UNITED STATES
FEDERAL AVIATION AGENCY

AIR VEHICLE PERFORMANCE CHARACTERISTICS

Volume IV-B

C L I M B

FOR

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BY

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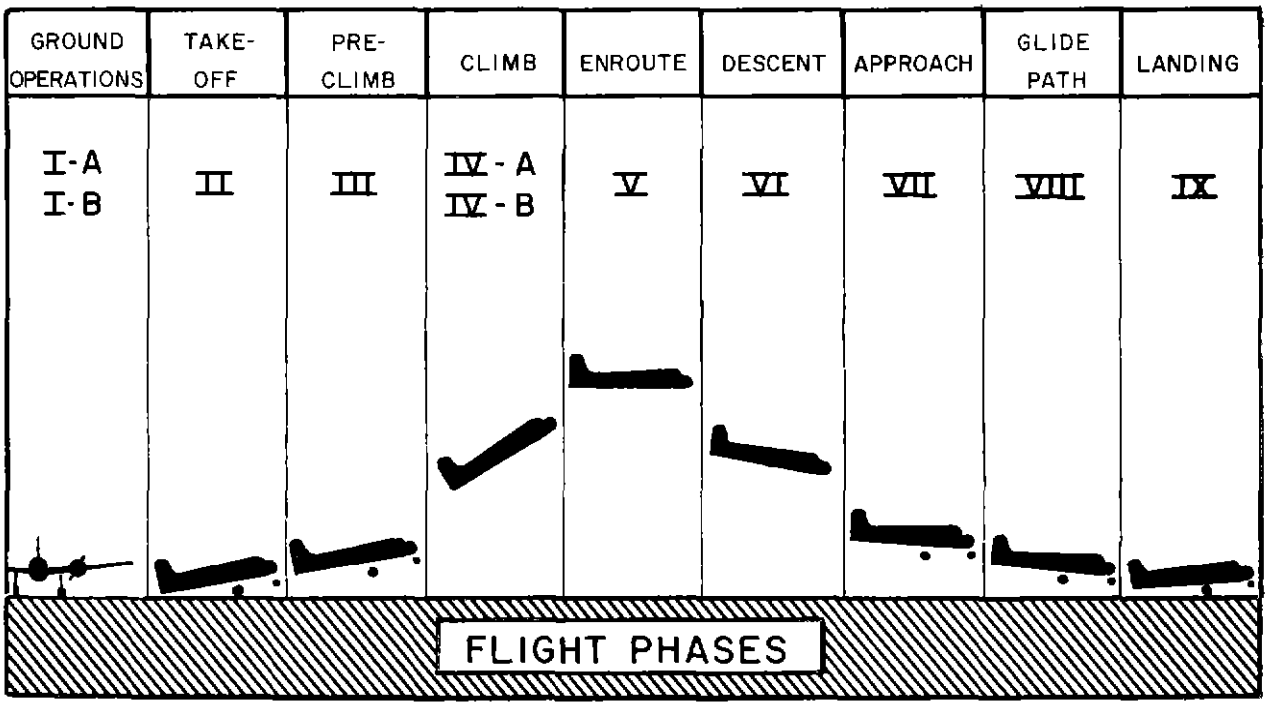
AIR VEHICLE PERFORMANCE CHARACTERISTICS

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



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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.

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MASTER INDEX - (Cont'd)

AIR VEHICLE PERFORMANCE CHARACTERISTICS

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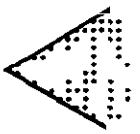

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AIR VEHICLE PERFORMANCE CHARACTERISTICS

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)

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NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 2, 000 feet a constant climb airspeed of 165 knots IAS is maintained to cruise altitude Speeds plus or minus 10 knots from the optimum will not materially affect performance.

Tables I, I A, and Figure 1 present climb data.

TABLE I, CLIMB
(Climb Schedule for Normal Power at 120,000 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)
2,000	1 8	4 2	1,910	200	165	170
3,000	2 4	5 9	1,670	266	"	173
4,000	3 0	7 7	1,430	332	"	175
5,000	3 8	10 0	1,190	420	"	178
10,000	7 9	22.6	1,150	870	"	192
15,000	12 5	37 9	980	1,480	"	208
20,000	18 1	58 1	815	2,000	"	226
25,000	24 8	84 5	610	2,730	"	246

*Fuel consumed from start engines through lift-off 450 pounds

TABLE I A, CLIMB
(Deviation With Change From 120,000 Pounds Gross Weight)

Altitude (Feet)	Per 5,000 Pounds Increase in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb	Per 5,000 Pounds Decrease in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb
2,000	10%	10%	10%	8%	8%	8%	8%	8%
3,000	11%	11%	11%	9%	9%	9%	9%	9%
4,000	"	"	"	10%	"	"	"	10%
5,000	12%	12%	12%	11%	10%	10%	10%	11%
10,000	14%	13%	14%	12%	"	"	"	12%
15,000	15%	14%	15%	13%	"	"	"	15%
20,000	16%	15%	16%	15%	11%	11%	11%	20%
25,000	18%	19%	18%	18%	12%	12%	12%	25%

Deviation With 10° Change From Standard Temperature

	Each 10° C Above Std Temp.	Each 10° C Below Std Temp
Rate of Climb Time of Climb Climb Distance Climb Fuel	Not available from operators	

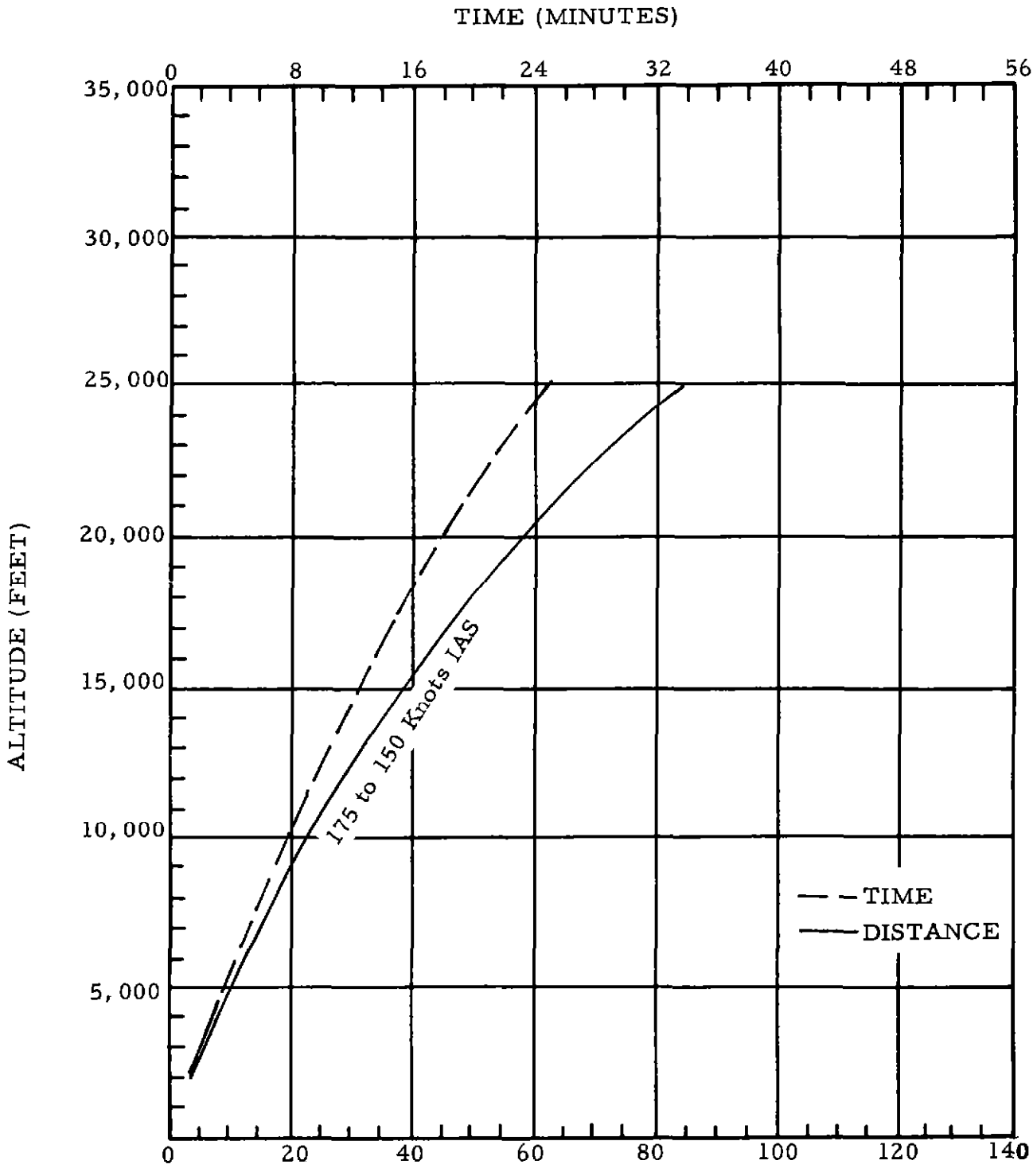


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 1, 500 feet, climb airspeed varies between 179 and 395 knots TAS

Table I, IA and Figure 1 present climb data

TABLE I, CLIMB
(Climb Schedule for Normal Power at 225, 000 Pounds Gross Weight

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)	MACH
1, 500	3. 0	8 0	500	1, 300	176	179	0 27
2, 000	4. 0	11 2	"	2, 100	195	201	0. 30
3, 000	6. 0	18 3	"	2, 900	215	226	0 34
4, 000	8 0	26 2	"	3, 700	235	248	0 38
5, 000	10 0	34 7	1, 000	4, 490	240	258	0 40
10, 000	13 0	47 6	1, 667	5, 540	"	278	0 44
15, 000	16 0	62 0	1, 429	6, 640	"	299	0 47
20, 000	20 0	82 3	1, 053	7, 920	235	318	0. 52
25, 000	25 5	112 4	834	9, 280	230	337	0 56
30, 000	32. 0	150. 2	667	10, 940	"	361	0 62
35, 000	40 5	203 7	600	12, 805	"	395	0. 68

*Fuel consumed from start engines to lift-off 1, 200 pounds

TABLE I A, CLIMB
(Deviation With Change From 225, 000 Pounds Gross Weight)

Altitude (Feet)	Per 10,000 Pounds Increase in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb	Per 10,000 Pounds Decrease in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb
1,500	0 0%		0 0%		1.1%		0 0%	
2,000	"		"		2.1%		"	
3,000	"		"		3 9%		1 3%	
4,000	"	Not	1.0%	Not	5 2%	Not	2 1%	Not
5,000	"	available	2 1%	available	6 7%	available	4 2%	available
10,000	"	from	3 5%	from	7 7%	from	7 0%	from
15,000	5 9%	operators	4.6%	operators	9 6%	operators	8.8%	operators
20,000	7 1%		5 7%		11 6%		10.6%	
25,000	7 5%		7 2%		12 4%		11 9%	
30,000	8 9%		8 7%		13 5%		13.2%	
35,000	14 3%		10.0%		14 9%		14 7%	

Deviation With 10° Change From Standard Temperature

	Each 10° C Above Std Temp	Each 10° C Below Std. Temp
Rate of Climb Time of Climb Climb Distance Climb Fuel	Not available from operators	

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

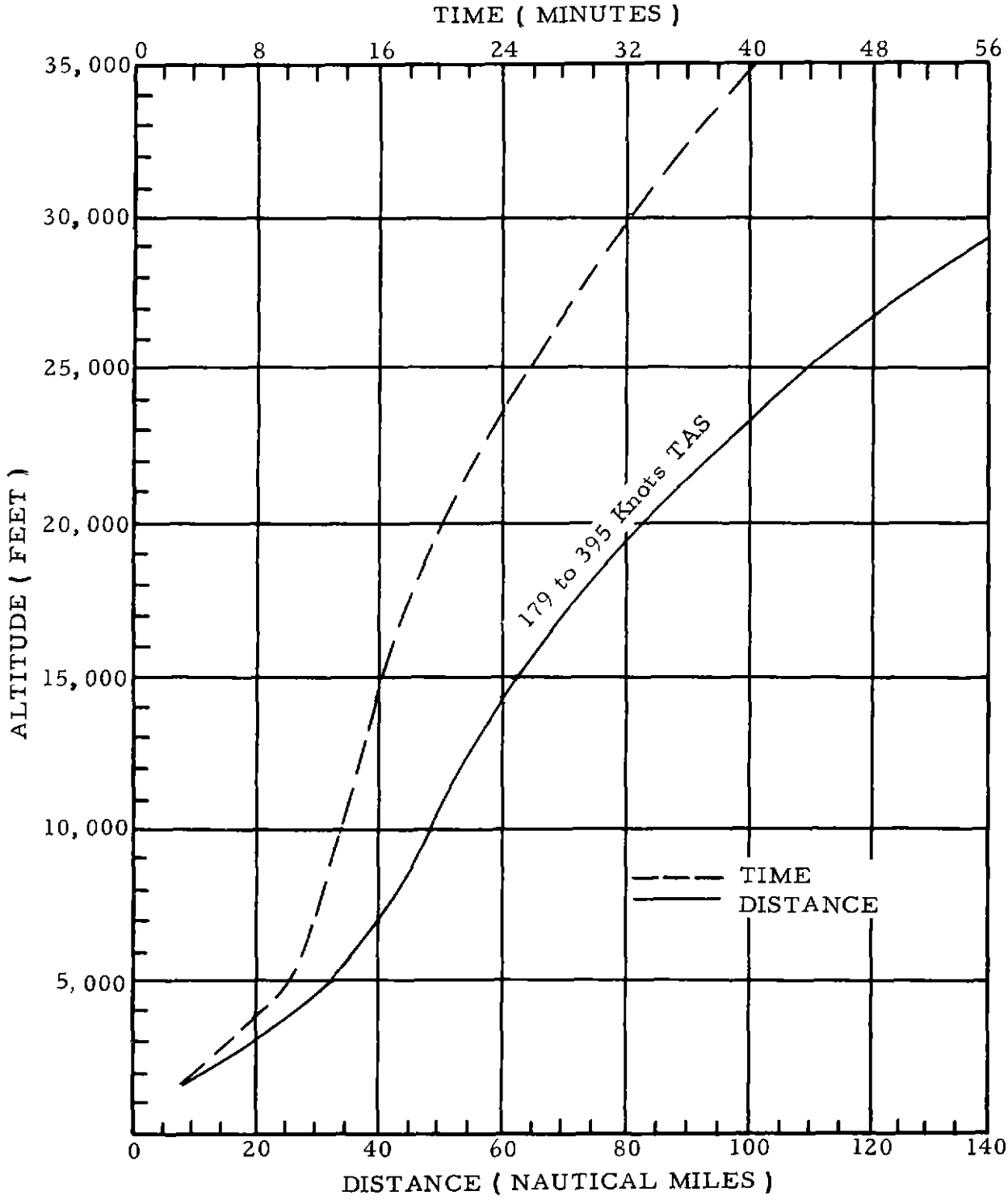


FIGURE 1 - CLIMB-DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 500 feet a constant climb speed of 155 knots IAS is maintained until cruise altitude is attained During climb, speeds plus or minus 5 knots from the optimum will not materially affect performance

Table I and Figure 1 present climb data.

TABLE I, CLIMB
(Climb Schedule for Normal Power at 48,000 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)
500	1 0	2.1	600	14.5	155	156
1,000	1.8	4.1	"	26.1	"	157
2,000	3.4	8.1	"	49 3	"	160
3,000	4.9	14.1	"	71.0	"	162
4,000	6.6	18.1	"	96.0	"	164
5,000	8.2	24.1	"	119.0	"	167
10,000	16.6	50 1	"	241.0	"	180
15,000	26.2	78.1	450	388.0	"	195
20,000	39 2	118 1	330	587.0	"	212

*Fuel consumed from start engines through lift-off 140.5 pounds

NOTE Deviation with change from gross weight not available from operators.

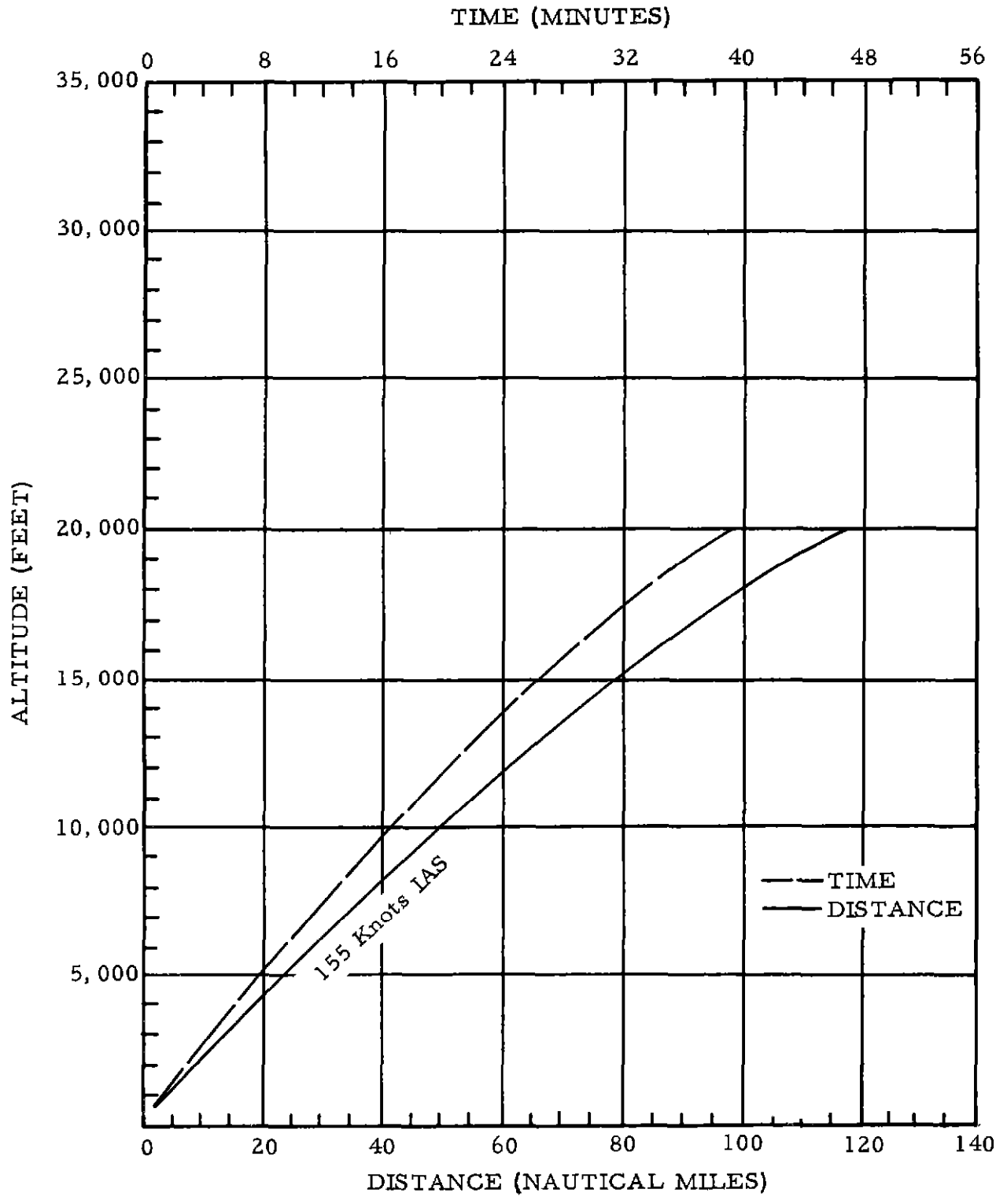


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 3,000 feet an airspeed of 320 knots IAS is maintained up to 23,500 feet altitude. Above 23,500 feet, Mach 0.74 is maintained until cruise altitude is attained. Rate of climb will vary from 1,660 fpm to 700 fpm. Speeds plus or minus 10 knots from the optimum will not materially affect performance.

Tables I, I A and Figure 1 present climb data.

