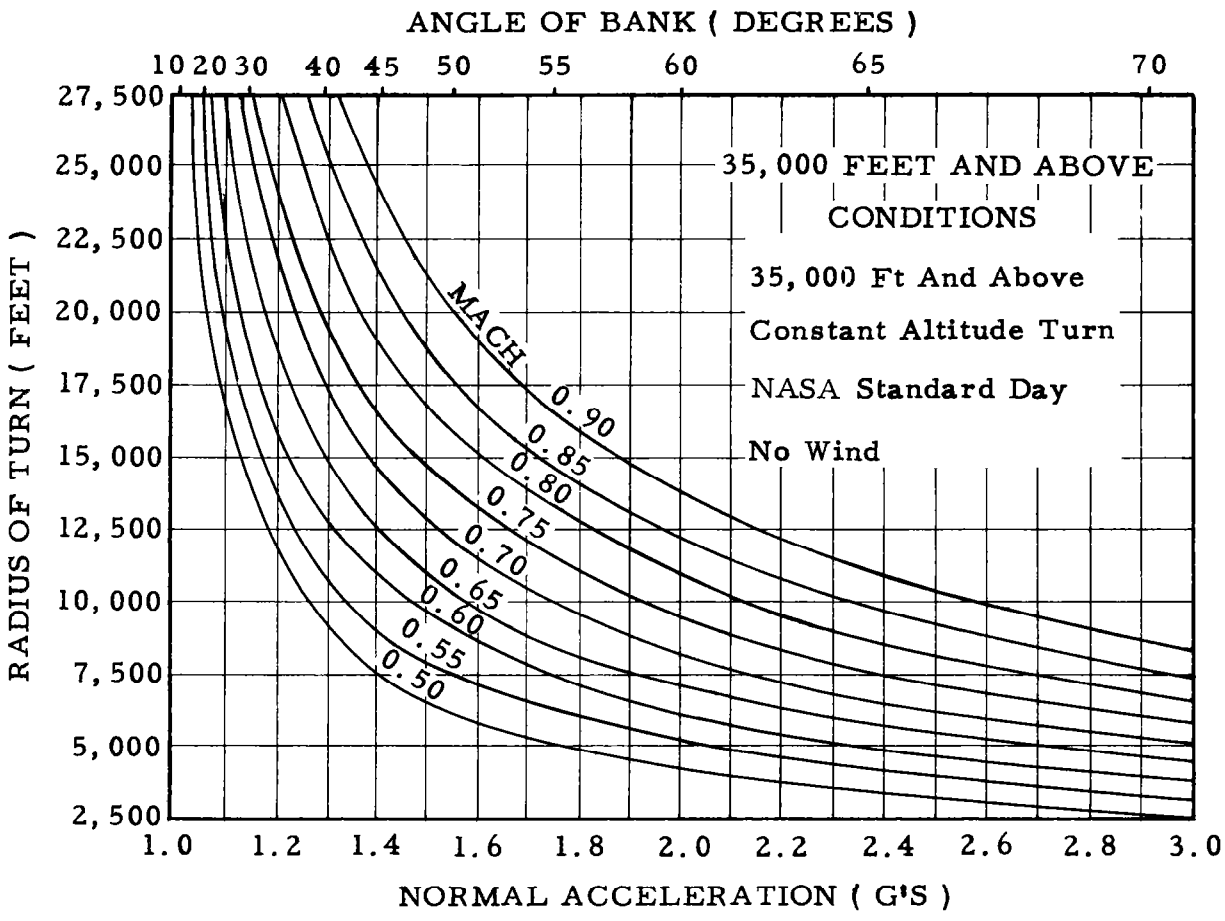
150
200
250
300
350
400
450
TRUE AIRSPEED - KNOTS



TURNING RADIUS GRAPH
HIGH ALTITUDES

LANDING

The following equations are used in conjunction with the landing tables. The equations will yield actual speed, distance, and time for given gross weight and atmospheric conditions. In substituting from the tables divide all percentage values by 100.

$$Sa = Sn \left(1 + a \frac{Wa - Wn}{X}\right)$$

$$Da = Dn \left(1 + b \frac{Wa - Wn}{X}\right) \left(1 + c \frac{ta - tn}{10}\right) \left(1 + \frac{dh}{1,000}\right) (1 - eG)$$

Note: Compute landing time same as landing distance by substituting Ta and Tn for Da and Dn.

Da - Actual landing distance
Dn - Normal landing distance
Ta - Actual landing time
Tn - Normal landing time
Sa - Actual landing speed
Sn - Normal landing speed
Wa - Actual gross weight
Wn - Normal gross weight
ta - Ambient temperature (^{o}C)
tn - Sea level standard day temp. (15^{o} C)
h - Pressure altitude (feet)
G - Runway gradient (% gradient is positive for uphill slope)
X - Unit pounds in which the deviation with gross weight is expressed

a - % Deviation in landing speed per X pound change in gross weight
b - % Deviation landing distance or time per X pound change in gross weight
c - % Deviation in landing distance or time per 10^{o}C change in temperature
d - % Deviation in landing distance or time per 1,000 feet change in pressure altitude
e - % Deviation in landing distance or time per 1% runway gradient