TABLE I, CLIMB
(Climb Schedule for Normal Power at 140,000 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)	MACH
3,000	1.8	7.5	1,660	1,350	320	330	0.51
4,000	2.4	10.1	"	1,650	"	338	0.52
5,000	3.0	12.0	"	1,900	"	343	0.53
10,000	5.1	24.0	2,310	2,600	"	370	0.57
15,000	7.3	38 0	1,960	3,400	"	397	0.63
20,000	10.2	57 0	1,610	4,250	"	428	0.70
25,000	13 5	83.0	1,430	5,250	315	446	0.74
30,000	17.2	108.0	1,110	6,175	280	438	"
35,000	22.5	147.0	700	7,250	250	428	"

*Fuel consumed from start engines through lift-off 500 pounds

TABLE I A, CLIMB
(Deviation With Change From 140,000 Pounds Gross Weight)

Altitude (Feet)	Per 10,000 Pounds Increase in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb	Per 10,000 Pounds Decrease in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb
3,000	10.0%	7.0%	10.0%	6.7%	11.0%	7.0%	10.0%	10.0%
4,000	"	7.4%	9.5%	7.3%	"	7.3%	9.5%	"
5,000	"	7.9%	9.2%	8.1%	"	7.5%	9.2%	"
10,000	"	8.4%	7.7%	9.9%	"	7.8%	9.0%	"
15,000	"	9.0%	7.1%	10.2%	"	8.1%	8.8%	10.7%
20,000	"	9.7%	6.6%	11.1%	"	9.0%	8.0%	16.5%
25,000	10.2%	10.9%	7.8%	14.6%	11.6%	10.9%	7.6%	19.2%
30,000	10.5%	12.0%	9.9%	16.8%	"	11.4%	8.8%	27.0%
35,000		Not applicable			12.9%	13.6%	10.3%	30.1%

Deviation With 10° Change From Standard Temperature

	Each 10° C Above Std Temp	Each 10° C Below Std. Temp
Rate of Climb	14.4%	Not available from manufacturer.
Time of Climb	20.3%	
Climb Distance	25.0%	
Climb Fuel	13.5%	

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

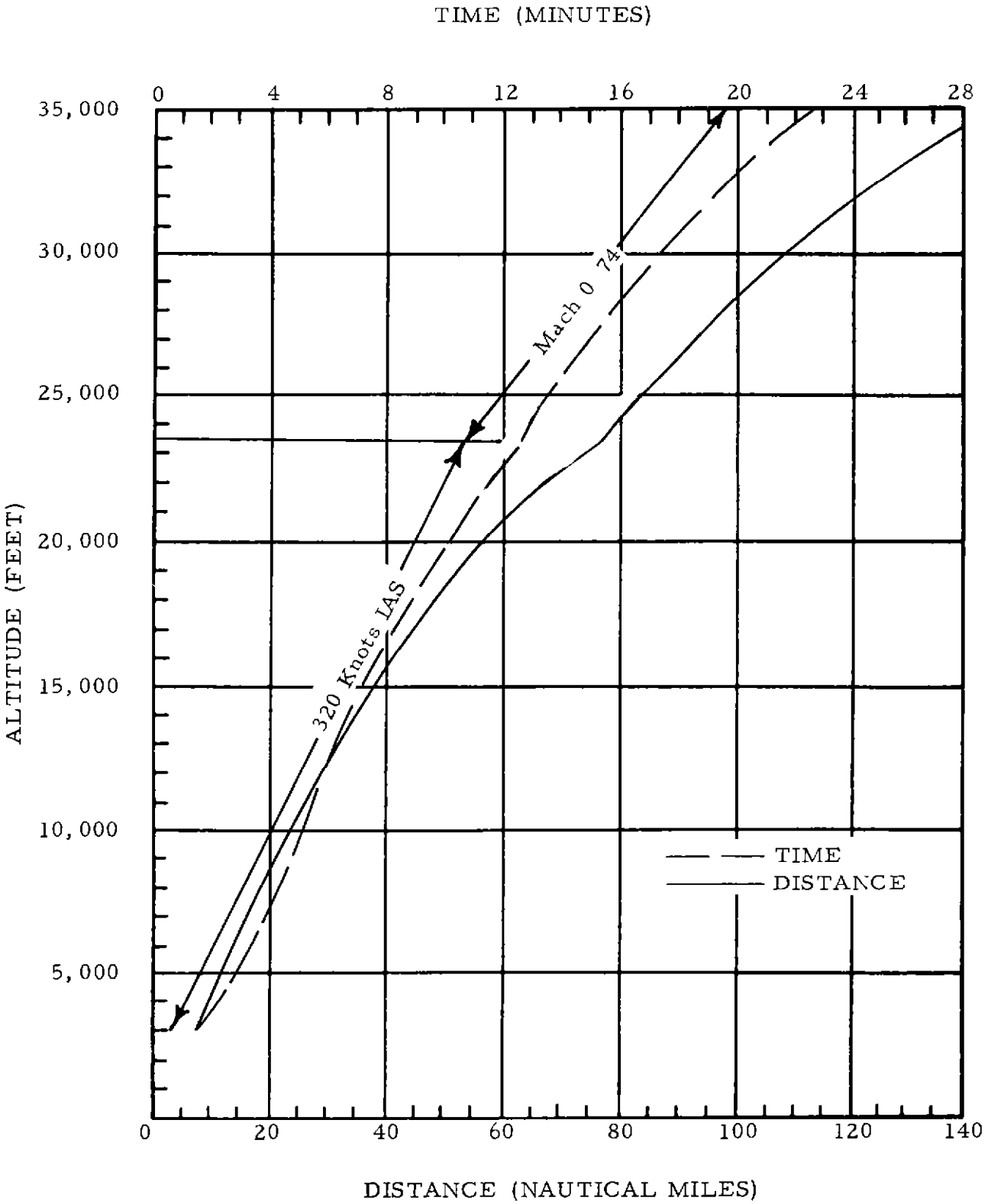


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 600 feet a constant climb airspeed of 105 knots is maintained until cruising altitude is attained During climb, speeds plus or minus 5 knots from the optimum will not materially affect performance.

Table I and Figure 1 present climb data

TABLE I, CLIMB
(Climb Schedule for Normal Power at 25, 346 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	* Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)
600	1.3	2.1	500	6	105	105
1,000	2 1	3 5	"	9	"	106
2,000	4.1	7.1	"	15	"	108
3,000	6 1	10 7	"	21	"	110
4,000	8.1	14 4	"	27	"	111
5,000	10.1	18 1	"	33	"	113
10,000	20.1	37 6	"	69	"	120
12,000	24 1	45.8	"	81	"	126

* Fuel consumed from start engines through lift-off 114 pounds

NOTE Deviation with change from gross weight not available from operators.

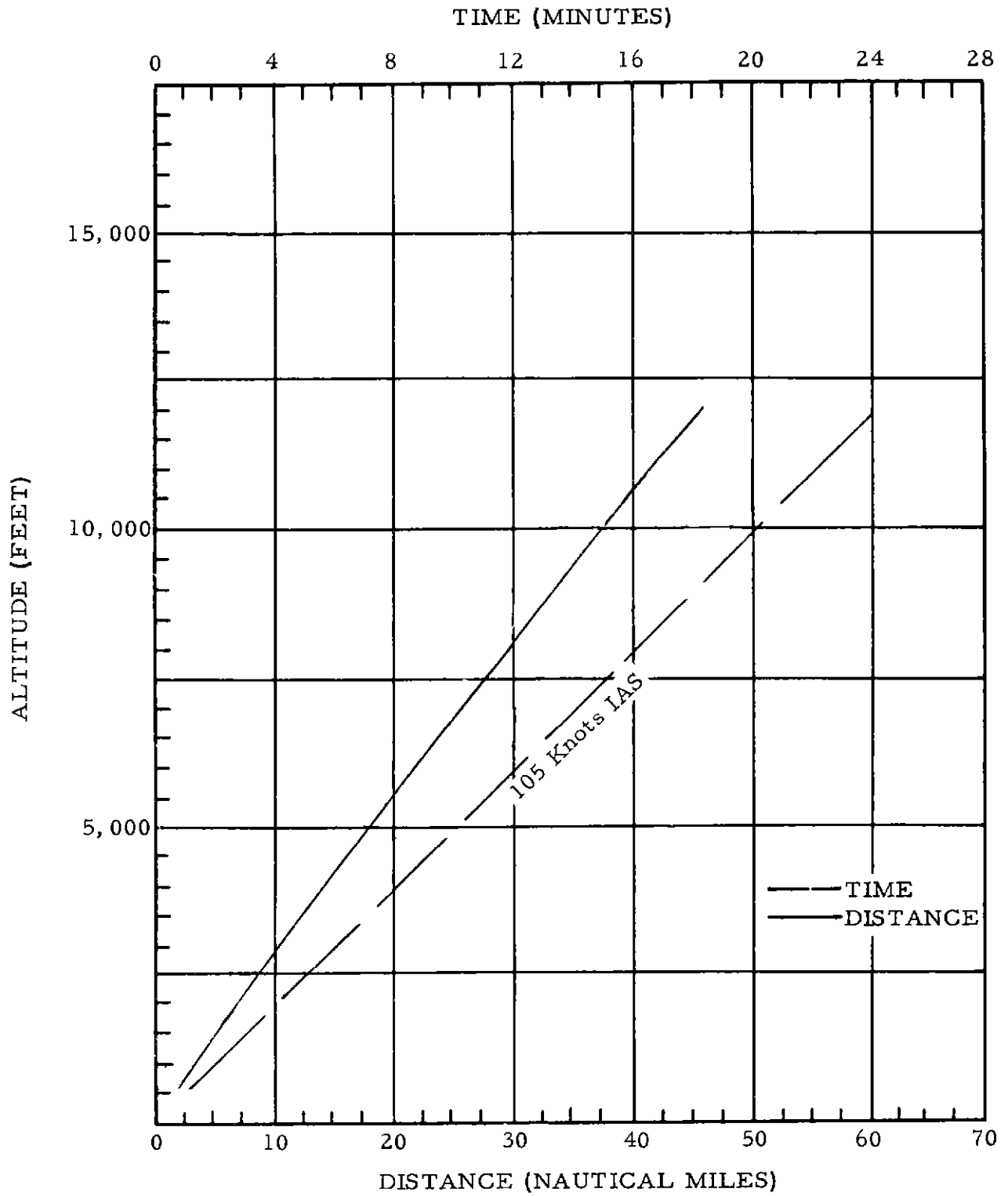


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 500 feet a constant airspeed of 135 knots IAS is maintained throughout climb Speeds plus or minus 5 knots from the optimum will not materially affect performance

Tables I, I A and Figure 1 present climb data

TABLE I, CLIMB
(Climb Schedule for Normal Power at 70,000 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	Climb Fuel* (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)
500	0.9	1.9	555	33	135	135
1,000	1.8	3.9	"	64	"	136
2,000	3.6	8.0	"	127	"	137
3,000	5 4	12.1	"	191	"	138
4,000	7.2	16.3	"	255	"	139
5,000	9.0	20.5	"	318	"	140
10,000	18 6	43.3	475	656	"	145
15,000	30.0	71.3	400	1,060	"	157

*Fuel consumed from start engines through lift-off 202 pounds

TABLE I A, CLIMB
(Deviation With Change From 70,000 Pounds Gross Weight)

Altitude (Feet)	Per 1,000 Pounds Increase in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb	Per 1,000 Pounds Decrease in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb
500	0%	0%	0%	0%	0%	0%	0%	0%
1,000	6%	5%	7%	2%	6%	5%	7%	2%
2,000	"	"	6%	3%	"	"	6%	3%
3,000	4%	3%	4%	4%	4%	3%	4%	4%
4,000	"	"	"	"	"	"	"	"
5,000	3%	4%	"	3%	3%	4%	"	3%
10,000	"	3%	3%	5%	"	3%	3%	5%
15,000	4%	4%	4%	3%	4%	4%	4%	3%

Deviation With 10° Change From Standard Temperature

	Each 10° C Above Std. Temp.	Each 10° C Below Std. Temp.
Rate of Climb		
Time of Climb		
Climb Distance	Not available from operators	
Climb Fuel		

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

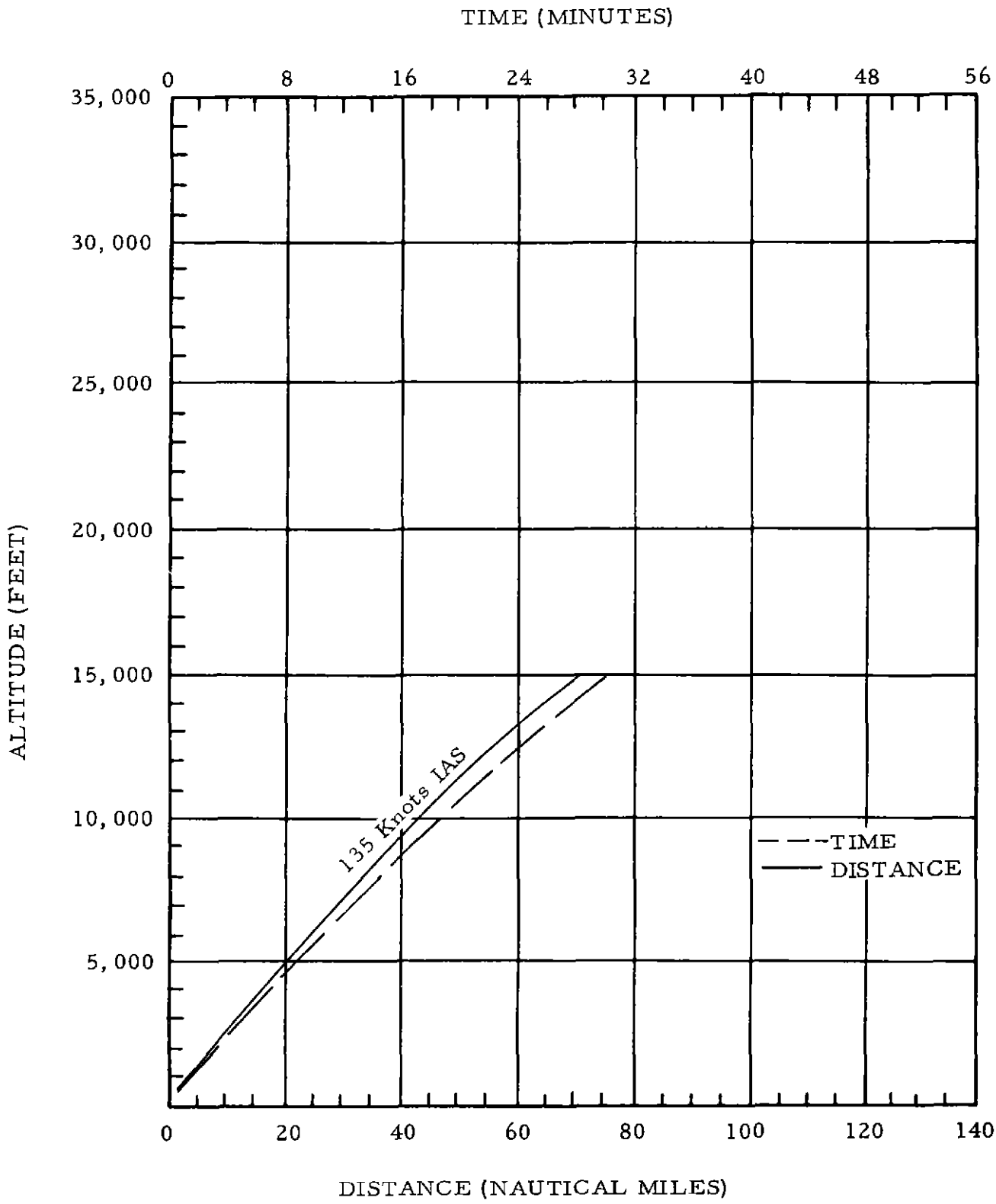


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 400 feet, a climb airspeed of 139 knots IAS is maintained until cruise altitude is attained. This airspeed is held constant for all gross weights

Table I, IA, and Figure 1 present climb data

TABLE I, CLIMB
(Climb Schedule for Normal Power at 90,000 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)
400	1 0	2.1	700	30	139	140
1,000	1 8	4 2	750	74	"	141
2,000	3.1	7.8	770	148	"	143
3,000	4 4	11 3	"	222	"	145
4,000	5.7	14.8	"	296	"	148
5,000	7 0	18 4	730	370	"	150
10,000	14.5	41 0	610	850	"	161
15,000	23 0	67.5	580	1,360	"	175
20,000	33.0	102.0	420	1,975	"	191

*Fuel consumed from start engines through lift-off 300 pounds (estimated)

TABLE I A, CLIMB
(Deviation With Change From 90,000 Pounds Gross Weight)

Altitude (Feet)	Per 5,000 Pounds Increase in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb	Per 5,000 Pounds Decrease in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb
400								
1,000								
2,000	Not available from operator				Not available from operator.			
3,000								
4,000								
5,000	14.0%	13.5%	13.5%		14.0%	13.5%	13.5%	
10,000	"	14.5%	13.0%		13.0%	"	12.0%	
15,000	15.0%	15 5%	"		"	"	"	
20,000	"	17.0%	17 0%		13 5%	"	11.5%	

Deviation With 10° Change From Standard Temperature

	Each 10° C Above Std Temp.	Each 10° C Below Std. Temp
Rate of Climb Time of Climb Climb Distance Climb Fuel	Not available from operator	

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

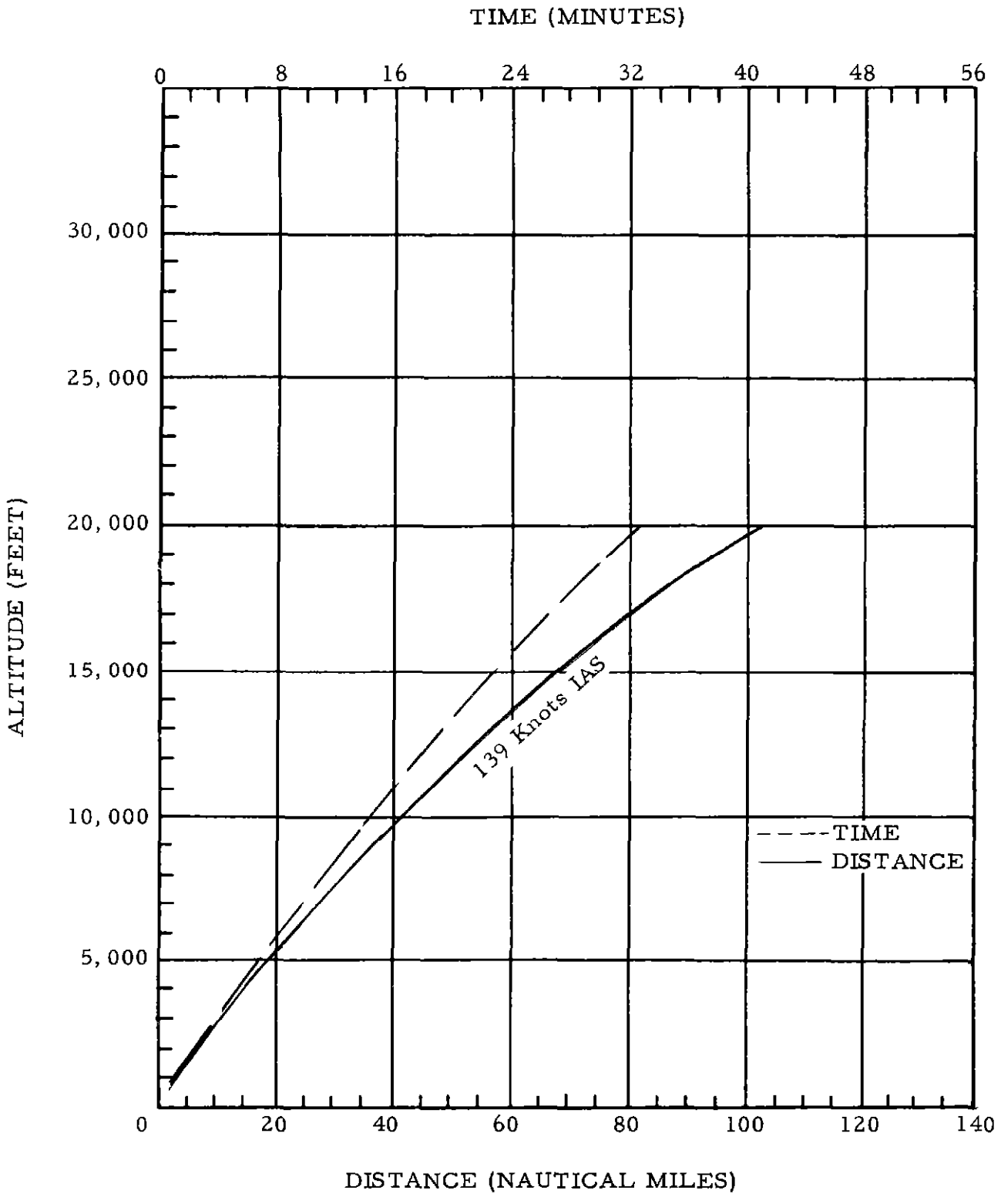


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 500 feet an initial climb airspeed of 155 knots IAS is established. During climb, airspeed will decrease approximately one knot IAS per 1,000 feet altitude until cruise altitude is attained Speeds plus or minus 5 knots from the optimum will not materially affect performance.

Table I, IA and Figure 1 present climb data

TABLE I, CLIMB
(Climb Schedule for Normal Power at 99, 500 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)
500	0.8	1.9	670	130	155	155
1,000	1 5	3.7	"	260	154	156
2,000	3.0	7.6	"	460	153	158
3,000	4.5	11.5	"	560	152	159
4,000	6.0	15.5	"	660	151	160
5,000	7 5	19 5	640	760	150	161
10,000	15 5	41.5	610	1,300	145	168
15,000	24.0	66.0	570	1,940	140	176
20,000	36.0	102.0	260	2,690	135	185

*Fuel consumed from start engines through lift-off 360 pounds (estimated)

TABLE IA, CLIMB
(Deviation With Change From 99,500 Pounds Gross Weight)

Altitude (Feet)	Per 7,000 Pounds Increase in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb	Per 10,000 Pounds Decrease in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb
500	Not available from operators				Not available from operators			
1,000								
2,000	24 0%	25.0%	15.0%	15 0%	20.5%	21 0%	8 5%	28.0%
3,000	24.5%	"	19.5%	"	21.0%	"	10 5%	28 5%
4,000	25 0%	26.0%	20 0%	"	22 0%	21 5%	13 5%	"
5,000	27.0%	27 0%	21.0%	15 5%	"	22.0%	14 5%	29.0%
10,000	29.0%	"	28.5%	17 5%	22 5%	23 0%	18.5%	32.5%
15,000	35.5%	29.0%	34 5%	23.0%	23.0%	24.0%	21 5%	38 0%
20,000	Not available from operators				26 0%	27 0%	"	50.0%

Deviation With 10° Change From Standard Temperature

	Each 10° C Above Std Temp.	Each 10° C Below Std. Temp.
Rate of Climb Time of Climb Climb Distance Climb Fuel	Not available from operators	

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

TABLE IA, CLIMB
(Deviation With Change From 99,500 Pounds Gross Weight)

Altitude (Feet)	Per 7,000 Pounds Increase in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb	Per 10,000 Pounds Decrease in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb
500	Not available from operators				Not available from operators			
1,000								
2,000	24 0%	25.0%	15.0%	15 0%	20.5%	21 0%	8 5%	28 0%
3,000	24.5%	"	19.5%	"	21.0%	"	10 5%	28 5%
4,000	25 0%	26 0%	20.0%	"	22 0%	21 5%	13 5%	"
5,000	27 0%	27.0%	21.0%	15 5%	"	22.0%	14.5%	29 0%
10,000	29.0%	"	28.5%	17 5%	22 5%	23 0%	18.5%	32.5%
15,000	35.5%	29 0%	34.5%	23.0%	23.0%	24.0%	21 5%	38 0%
20,000	Not available from operators				26.0%	27 0%	"	50.0%

Deviation With 10° Change From Standard Temperature

	Each 10° C Above Std Temp.	Each 10° C Below Std. Temp
Rate of Climb Time of Climb Climb Distance Climb Fuel	Not available from operators	

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

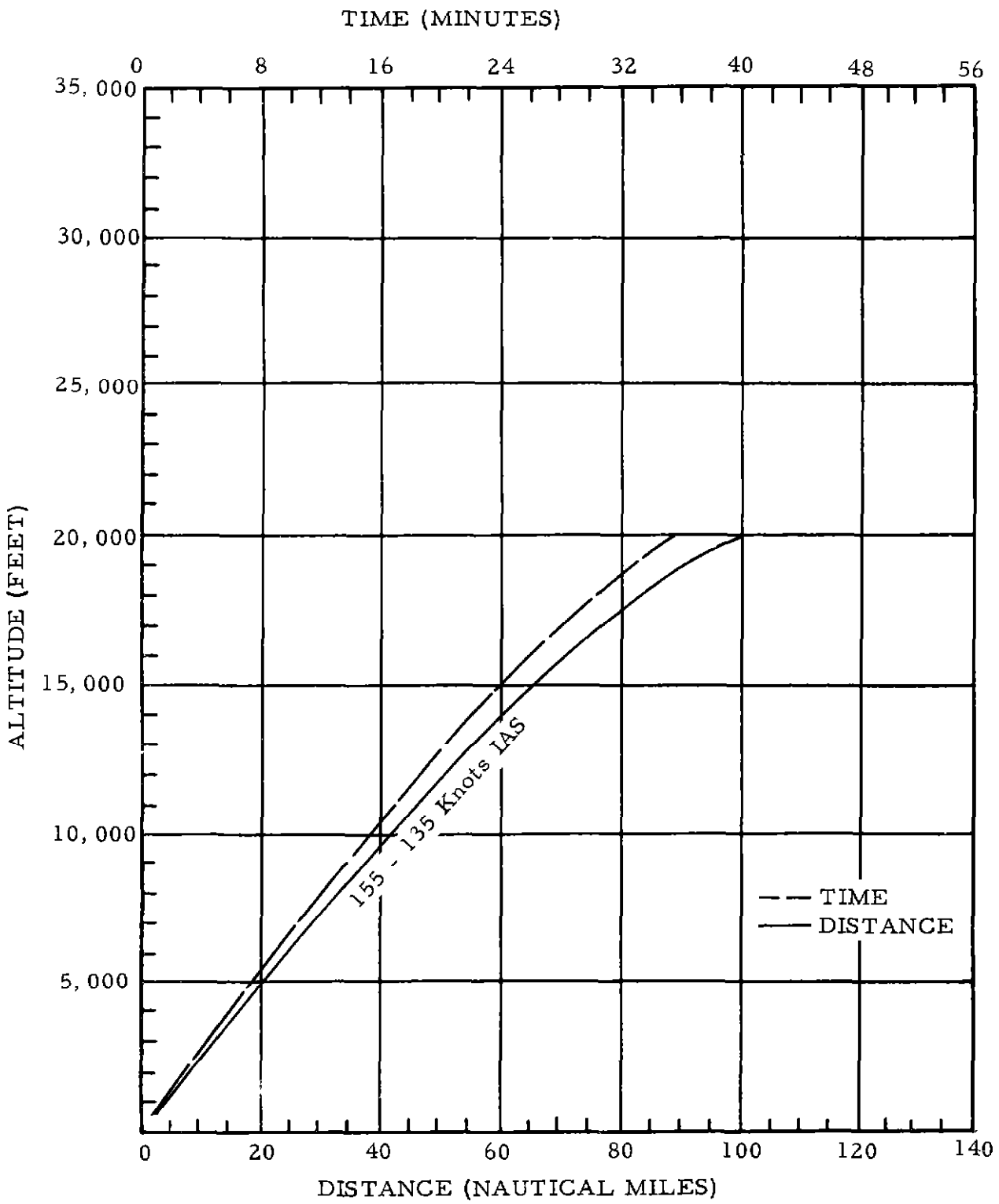


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 500 feet a constant climb airspeed of 175 knots IAS is maintained until cruise altitude is attained Speeds plus or minus 5 knots from the optimum will not materially affect performance

Tables I, I A and Figure 1 present climb data.

TABLE I, CLIMB
(Schedule for Standard Climb Power at 109,400 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed LAS (Knots)	Climb Speed TAS (Knots)
500	0 8	2 0	1,000	50	175	176
1,000	1 3	3 5	"	130	"	178
2,000	2 4	6 9	960	210	"	180
3,000	3 5	10 3	940	290	"	183
4,000	4.6	13 7	920	370	"	186
5,000	5 7	17 1	900	450	"	189
10,000	11.7	36 8	790	950	"	204
15,000	18 5	60.8	690	1,520	"	220
20,000	26 1	89 8	590	2,200	"	238
25,000	35 7	129 5	490	3,050	"	258

* Fuel consumed from start engines through lift-off. 600 pounds (estimated).

TABLE I A, CLIMB
(Deviation With Change From 109, 400 Pounds Gross Weight)

Altitude (Feet)	Per 10,000 Pounds Increase in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb	Per 10,000 Pounds Decrease in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb
500	21%	25%	26%	16%	16%	18%	17%	17%
1,000	"	"	"	"	"	"	"	18%
2,000	"	"	"	17%	"	"	"	"
3,000	"	"	"	"	"	"	"	"
4,000	"	"	"	"	"	"	"	"
5,000	"	"	"	18%	"	"	"	"
10,000	23%	26%	"	19%	"	19%	"	19%
15,000	25%	"	"	23%	17%	"	"	20%
20,000	30%	27%	27%	29%	18%	"	18%	"
25,000	34%	35%	31%	35%	19%	"	20%	"

Deviation With 10° Change From Standard Temperature

	Each 10° C Above Std Temp		Each 10° C Below Std Temp	
Rate of Climb	Not available from operator			
Time of Climb	"	"	"	"
Climb Distance	"	"	"	"
Climb Fuel	"	"	"	"

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

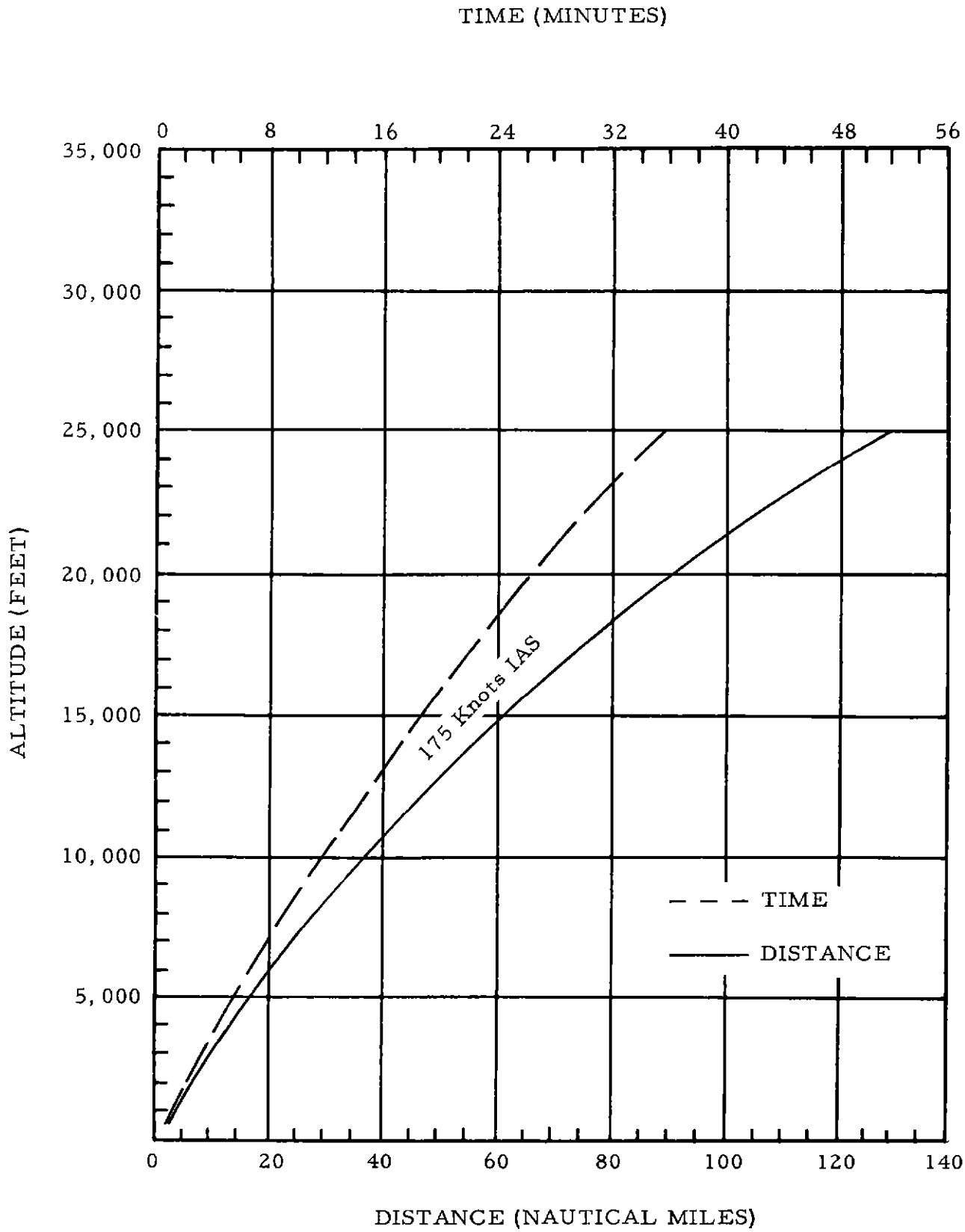


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 500 feet a constant climb airspeed of 175 knots IAS is maintained until cruise altitude is attained Speeds plus or minus 5 knots from the optimum will not materially affect performance

Tables I, I A and Figure 1 present climb data

TABLE I, CLIMB
(Climb Schedule for Normal Power at 109, 400 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)
500	0 8	2 0	1,000	50	175	176
1,000	1 3	3 5	1,000	130	"	178
2,000	2 4	6.9	960	210	"	180
3,000	3 5	10 3	940	290	"	183
4,000	4 6	13 7	920	370	"	186
5,000	5 7	17 1	900	450	"	189
10,000	11.7	36 8	790	950	"	204
15,000	18.5	60.8	690	1,520	"	220
20,000	26.1	89 8	590	2,200	"	238
25,000	35.7	129 5	490	3,050	"	258

*Fuel consumed from start engines through lift-off. 600 pounds

TABLE I A, CLIMB
(Deviation With Change From 109, 400 Pounds Gross Weight)

Altitude (Feet)	Per 10,000 Pounds Increase in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb	Per 10,000 Pounds Decrease in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb
500	21%	25%	26%	16%	16%	18%	17%	17%
1,000	"	"	"	"	"	"	"	18%
2,000	"	"	"	17%	"	"	"	"
3,000	"	"	"	"	"	"	"	"
4,000	"	"	"	"	"	"	"	"
5,000	"	"	"	18%	"	19%	"	"
10,000	23%	26%	"	19%	"	"	"	19%
15,000	25%	"	"	23%	17%	"	"	20%
20,000	30%	27%	27%	29%	18%	"	18%	"
25,000	34%	35%	31%	35%	19%	"	20%	"

Deviation With 10° Change From Standard Temperature

	Each 10° C Above Std. Temp.	Each 10° C Below Std. Temp.
Rate of Climb Time of Climb Climb Distance Climb Fuel	Not available from operators	

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

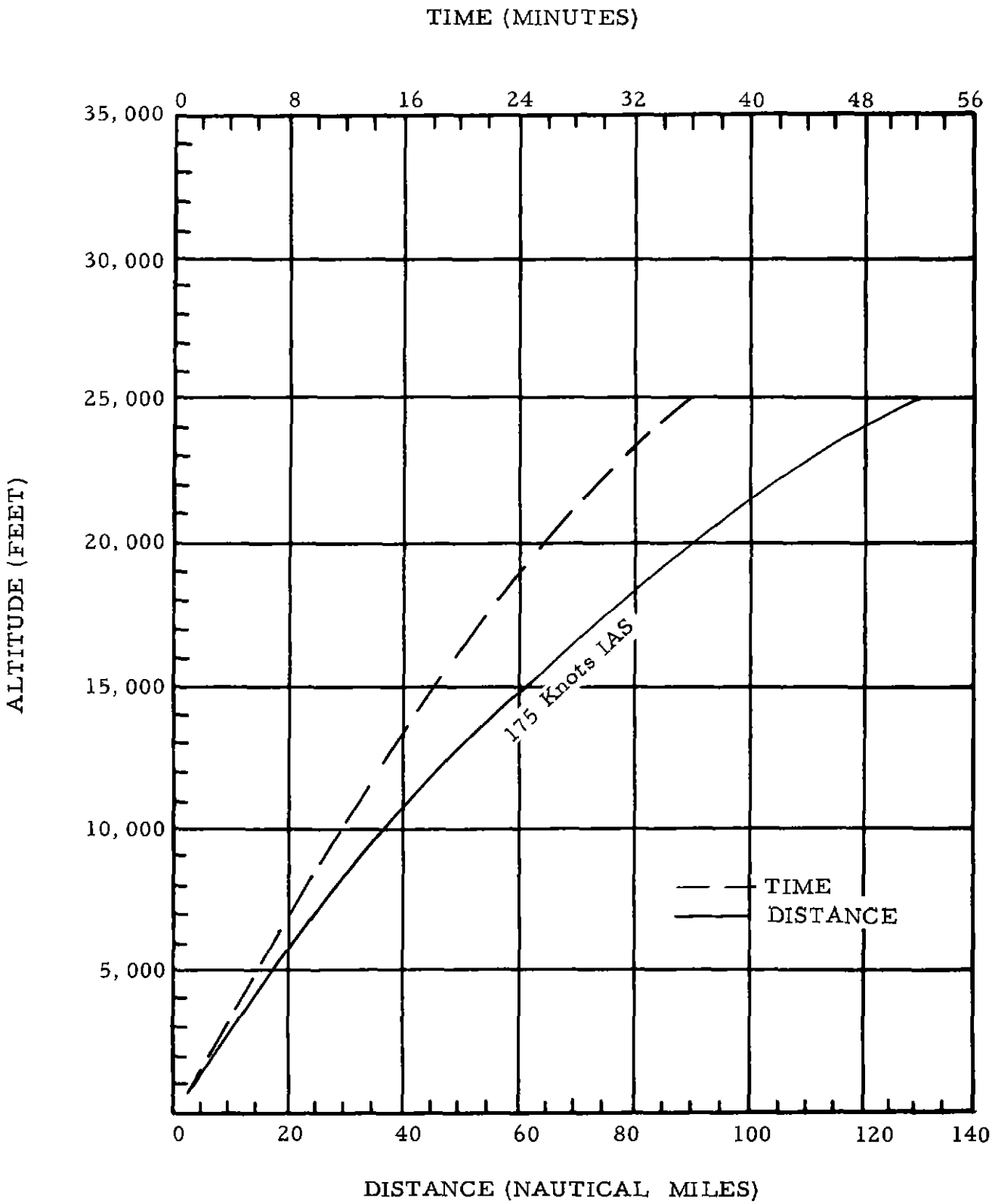


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 1,000 feet, a constant climb airspeed of 175 knots IAS is maintained until cruise altitude is attained. Speeds plus or minus 5 knots from the optimum will not materially affect performance.

Tables I, I A, and Figure 1 present climb data.

TABLE I, CLIMB
(Climb Schedule for Normal Power at 130,000 Pounds Gross Weight

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)	MACH
1,000	1.2	3 0	700	99	175	177	0 26
2,000	3.0	8.4	"	245	"	180	0.27
3,000	4.3	12.4	"	354	"	183	0.27
4,000	5.6	16.4	"	461	"	186	0 28
5,000	7.2	21.6	"	593	"	188	0.29
10,000	15 6	49 9	570	1,285	"	204	0.31
15,000	24 9	82.8	480	1,782	"	220	0.35
20,000	36 6	127 5	300	2,782	"	238	0.38
25,000	64.0	240.4	60	5,112	"	257	0.43

*Fuel consumed from start engines through lift-off 301 pounds

TABLE I A, CLIMB
(Deviation With Change From 130,000 Pounds Gross Weight)

Altitude (Feet)	Per 10,000 Pounds Increase in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb	Per 10,000 Pounds Decrease in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb
1,000				26%				17%
2,000	Not available from operators			"	Not available from operators			"
3,000				"				"
4,000	34%	35%	35%	"	14%	12%	14%	"
5,000	33%	33%	25%	"	15%	12%	"	"
10,000	26%	25%	25%	21%	19%	20%	19%	25%
15,000	27%	27%	47%	27%	"	"	6%	26%
20,000	30%	30%	43%	12%	21%	22%	11%	28%
25,000	Not available from operators				28%	28%	Not available from operators	30%

Deviation With 10° Change From Standard Temperature

	Each 10° C Above Std. Temp	Each 10° C Below Std. Temp
Rate of Climb Time of Climb Climb Distance Climb Fuel	Not available from operators	

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

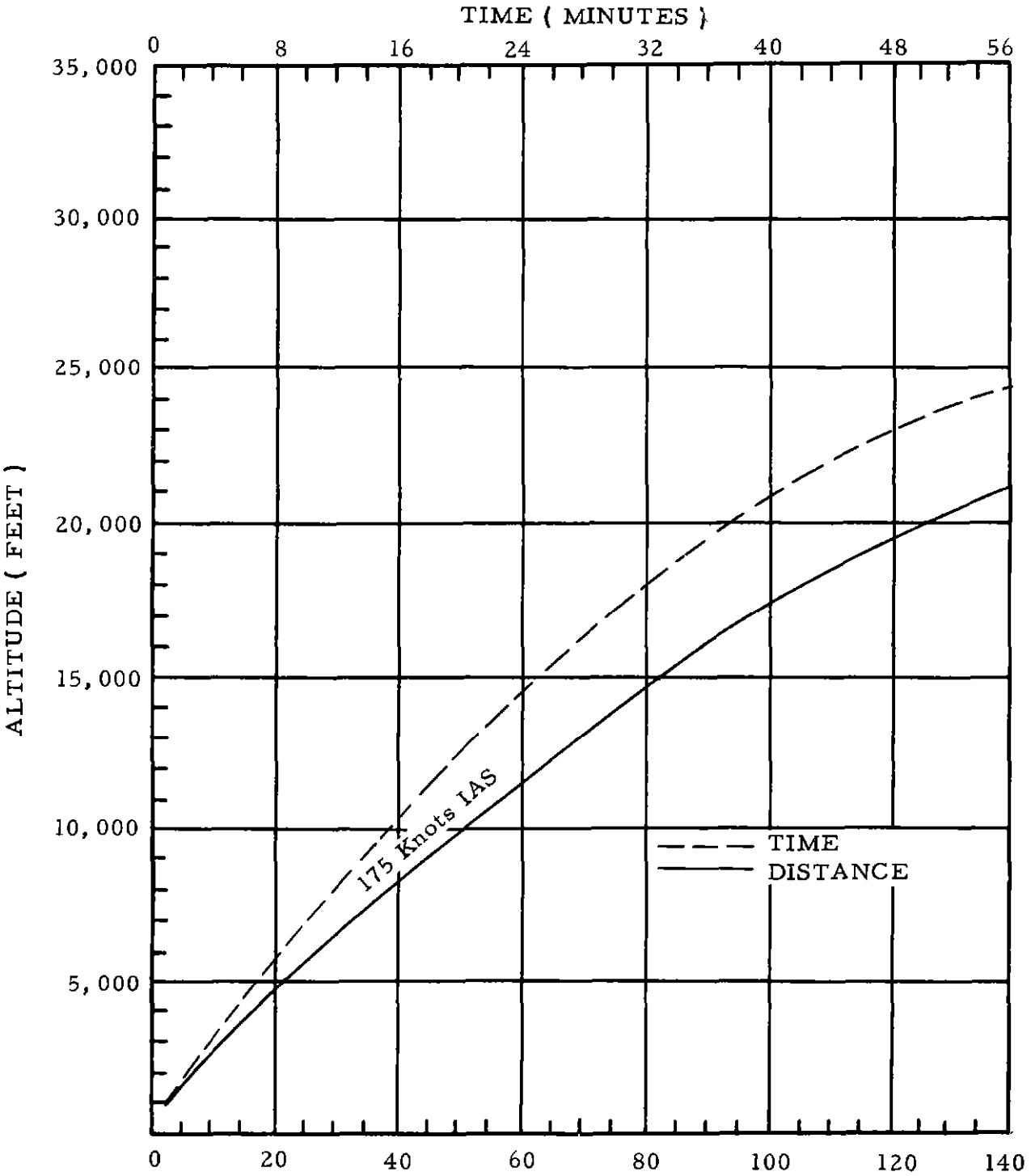


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 1,000 feet a constant climb airspeed of 127 knots IAS is maintained until an altitude of 5,000 feet is attained Above 5,000 feet, the optimum climb airspeed will vary between 127 and 115 knots IAS During climb, speeds plus or minus 5 knots from the optimum will not materially affect performance

Tables I, I A, and Figure 1 present climb data

TABLE I, CLIMB
(Climb Schedule for Normal Power at 34,000 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)
1,000	3 3	5.9	1,000	30	127	129
2,000	4 3	8 1	"	55	"	131
3,000	5 3	10.3	"	80	"	133
4,000	6.3	12 5	"	105	"	135
5,000	7 3	14 8	"	130	"	137
10,000	12 3	26 4	"	265	122	142
15,000	17 7	39.5	860	410	119	150
20,000	24 3	56.4	660	565	115	157

* Fuel consumed from start engines through lift-off 200 pounds

TABLE I A, CLIMB
(Deviation With Change From 34,000 Pounds Gross Weight)

Altitude (Feet)	Per 1,000 Pounds Increase in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb	Per 1,000 Pounds Decrease in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb
1,000	8%	10%	0%	8%	8%	9%	0%	8%
2,000	4%	5%	7%	9%	4%	5%	7%	4%
3,000	"	"	"	"	"	"	"	"
4,000	"	"	"	"	"	"	"	"
5,000	"	"	"	"	"	"	"	"
10,000	"	"	"	"	"	"	"	"
15,000	"	6%	"	"	"	"	"	"
20,000	"	"	"	"	"	"	"	"

Deviation With 10° Change From Standard Temperature

	Each 10° C Above Std Temp	Each 10° C Below Std Temp
Rate of Climb	6%	4%
Time of Climb	18%	12%
Climb Distance	11%	4%
Climb Fuel	14%	"

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

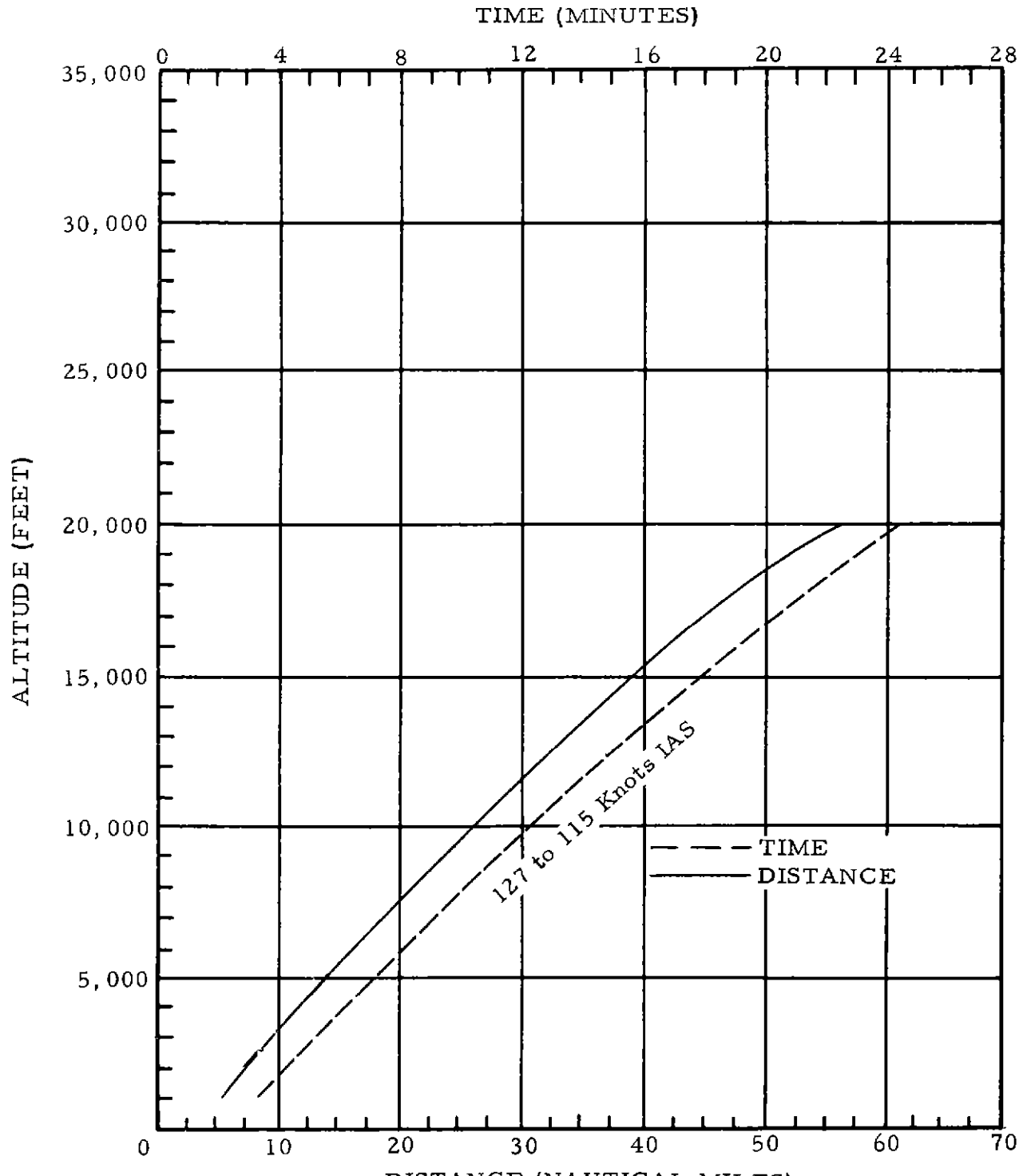


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 1,000 feet a constant climb airspeed of 210 knots is maintained until cruise altitude is attained During climb, speeds plus or minus 10 knots from the optimum will not materially affect performance

Table I and Figure 1 present climb data

TABLE I, CLIMB
(Climb Schedule for Normal Power at 108,000 Pounds Gross Weight

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)	MACH
1,000	1.2	3 2	1,000	240	210	213	0 31
2,000	1 6	4.8	"	340	"	216	0 32
3,000	2.1	6 4	1,100	460	"	219	0 33
4,000	2 6	8 1	"	580	"	222	0 34
5,000	3 0	9 8	1,300	700	"	225	0 35
10,000	5 2	18.3	1,600	1,200	"	242	0 38
15,000	9.2	35 0	1,000	2,200	"	260	0 42
20,000	15 0	61 0	600	3,600	"	282	0 46
25,000	25 0	110 0	400	6,000	"	305	0 51

*Fuel consumed from start engines through lift-off· 1,760 pounds

Note: Deviation with change from 108,000 pounds gross weight not available from operators

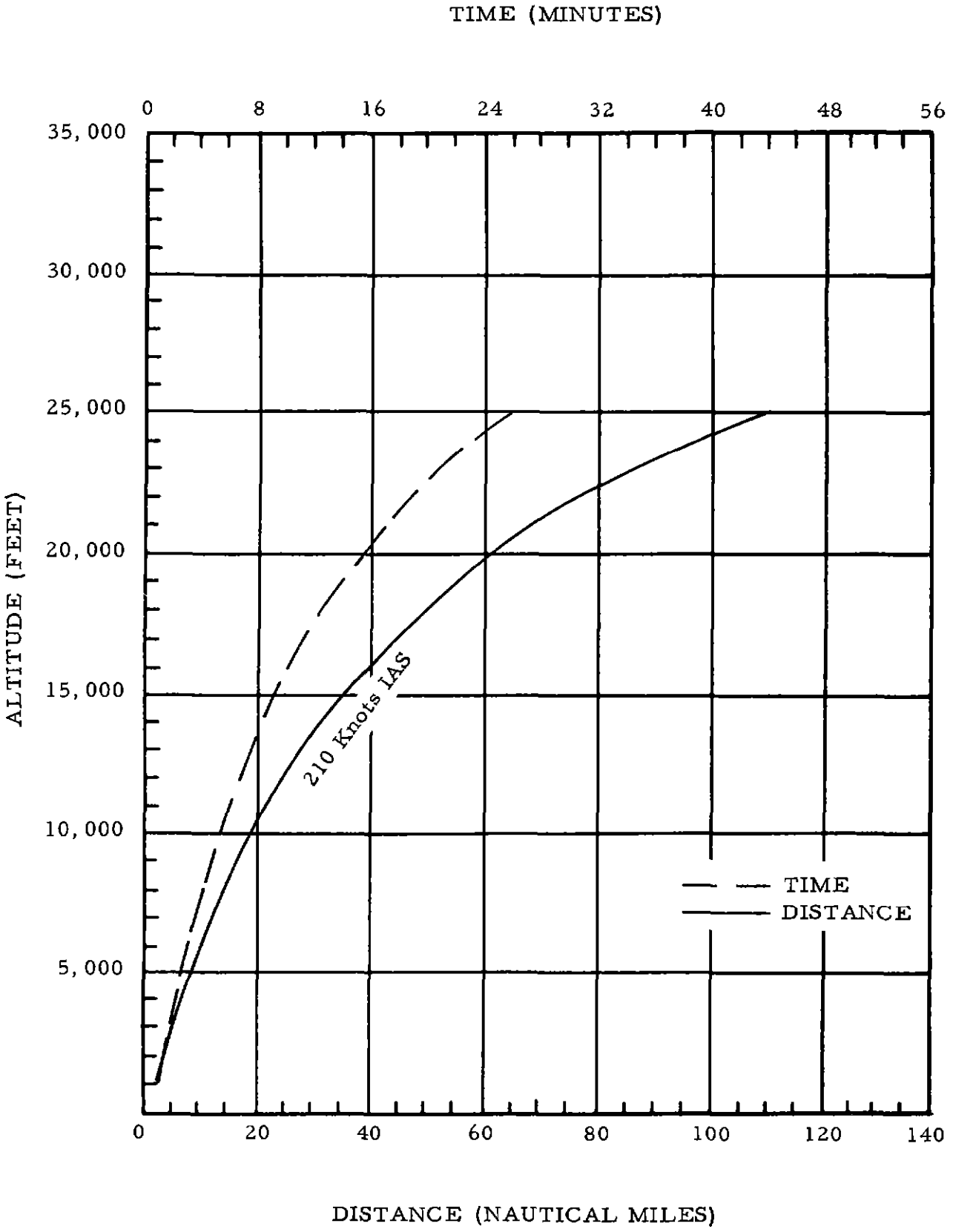


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 300 feet a constant climb speed of 170 knots IAS is maintained until cruise altitude is attained Speeds plus or minus 10 knots from the optimum will not materially affect performance

Table I and Figure 1 present climb data.

TABLE I, CLIMB
(Climb Schedule for Normal Power at 137,000 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)
300	0.8	2 0	500	150	170	170
1,000	2 2	6.0	"	320	"	173
2,000	4.2	11 8	"	405	"	175
3,000	6.2	17 7	"	575	"	178
4,000	8.2	23 7	"	745	"	180
5,000	10 2	29 8	"	915	"	183
10,000	21 2	64.4	380	1,845	"	197
15,000	36.2	115 7	320	3,165	"	213
20,000	52 2	174 5	300	4,605	"	230
21,000	57.2	193 9	150	5,055	"	233

*Fuel consumed from start engines through lift-off 190 pounds

NOTE Deviation with change from gross weight not available from operators

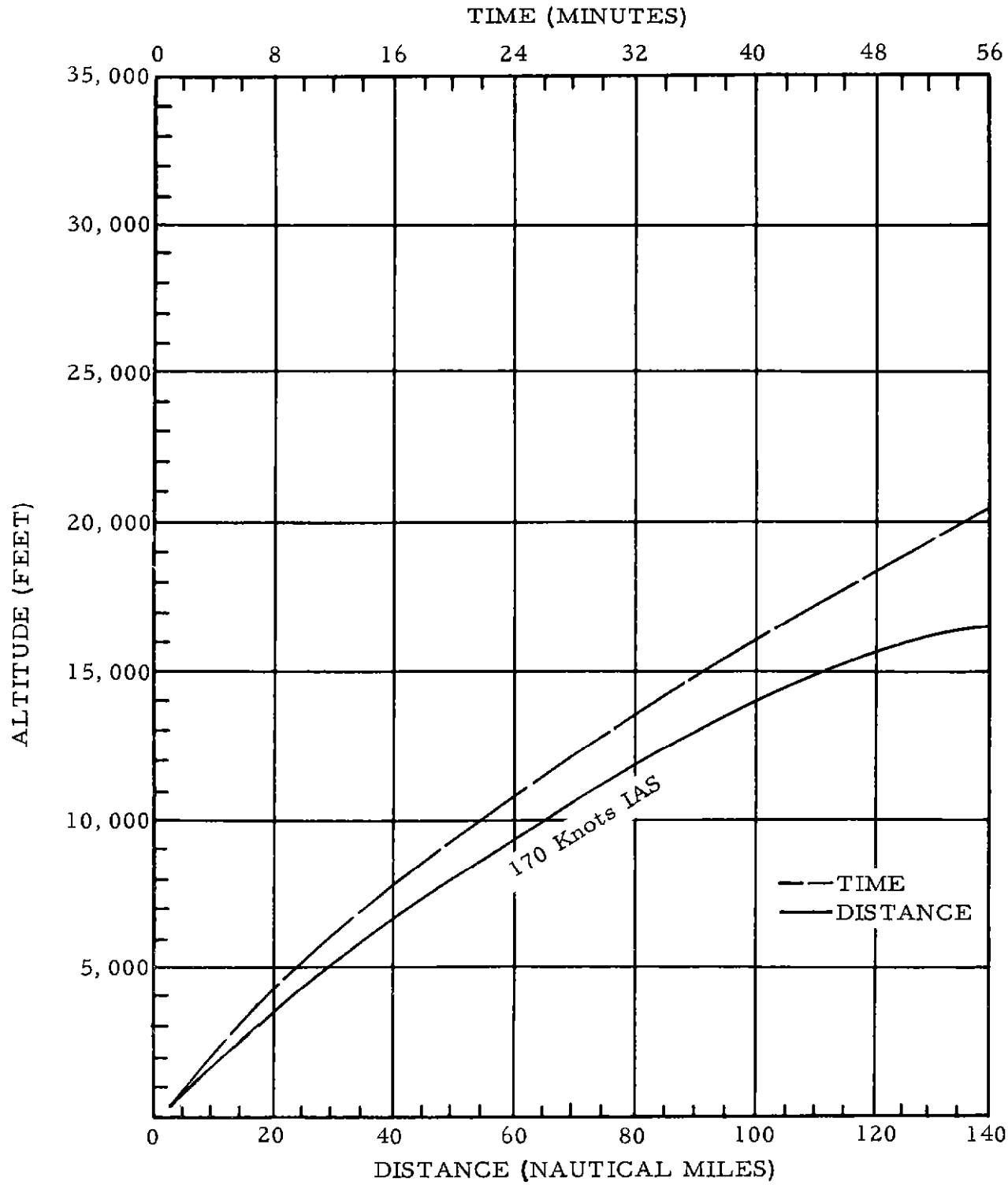


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 300 feet a constant climb airspeed of 170 knots IAS is maintained until cruise altitude is attained. Speeds plus or minus 5 knots from the optimum will not materially affect performance.

Tables I, IA, and Figure 1 present climb data.

TABLE I, CLIMB
(Climb Schedule for Normal Power at 160,000 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)
300	1.0	2.5	300	120	170	170
500	1.7	4.5	"	200	"	172
1,000	3.3	9.1	"	410	"	173
2,000	6.7	19.0	"	665	"	175
3,000	10.0	28.7	"	920	"	178
4,000	13.3	38.5	"	1,090	"	180
5,000	16.7	48.5	290	1,425	"	183
10,000	36.3	110 5	220	1,765	"	197
15,000	62.0	198.7	170	5,840	"	214
20,000	93.0	314.5	150	7,910	"	233

*Fuel consumed from start engine through lift-off 330 pounds

TABLE I A, CLIMB
(Deviation With Change From 160,000 Pounds Gross Weight)

Altitude (Feet)	Per 5,000 Pounds Increase in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb	Per 5,000 Pounds Decrease in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb
300					5 9%	5 9%	5 9%	
500					6 0%	6 0%	6 0%	
1,000					6 1%	6 1%	6 1%	Not
2,000					6 3%	6 3%	6 3%	available
3,000		Not applicable			6 4%	6 4%	6 4%	from
4,000					6 5%	6 5%	6 5%	operator
5,000					6 9%	6 9%	6 9%	
10,000					7 8%	7 8%	7 8%	
15,000					8 3%	8.3%	8 3%	
20,000					"	"	"	

Deviation With 10^{o} Change From Standard Temperature

	Each 10^{o} C Above Std Temp	Each 10^{o} C Below Std. Temp
Rate of Climb		
Time of Climb	Not available from operator	
Climb Distance		
Climb Fuel		

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

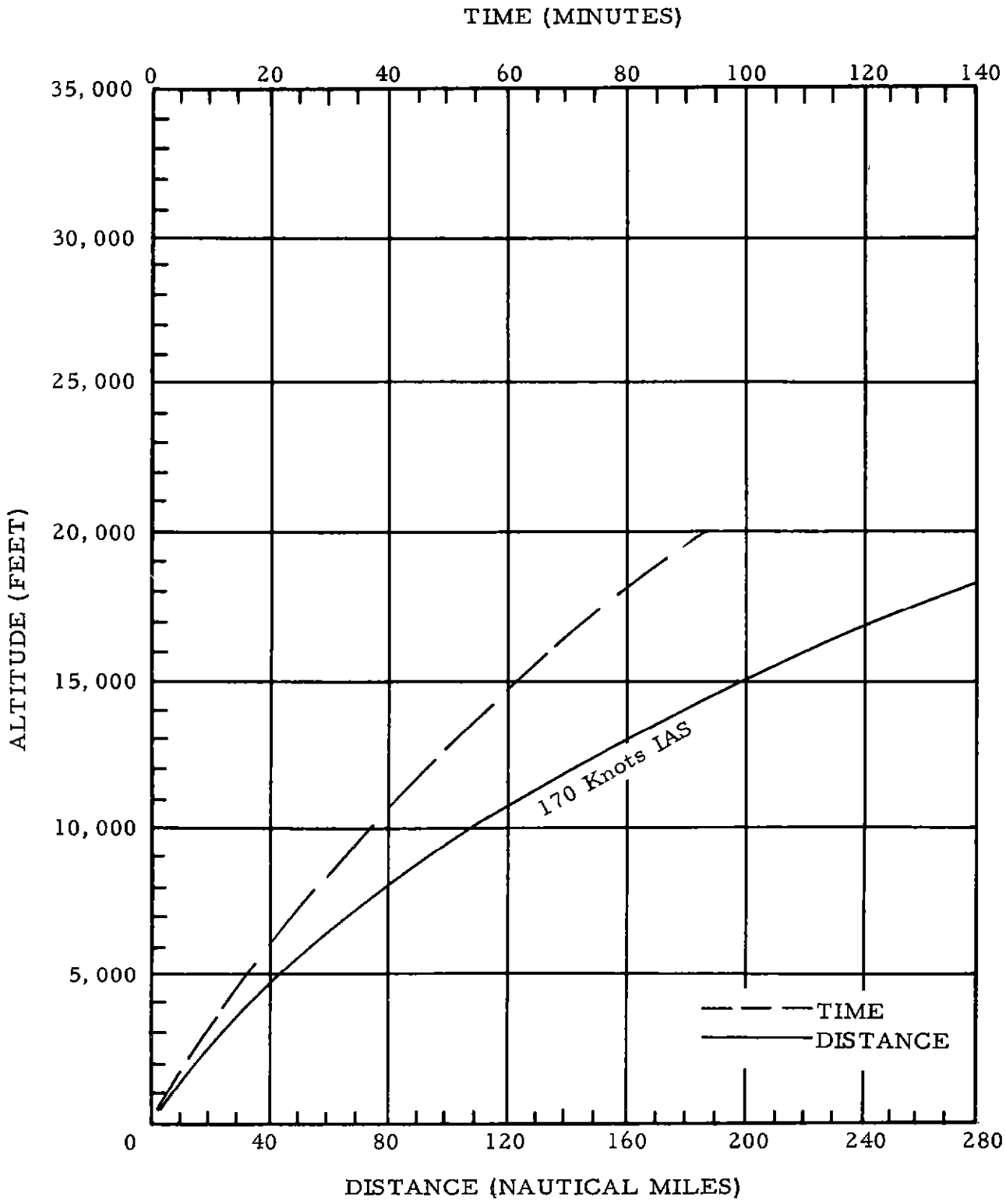


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 500 feet a constant climb airspeed of 140 knots IAS is maintained until cruise altitude is attained Speeds plus or minus 5 knots from optimum will not materially affect performance

Table I and Figure 1 present climb data

TABLE I, CLIMB
(Climb Schedule for Normal Power at 44, 900 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)
500	1 0	2.0	500	48	140	141
1,000	2 1	4.6	450	80	"	142
2,000	4 3	9.9	"	114	"	144
3,000	6 5	15 2	"	178	"	146
4,000	8.7	20.6	"	242	"	148
5,000	10 9	26 0	"	306	"	151
10,000	22 0	55.0	"	626	"	162
15,000	33 1	85.4	"	946	"	176

*Fuel consumed from start engines through lift-off: 112 pounds

NOTE Deviations with change from 44, 900 pounds gross weight not available from operators

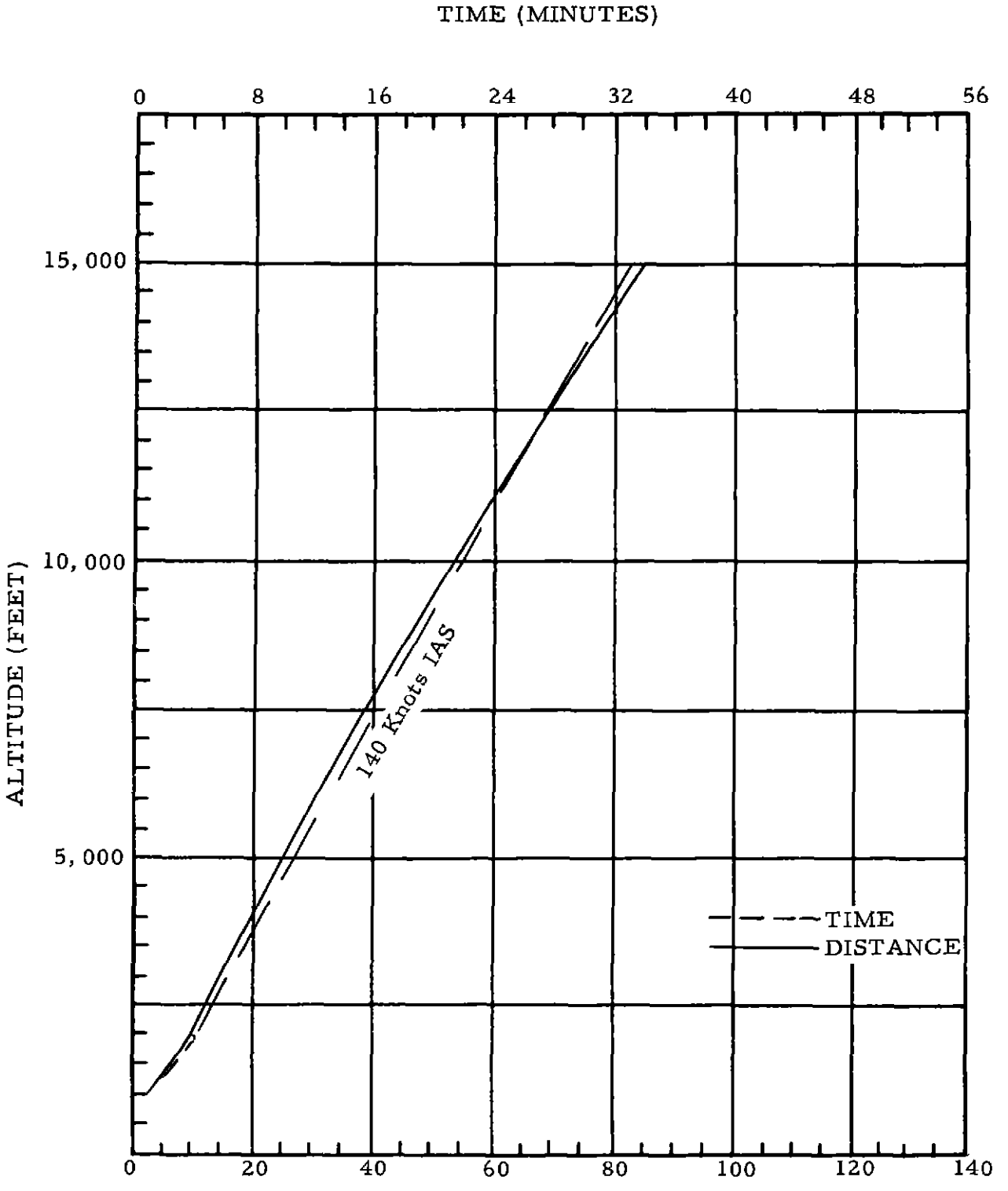


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 700 feet a constant climb airspeed of 160 knots IAS is maintained until cruise altitude is attained. Speeds plus or minus 10 knots from the optimum will not materially affect performance

Tables I, I A, and Figure 1 present climb data

TABLE I, CLIMB

(Climb Schedule for METO Power at 64,500 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)
700	1.5	3 5	1,000	40	160	161
1,000	1 9	4.5	"	60	"	163
2,000	2.9	7 2	1,120	120	"	165
3,000	3 6	9.3	1,380	180	"	167
4,000	4.3	11 2	1,400	240	"	169
5,000	5.0	13 1	1,430	305	"	172
10,000	11.0	31.1	700	650	"	188
15,000	19.5	59.0	410	1,075	"	200
20,000	35.5	114.8	200	1,750	"	218

*Fuel consumed from start engines to take-off 360 pounds

TABLE I A, CLIMB
(Deviation With Change From Maximum Gross Weight)

Altitude (Feet)	Per 2,000 Pounds Increase in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb	Per 2,000 Pounds Decrease in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb
700					6.0%	6 4%	5.3%	7.4%
1,000					"	"	"	"
2,000					6 1%	6.2%	5.2%	"
3,000					6.2%	6.0%	5.1%	7.5%
4,000	Not Applicable				6 3%	5.8%	5.0%	7 8%
5,000					6.4%	5.7%	5.1%	8.0%
10,000					7 0%	5 6%	5.2%	10.3%
15,000					7 7%	5.7%	5.6%	13 9%
20,000					8 6%	5.8%	6.2%	25.0%

Deviation With 10° Change From Standard Temperature

	Each 10° C Above Std Temp.	Each 10° C Below Std Temp
Rate of Climb	23.0%	Not available from operators.
Time of Climb	"	
Climb Distance	"	
Climb Fuel	13.1%	

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

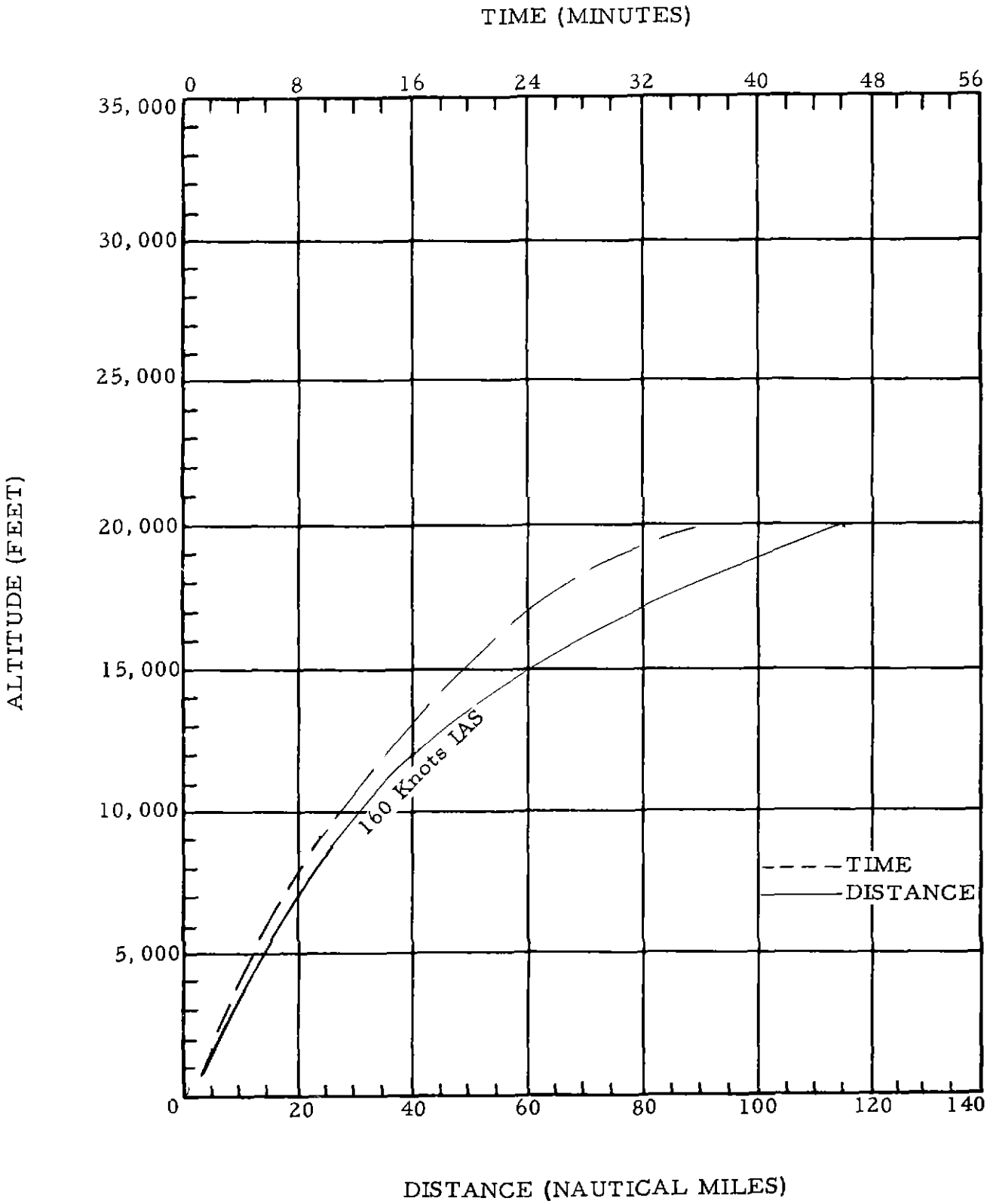


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 500 feet a constant climb airspeed of 160 knots IAS is maintained until cruise altitude is attained Speeds plus or minus 10 knots from the optimum will not materially affect performance

Tables I and Figure 1 present climb data.

TABLE I, CLIMB
(Climb Schedule for Normal Power at 69,000 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)
500	1 3	3.0	1,000	230	160	161
1,000	1 8	4.3	"	250	"	163
2,000	2 8	7 0	"	270	"	165
3,000	3 8	9 7	"	290	"	167
4,000	4 8	12 5	"	320	"	169
5,000	5 8	15.3	"	350	"	172
10,000	10.8	30.3	"	450	"	188
15,000	15 8	46.5	"	650	"	200
20,000	21.5	66 3	750	1,000	"	218
25,000	31 0	102.3	300	1,460	"	238

*Fuel consumed from start engines through lift-off 230 pounds

NOTE Deviation with change from 69,000 pounds gross weight not available from operator

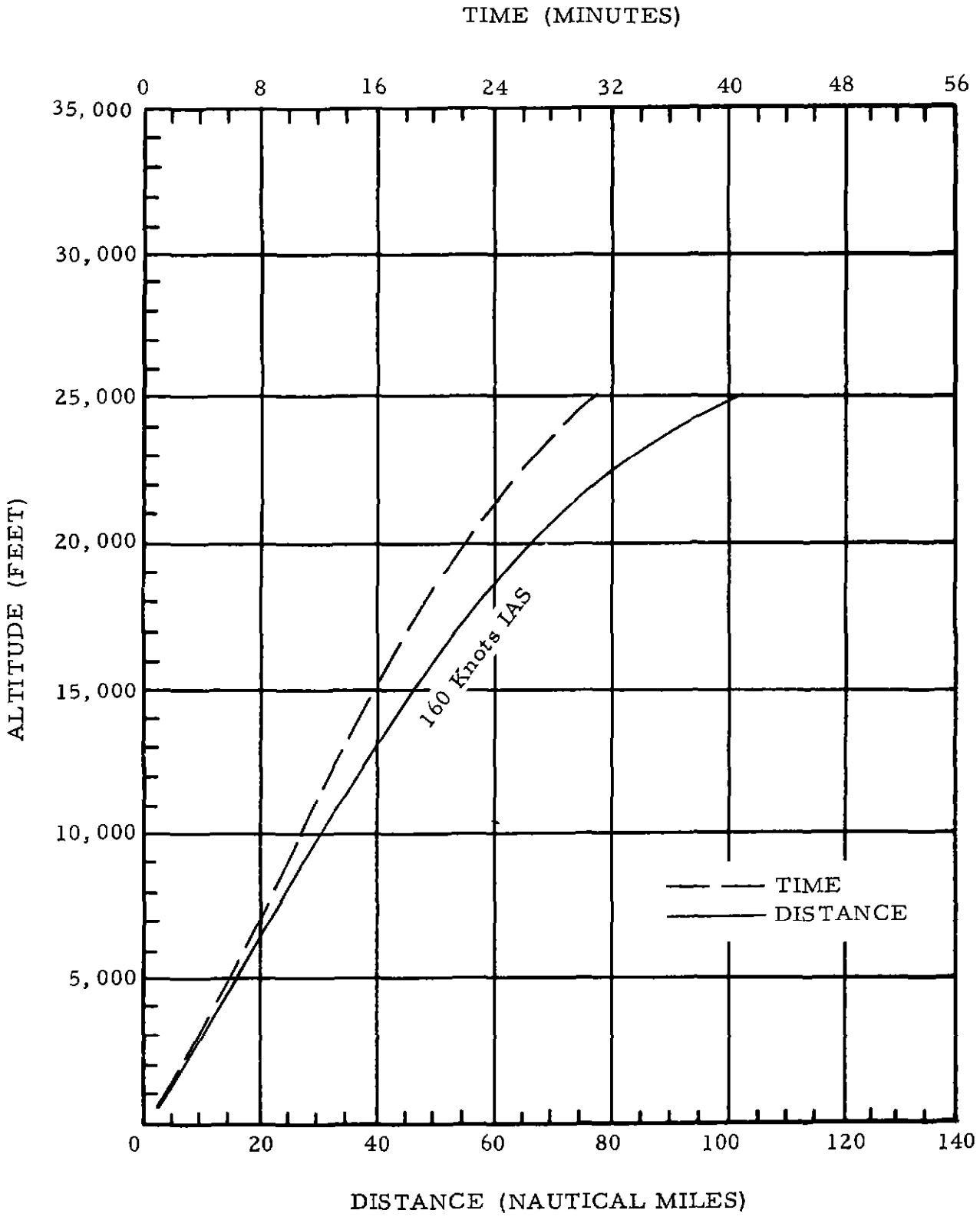


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

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

From an altitude of 500 feet a constant climb speed of 95 knots is maintained until an altitude of 10, 000 feet is attained Speeds plus or minus 5 knots from the optimum will not materially affect performance

Table I and Figure 1 present climb data

TABLE I, CLIMB
(Climb Schedule for Normal Power at 6,000 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)
500	0.5	0.8	1,000	3	95	95
1,000	0.9	1.2	1,300	5	"	96
2,000	1 8	2 6	1,200	9	"	97
3,000	2.7	4 0	1,100	13	"	98
4,000	3 7	5.5	1,000	18	"	100
5,000	4.9	7 1	900	24	"	102
10,000	12.0	19 4	750	72	"	110

*Fuel consumed from start engines through lift-off 13 pounds

NOTE Deviation with change from gross weight not available from manufacturer

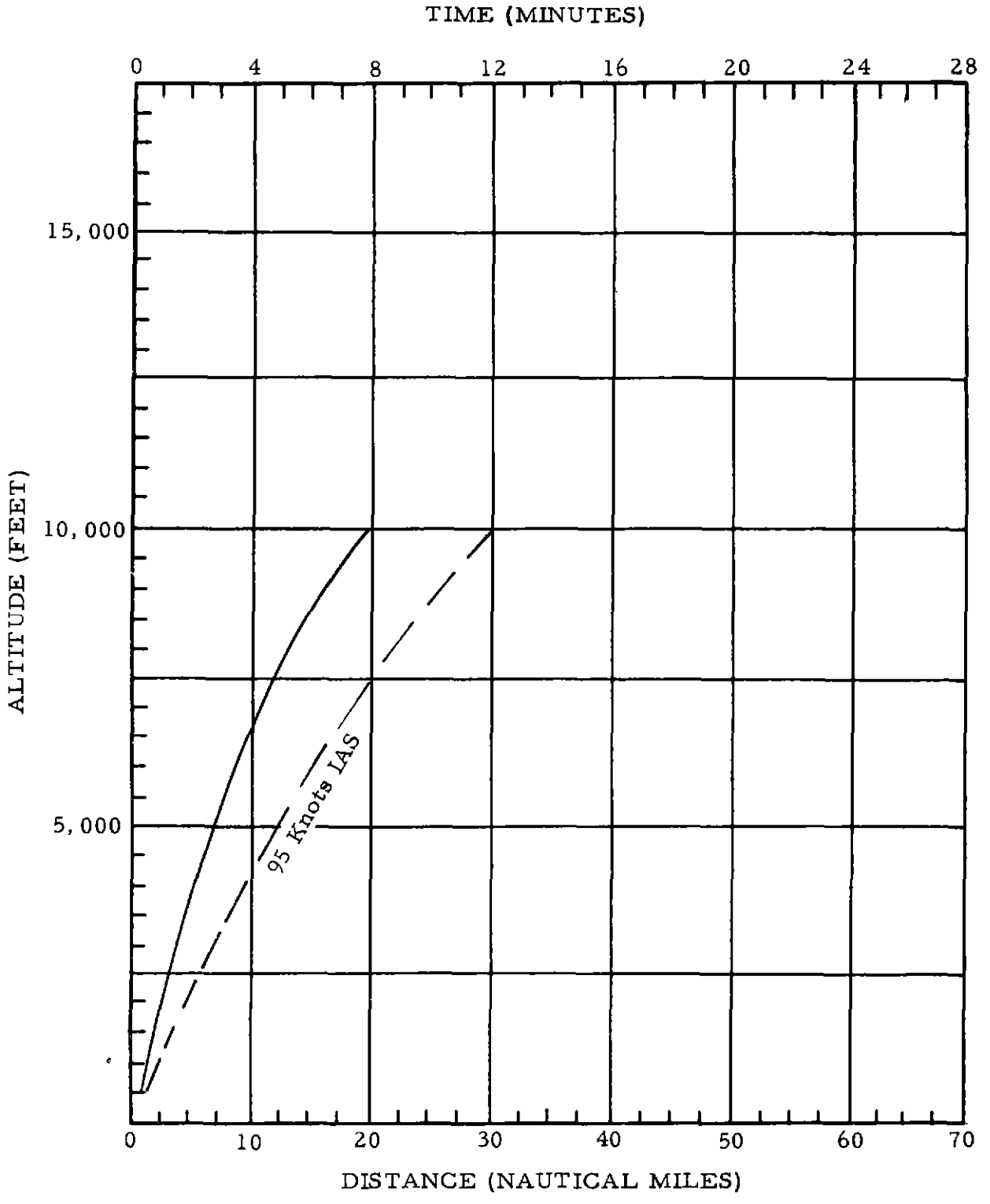


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 1,000 feet a constant climb airspeed of 113 knots IAS is maintained until an altitude of 5,000 feet is attained Above 5,000 feet, the optimum climb speed is 104 knots IAS Speeds plus or minus 5 knots from optimum will not materially affect performance

Table I and Figure 1 present climb data

TABLE I, CLIMB
(Climb Schedule for Normal Power at 6,600 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)
1,000	0 7	1.1	1,533	6	113	115
2,000	1 3	2 4	1,526	54	"	116
3,000	2 0	3.7	1,519	60	"	118
4,000	2 6	5 0	1,512	66	"	120
5,000	3 4	6 3	1,505	72	104	112
10,000	6 9	13.1	1,360	102	"	121

* Fuel consumed from start engines through lift-off 48 pounds

NOTE: Deviation with change from 6,600 pounds gross weight not available from operators.

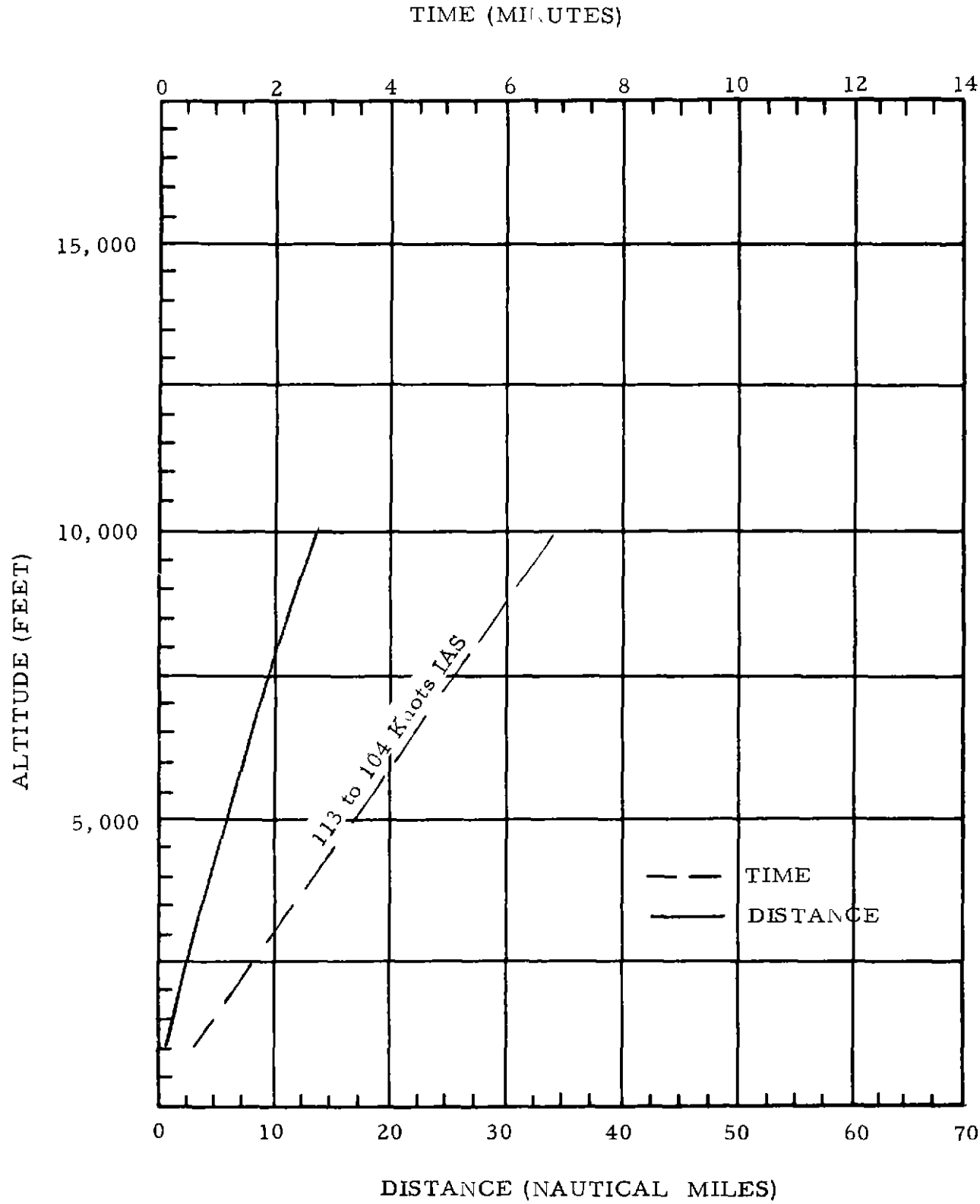


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 1, 000 feet, a constant climb speed of 104 knots IAS is maintained until cruise altitude is attained Flaps are extended 10 degrees during climb Speeds plus or minus 5 knots from the optimum will not materially affect performance

Table I and Figure 1 present climb data

TABLE I, CLIMB
(Climb Schedule for METO Power at 7,500 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)
1,000	1 0	1 6	1,375	6	104	106
2,000	1 7	2 8	1,350	12	"	107
3,000	2 4	4 2	"	18	"	109
4,000	3 2	5 7	1,325	24	"	110
5,000	4 0	7 2	1,300	30	"	112
10,000	8 1	15 2	1,175	60	"	121
15,000	13 3	26 1	775	90	"	131

*Fuel consumed from start engines through lift-off 48 pounds

NOTE. Deviation with change from gross weight not available from manufacturer

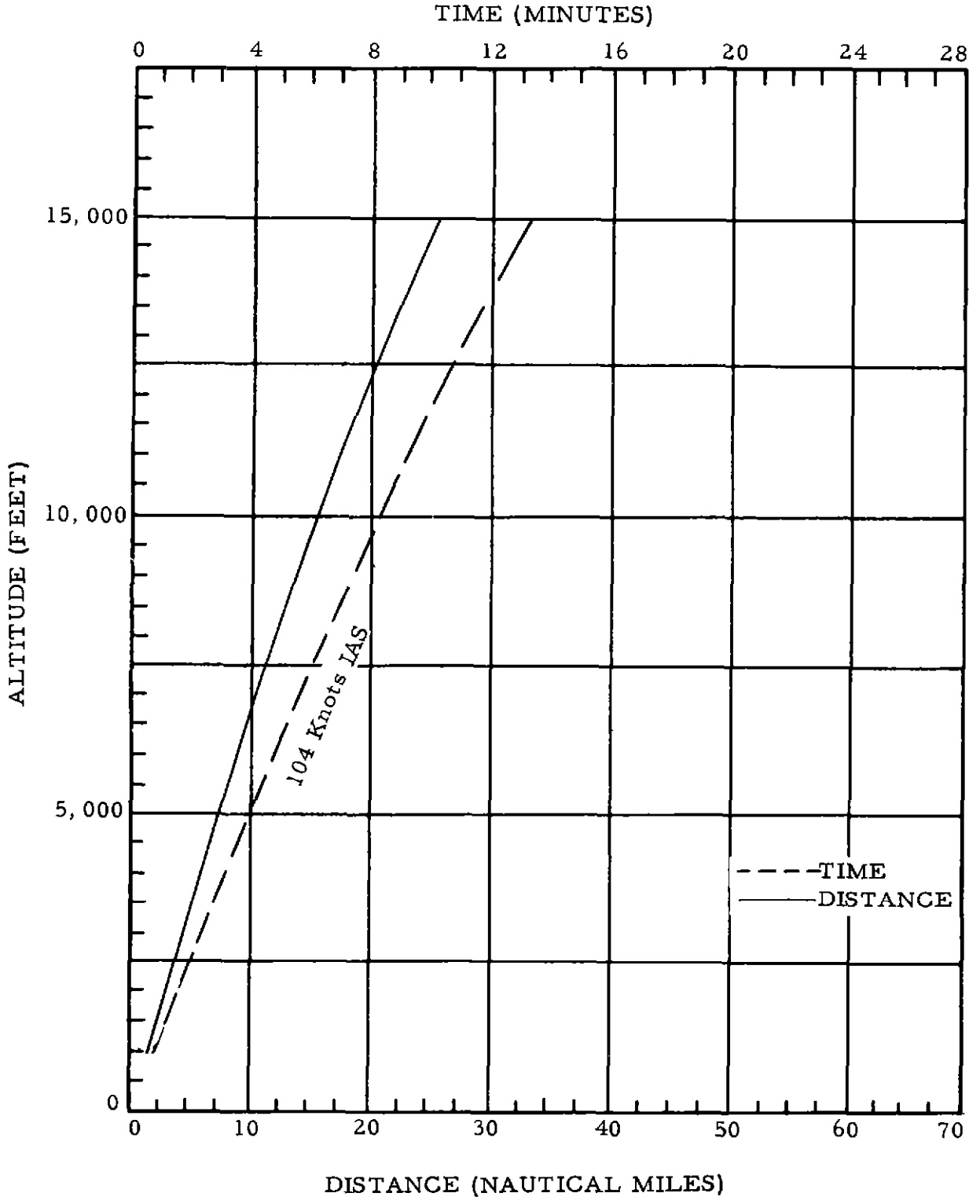


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 500 feet climb airspeed will vary between 90 and 80 knots IAS During climb, speeds plus or minus 5 knots from the optimum will not materially affect performance

Tables I and Figure 1 present climb data

TABLE I, CLIMB
(Climb Schedule for Normal Power at 2,950 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)
500	0.4	0 5	1,170	1	90	91
1,000	0 8	1 1	1,120	3	"	"
2,000	1 7	2 5	1,065	4	"	92
3,000	2 7	4 0	1,015	6	89	93
4,000	3 8	5.7	960	8	"	94
5,000	5 1	7 7	905	10	88	95
10,000	11 6	18 2	630	22	85	99

*Fuel consumed from start engines through lift-off 47 pounds

NOTE Deviation with change from 2,950 pounds gross weight not available from manufacturer

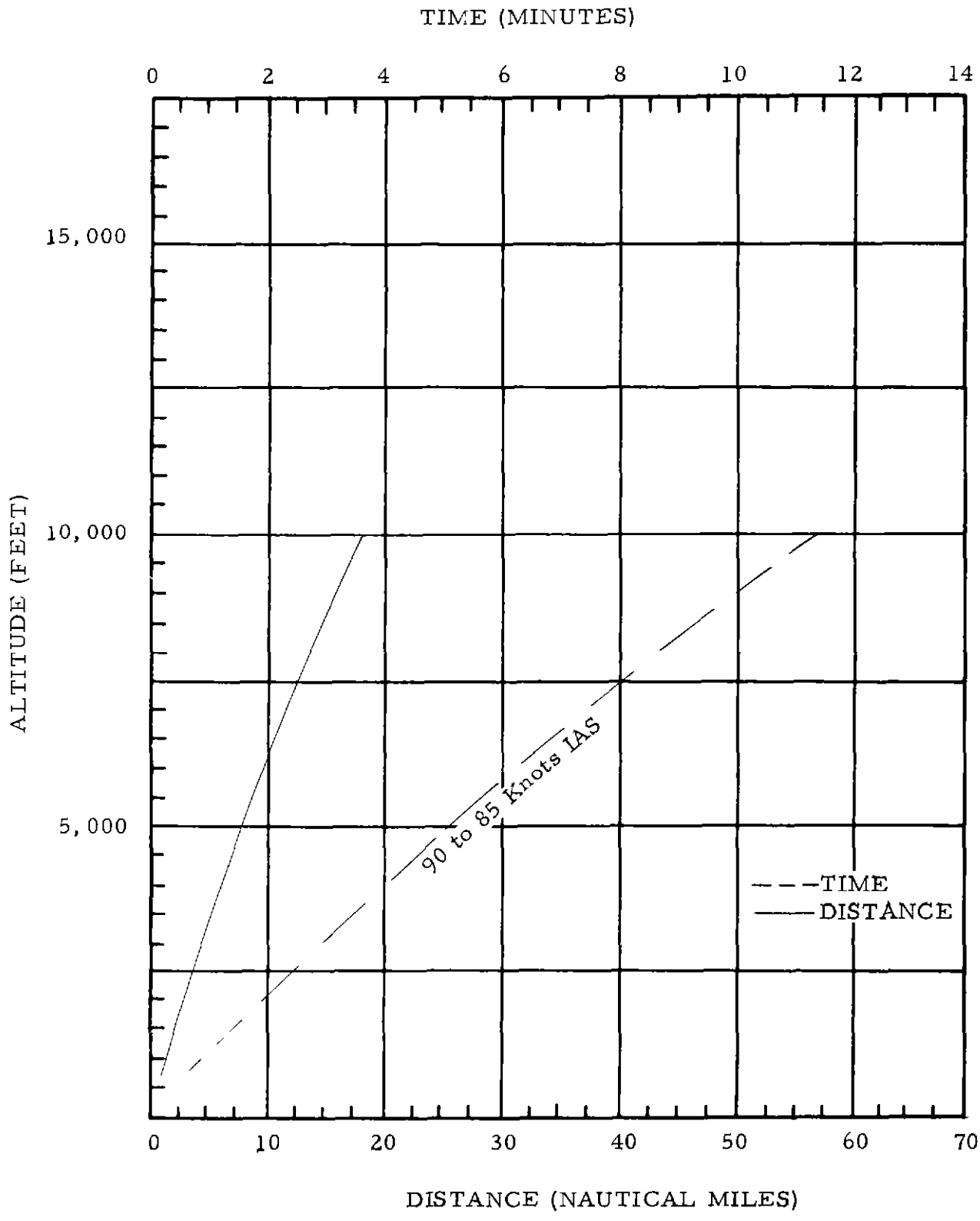


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 500 feet a constant climb airspeed of 120 knots IAS is maintained until an altitude of 4, 000 feet is attained. From this altitude to 10, 000 feet, climb airspeed will vary between 120 and 110 knots IAS Speeds plus or minus 5 knots from the optimum will not materially affect performance

Tables I, I A and Figure 1 present climb data.

TABLE I, CLIMB
(Climb Schedule for Normal Power at 7,000 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)
500	0 5	0.6	500	6	120	121
1,000	1 3	2 2	1,000	13	"	122
2,000	2 1	3 8	1,500	19	"	124
3,000	2 8	5 3	"	25	"	126
4,000	3 5	6.8	"	31	"	127
5,000	4.2	8 3	"	39	115	124
10,000	7.5	15 2	"	76	110	128

*Fuel consumed from start engines through lift-off 24 pounds

TABLE I A, CLIMB
(Deviation With Change From 7,000 Pounds Gross Weight)

Altitude (Feet)	Per 500 Pounds Increase in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb	Per 500 Pounds Decrease in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb
500					5%	5%	5%	5%
1,000					"	7%	6%	"
2,000					8%	8%	8%	8%
3,000					10%	9%	"	10%
4,000		Not Applicable			11%	10%	"	11%
5,000					14%	12%	9%	14%
10,000					"	17%	10%	"
15,000					15%	16%	"	15%

Deviation With 10° Change From Standard Temperature

	Each 10° C Above Std Temp	Each 10° C Below Std. Temp
Rate of Climb	3%	Not
Time of Climb	"	available
Climb Distance	2 4%	from
Climb Fuel	2 9%	operators.

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

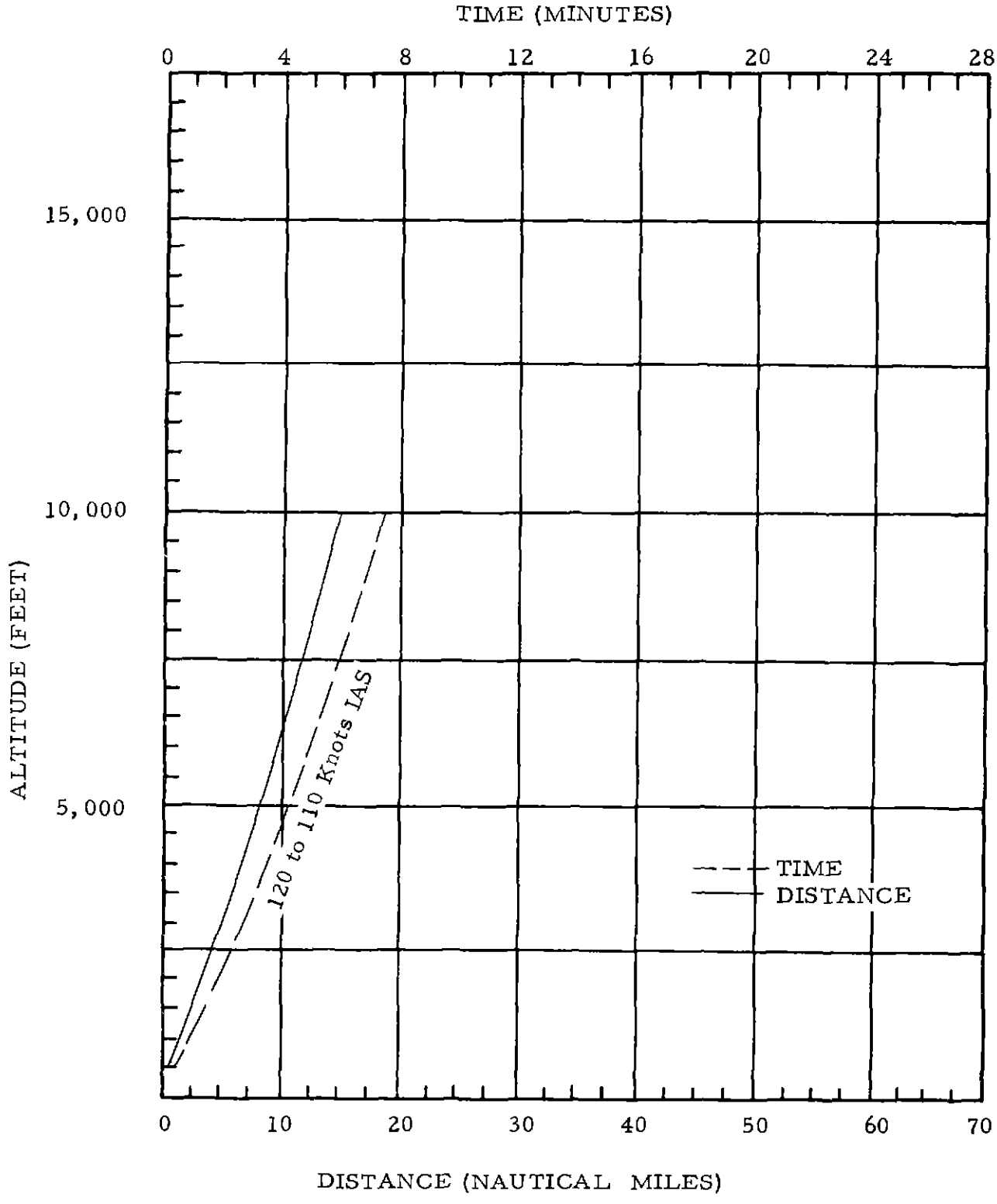


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 500 feet the climb airspeed varies between 90 and 88 knots IAS During climb, speeds plus or minus 5 knots from the optimum will not materially affect performance

Table I and Figure 1 present climb data

TABLE I, CLIMB
(Climb Schedule for Normal Power at 4,000 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)
500	0.3	0.5	1,320	2	90	90
1,000	0.7	1.0	1,290	3	"	91
2,000	1.5	2.2	1,225	6	"	93
3,000	2.3	3.6	1,165	9	"	94
4,000	3.2	4.9	1,100	12	"	95
5,000	4.2	6.4	1,040	16	"	97
10,000	9.8	15.8	700	38	88	102

* Fuel consumed from start engines through lift-off 4 to 8 pounds

NOTE: Deviations with change from 4,000 pounds gross weight not available from manufacturer.

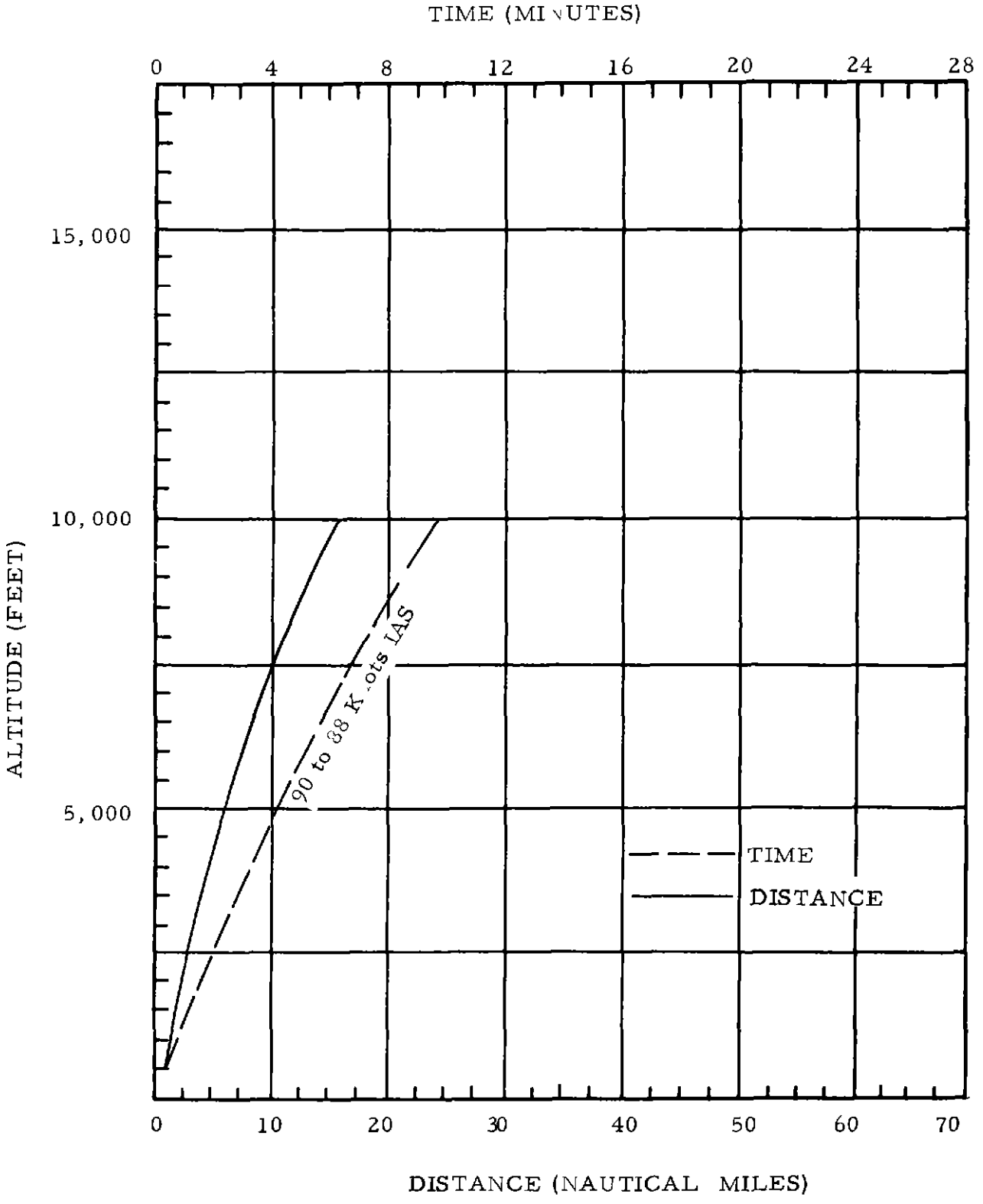


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 500 feet, the initial climb airspeed of 106 knots IAS is gradually decreased to 102 knots IAS at 10,000 feet altitude Speeds plus or minus 5 knots from the optimum will not materially affect performance

Table I and Figure 1 present climb data.

TABLE I, CLIMB
(Climb Schedule for Normal Power at 9,700 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)
500	0 5	0 8	1,340	3	106	106
1,000	0 9	1.5	1,320	6	"	107
2,000	1 6	2.8	1,300	12	105	108
3,000	2 4	4 2	1,270	18	"	110
4,000	3 2	5 7	1,240	24	104	111
5,000	4 1	7.4	1,150	30	"	112
10,000	9 5	17.7	690	65	102	118

*Fuel consumed from start engines through lift-off 57 pounds

Note Deviation with change from 9,700 pounds gross weight not available from manufacturer

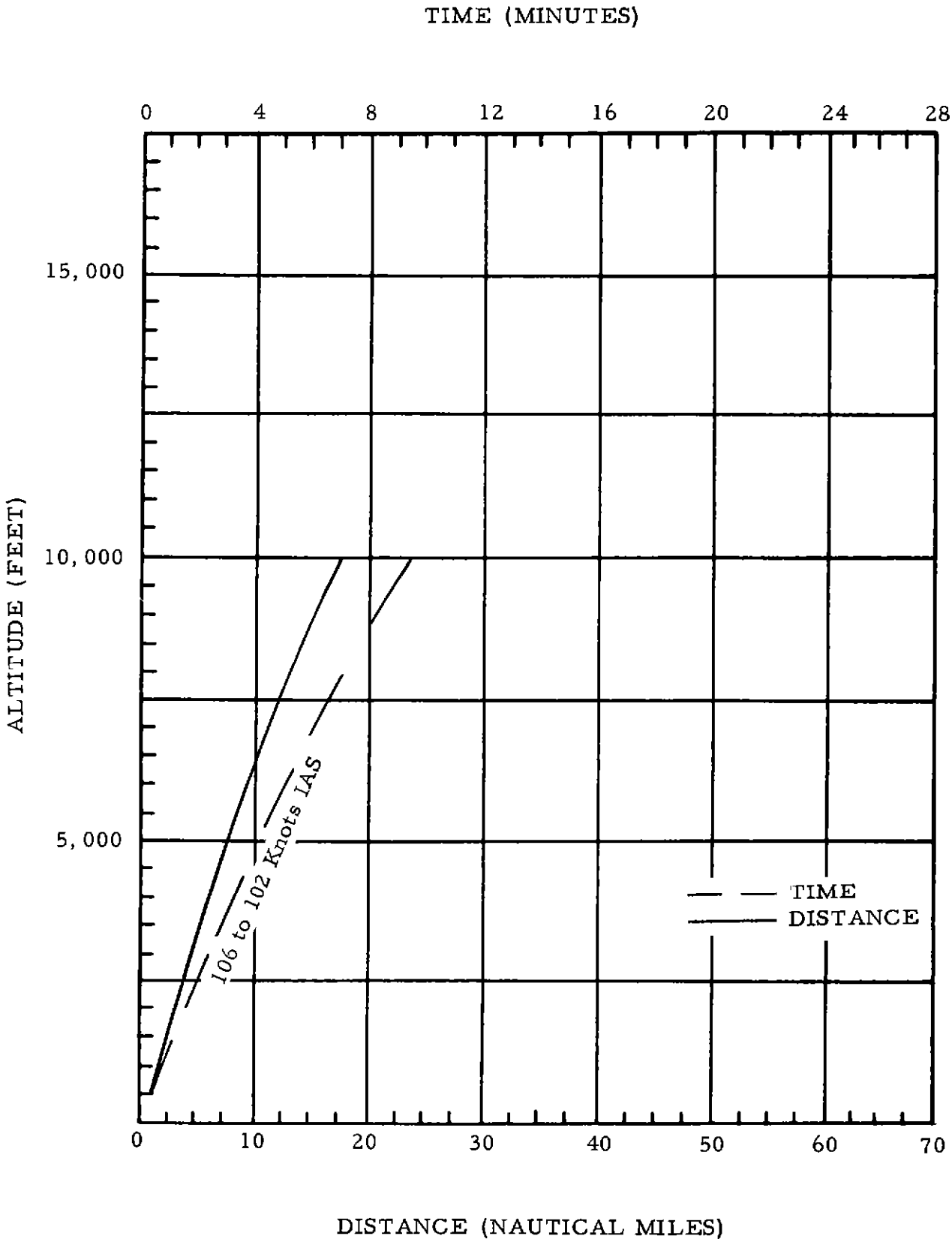


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 500 feet, a constant climb airspeed of 65 knots IAS is maintained until an altitude of 5,000 feet is attained Above 5,000 feet, the optimum climb airspeed will vary between 63 and 59 knots IAS During climb, speeds plus or minus 5 knots from the optimum will not materially affect performance

Tables I, I A, and Figure 1 present climb data

TABLE I, CLIMB
(Climb Schedule for Normal Power at 2,200 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)
500	0.8	0.8	660	1	65	66
1,000	1.5	1 6	"	2	"	"
2,000	3.0	3 3	"	4	"	67
3,000	4.6	5 0	"	6	"	68
4,000	6 1	6.8	"	8	"	69
5,000	7 6	8 5	"	10	63	68
10,000	18 8	20 4	240	23	60	70
15,000	39 6	45 4	30	60	59	74

*Fuel consumed from start engines through lift-off 5 pounds

TABLE I A, CLIMB
(Deviation With Change From 2,200 Pounds Gross Weight)

Altitude (Feet)	Per 100 Pounds Increase in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb	Per 100 Pounds Decrease in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb
500					8%	9%	0%	8%
1,000					"	"	"	"
2,000					"	"	"	"
3,000		Not Applicable			"	"	"	"
4,000					"	"	"	"
5,000					"	"	11%	"
10,000					10%	10%	"	17%
15,000					12%	14%	13%	18%

Deviation With 10° Change From Standard Temperature

	Each 10° C Above Std Temp.	Each 10° C Below Std. Temp.
Rate of Climb Time of Climb Climb Distance Climb Fuel	Not available from manufacturer	

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

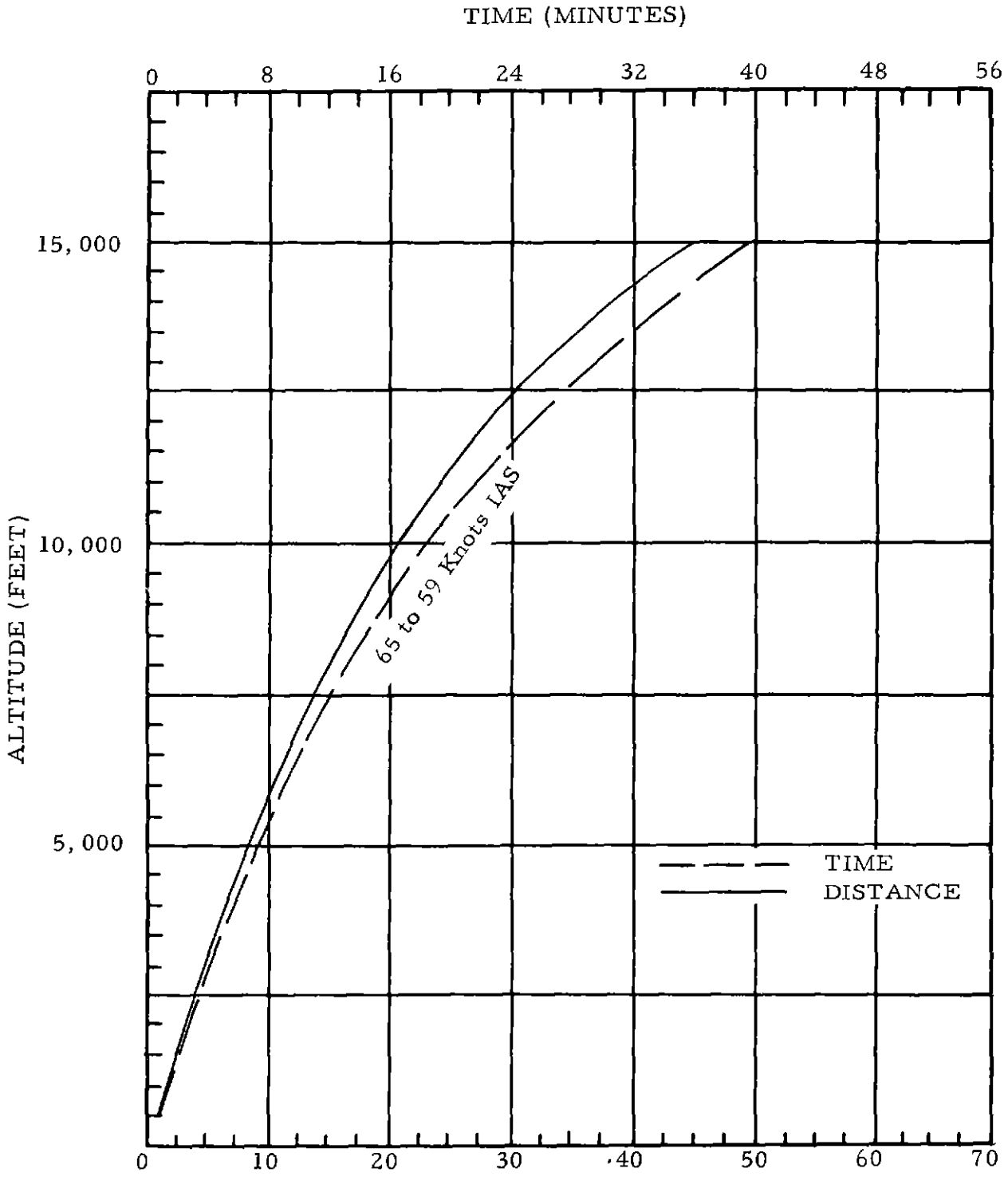


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 500 feet, a constant climb airspeed of 73 knots IAS is maintained until an altitude of 5,000 feet is attained Above 5,000 feet, the optimum climb airspeed will vary between 71 and 70 knots IAS.

Table I and Figure 1 present climb data.

TABLE I, CLIMB
(Climb Schedule for Normal Power at 2,350 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)
500	1 5	1.5	850	1	73	74
1,000	2 1	2 3	"	2	"	"
2,000	3 3	3.7	"	4	"	75
3,000	4 5	5 1	"	5	"	76
4,000	5 7	6 7	"	7	"	77
5,000	7 0	8 4	615	9	71	79
10,000	17 0	22 1	380	19	70	85

*Fuel consumed from start engine through lift-off 6 pounds

NOTE Deviation with change from gross weight not available from manufacturer

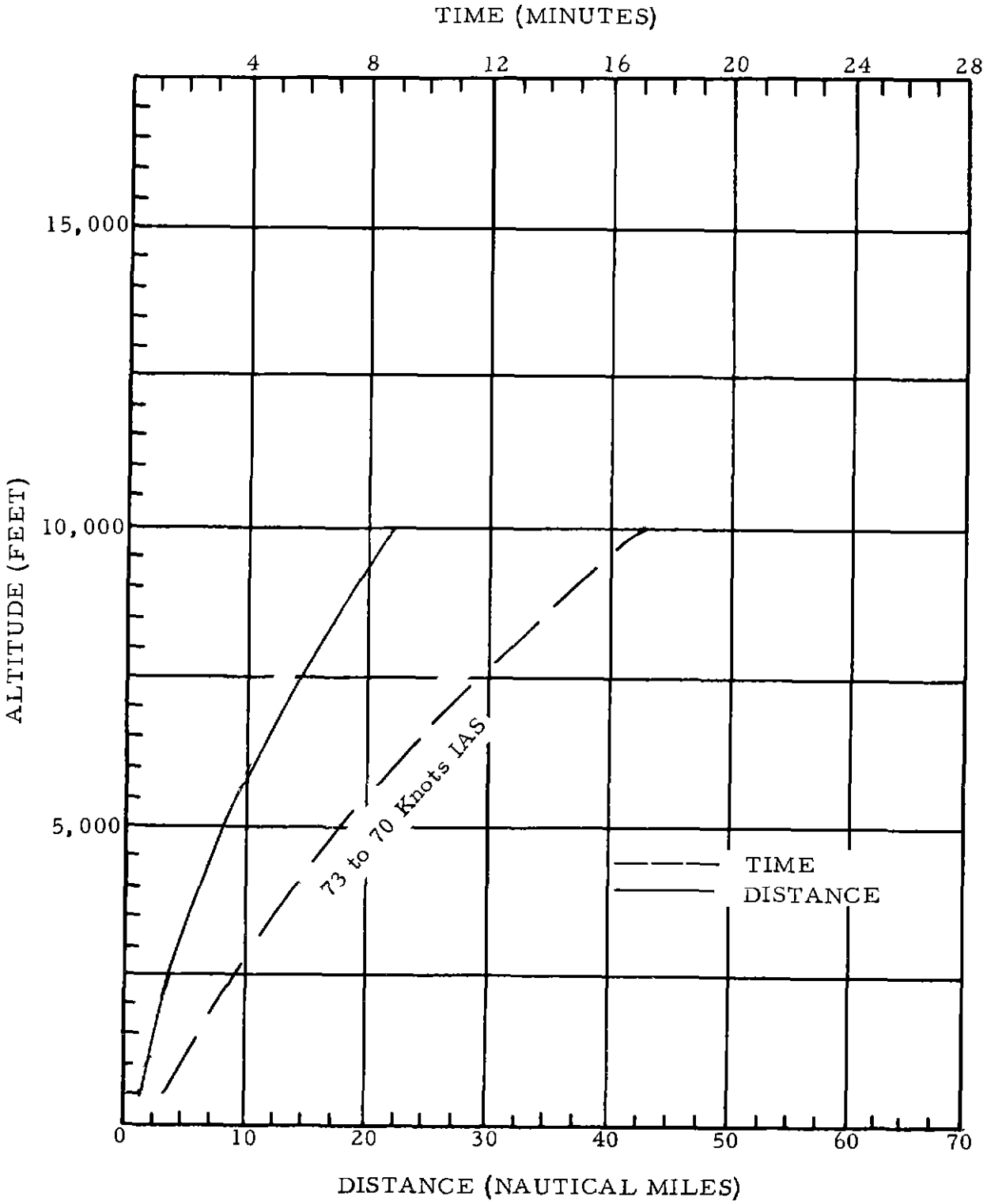


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 500 feet, a constant climb speed of 75 knots IAS and a maximum rate of climb are maintained until cruise altitude is attained Speeds plus or minus 5 knots from the optimum will not materially affect performance.

Tables I, I A and Figure 1 present climb data.

TABLE I, CLIMB
(Climb Schedule for Normal Power at 2,850 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)
500	0 7	0.8	1,055	3	75	75
1,000	1 2	1 4	1,000	4	"	76
2,000	2 2	2 6	960	6	"	77
3,000	3.3	3.8	915	9	"	78
4,000	4.5	5 4	840	12	"	79
5,000	5.8	7.1	770	15	"	80
10,000	13.7	18.2	485	31	"	87

*Fuel consumed from start engines through lift-off 6 pounds

TABLE I A, CLIMB
(Deviation With Change From 2, 850 Pounds Gross Weight)

Altitude (Feet)	Per 250 Pounds Increase in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb	Per 250 Pounds Decrease in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb
500					12%	15%	Negligible	17%
1, 000					"	"	"	"
2, 000					"	"	"	"
3, 000		Not Applicable			"	"	"	"
4, 000					"	"	"	"
5, 000					17%	26%	9%	20%
10, 000					28%	28%	13%	30%

Deviation With 10° Change From Standard Temperature

	Each 10° C Above Std Temp	Each 10° C Below Std. Temp
Rate of Climb	Not available from manufacturer	
Time of Climb		
Climb Distance		
Climb Fuel		

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

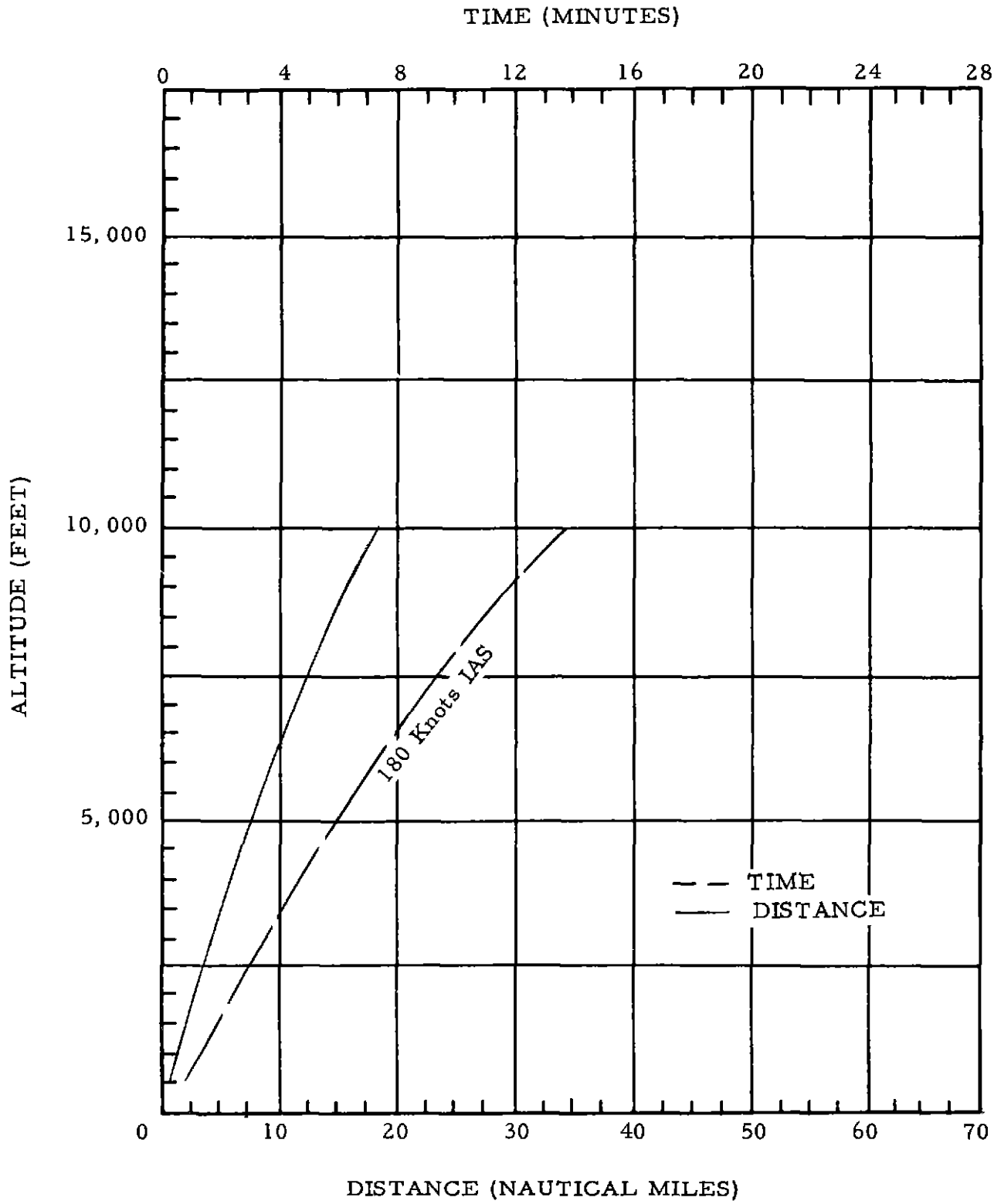


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 500 feet a climb speed of 75 to 68 knots LAS is maintained until cruise altitude is attained. Speeds of plus or minus 5 knots from the optimum will not materially affect performance

Tables I, IA and Figure 1 present climb data

TABLE I, CLIMB
(Climb Schedule for Normal Power at 2,650 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed LAS (Knots)	Climb Speed TAS (Knots)
500	0 6	0.7	1,030	3.0	75	75
1,000	1.1	1 3	"	5.5	74	"
2,000	2.2	2.7	930	8.0	"	76
3,000	3 3	4.1	890	10.5	73	"
4,000	4.4	5.5	"	13 0	"	77
5,000	5.6	7.1	795	15.0	72	78
10,000	12.6	16.3	560	29.0	68	79

*Fuel consumed from start engines through lift-off. 6 pounds

TABLE I A, CLIMB
(Deviation With Change From Maximum 2, 650 pounds Gross Weight)

Altitude (Feet)	Per 250 Time of Climb	Pounds Increase in Gross Weight Climb Distance	Climb Fuel	Rate of Climb	Per 250 Time of Climb	Pounds Decrease in Gross Weight Climb Distance	Climb Fuel	Rate of Climb
500					14%	10%	Negligible	17%
1,000					"	"	"	"
2,000					"	"	"	"
3,000		Not Applicable			"	"	"	"
4,000					"	"	"	"
5,000					"	"	11%	20%
10,000					20%	15%	15%	26%

Deviation With 10° Change From Standard Temperature

	Each 10° C Above Std. Temp.	Each 10° C Below Std Temp
Rate of Climb Time of Climb Climb Distance Climb Fuel	Not available from manufacturer	

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

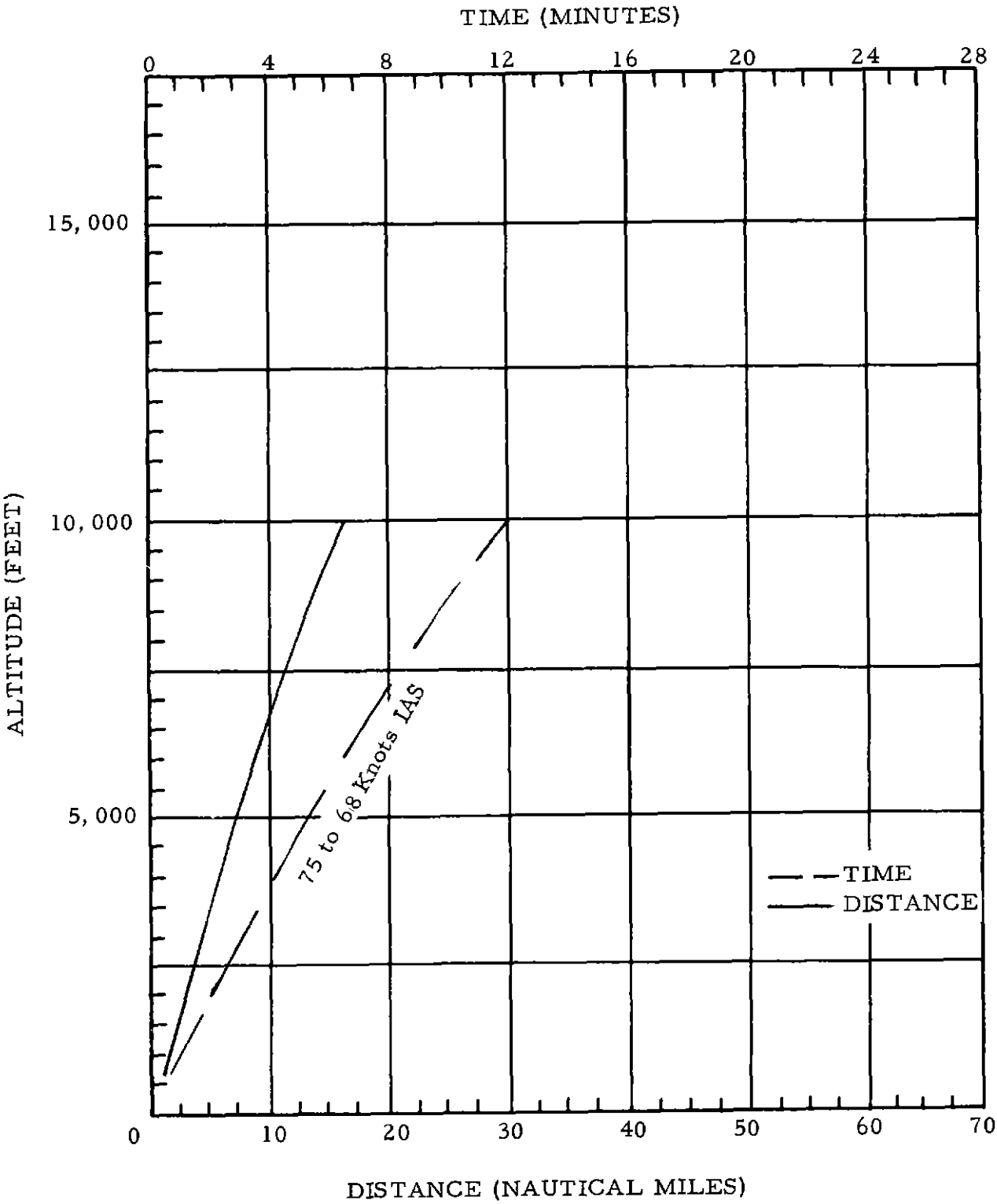


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 500 feet climb airspeed varies between 108 and 97 knots IAS. Speeds plus or minus 5 knots from the optimum will not materially affect performance

Tables I, IA and Figure 1 present climb data

TABLE I, CLIMB
(Climb Schedule for Normal Power at 4,400 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	* Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)
500	0.4	0 7	1,802	5	108	109
1,000	0 7	1 2	"	11	"	110
2,000	1 2	2.4	"	17	"	111
3,000	1.8	3.5	"	23	"	112
4,000	2 4	5.0	"	29	"	"
5,000	2 9	6.5	"	35	104	113
10,000	7.0	14 1	1,176	51	101	117
15,000	13.3	26.6	800	63	97	122

*Fuel consumed from start engines through lift-off 18 pounds (estimated)

TABLE I A, CLIMB
(Deviation With Change From 4, 400 Pounds Gross Weight)

Altitude (Feet)	Per Time of Climb	Pounds Increase in Gross Weight: Climb Distance	Climb Fuel	Rate of Climb	Per Time of Climb	Pounds Decrease in Gross Weight: Climb Distance	Climb Fuel	Rate of Climb
500								
1,000								
2,000	Not available from manufacturer or operators				Not available from manufacturer or operators			
3,000								
4,000								
5,000	17.0%	15.5%	Not available from manufacturer or operators		7.0%	6.5%	Not available from manufacturer or operators	
10,000	11.5%	11 5%			"	7.0%		
15,000	"	"			"	"		

Deviation With 10° Change From Standard Temperature

	Each 10° C Above Std Temp	Each 10° C Below Std. Temp.
Rate of Climb	Not available from manufacturer or operators	
Time of Climb	5.4%	3.3%
Climb Distance	"	"
Climb Fuel	Not available from manufacturer or operators	

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

Cessna 310A (L-27A)

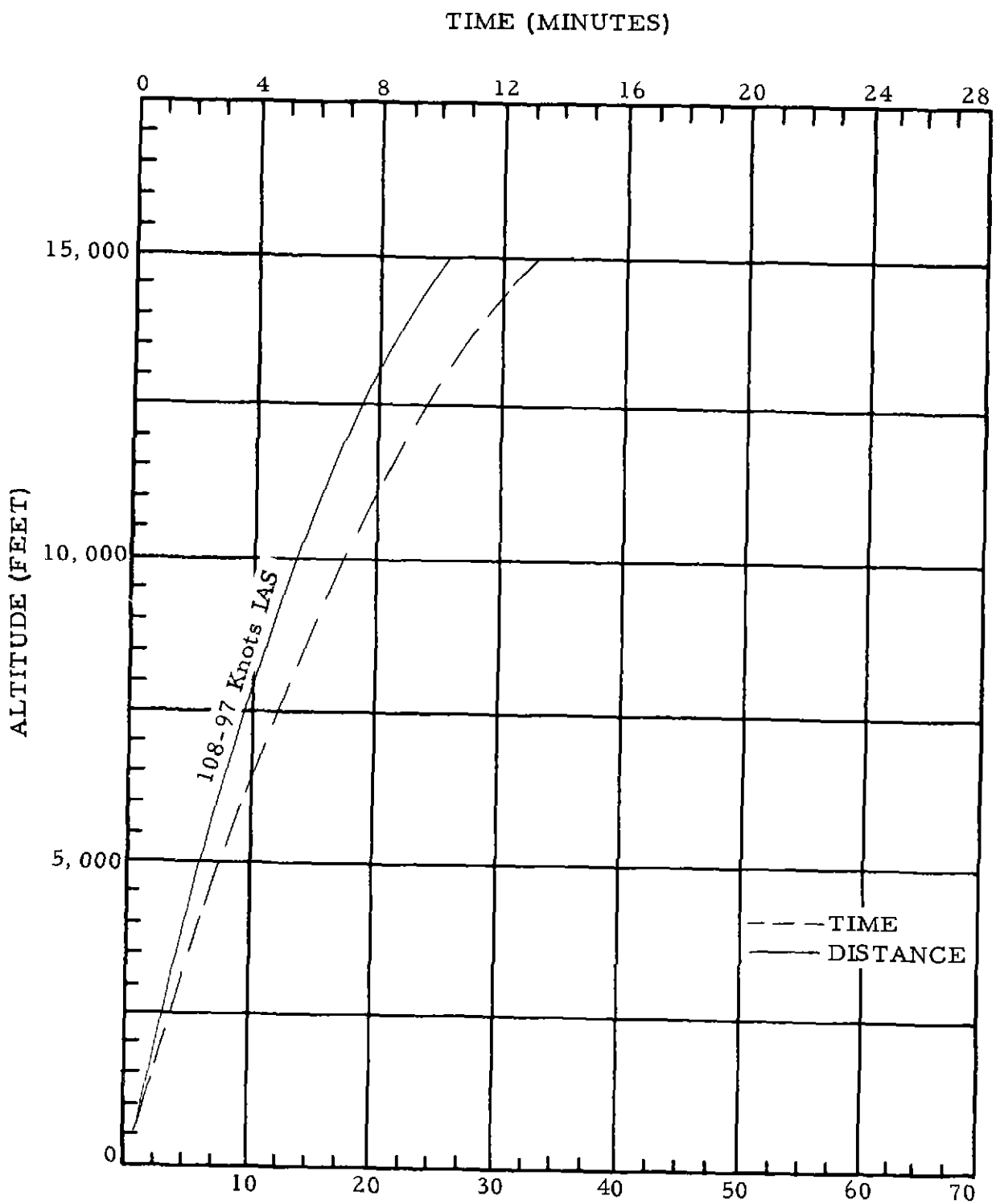


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 1,000 feet a constant climb airspeed of 103 knots IAS is maintained until an altitude of 5,000 feet is attained. Above 5,000 feet the optimum climb airspeed will vary between 102 and 100 knots IAS.

Tables I, IA, and Figure 1 present climb data

TABLE I, CLIMB
(Climb Schedule for Normal Power at 4, 830 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)
1, 000	1 5	1.6	1, 800	3	103	105
2, 000	2.1	2.6	"	5	"	106
3, 000	2 7	3 7	"	8	"	108
4, 000	3 3	4.8	"	12	"	109
5, 000	3 9	5.9	1, 405	13	102	110
10, 000	8 1	13 8	1, 005	27	100	116

*Fuel consumed from start engines through lift-off. 21 pounds

TABLE I A, CLIMB
(Deviation With Change From 4, 830 Pounds Gross Weight)

Altitude (Feet)	Per 400 Time of Climb	Pounds Increase in Gross Weight: Climb Distance	Climb Fuel	Rate of Climb	Per 400 Time of Climb	Pounds Decrease in Gross Weight: Climb Distance	Climb Fuel	Rate of Climb
1, 000					23%	27%	1%	15%
2, 000					"	"	2%	"
3, 000					22%	26%	3%	"
4, 000		Not applicable			"	"	4%	"
5, 000					21%	25%	5%	16%
10, 000					18%	20%	8%	19%
15, 000					"	"	11%	27%

Deviation With 10° Change From Standard Temperature

	Each 10° C Above Std Temp	Each 10° C Below Std. Temp.
Rate of Climb	Not available from manufacturer	
Time of Climb		
Climb Distance		
Climb Fuel		

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

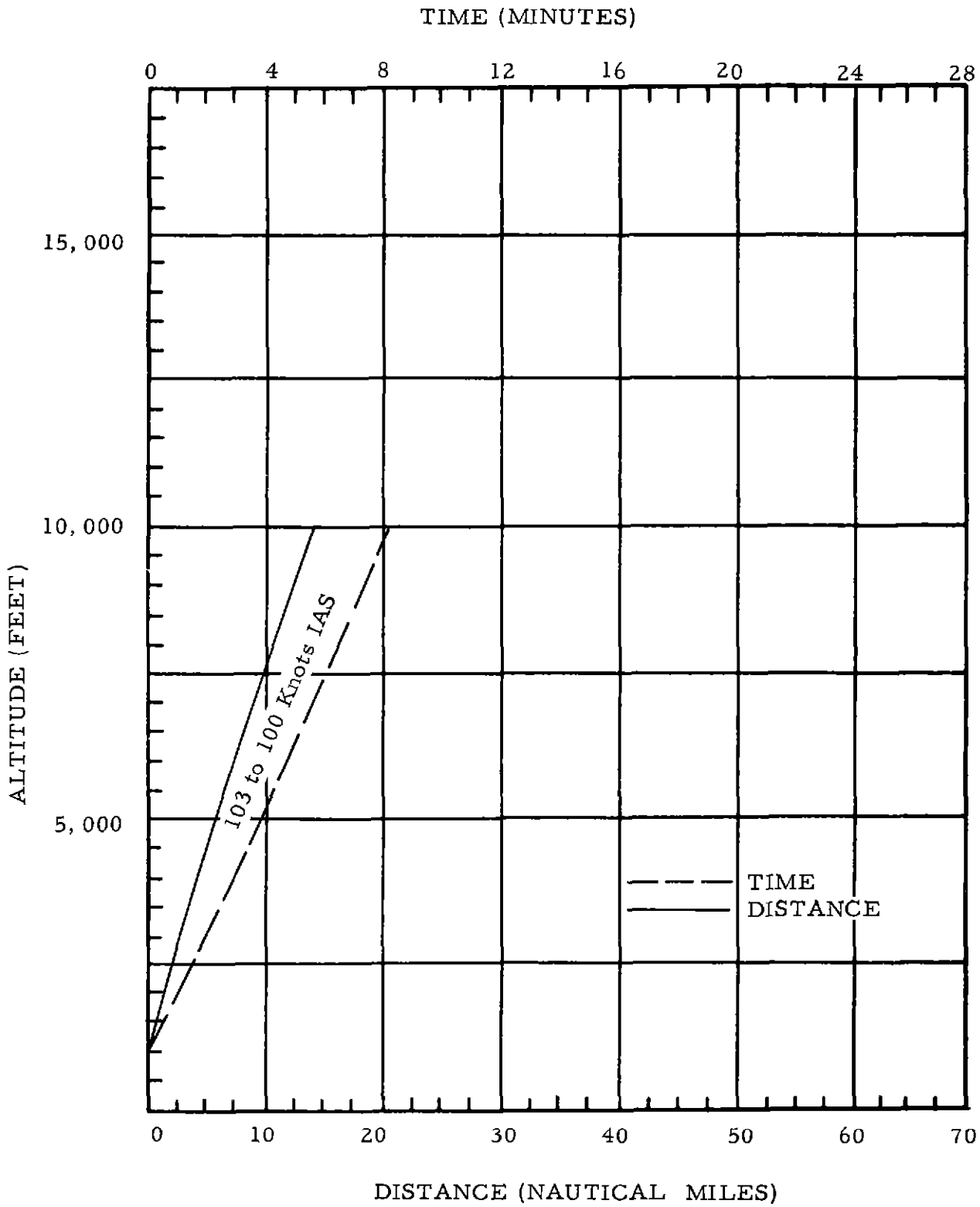


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 500 feet a constant climb airspeed of 81 knots IAS is maintained until an altitude of 5,000 feet is attained Above 5,000 feet, the optimum climb airspeed will vary between 77 and 74 knots IAS. Speeds plus or minus 5 knots from the optimum will not materially affect performance

Tables I, I A and Figure 1 present climb data

TABLE I, CLIMB
(Climb Schedule for Normal Power at 4, 800 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)
500	1 0	1.1	920	2	81	81
1,000	1 4	1.7	"	4	"	82
2,000	2.5	3 2	"	7	"	83
3,000	3.6	4.8	"	11	"	85
4,000	4.7	6 3	"	14	"	86
5,000	5 8	7 8	875	18	77	83
10,000	12.5	17.2	625	48	74	86

*Fuel consumed from start engine through lift-off 40 pounds

TABLE I A, CLIMB
(Deviation With Change From 4, 800 Pounds Gross Weight)

Altitude (Feet)	Per 300 Pounds Increase in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb	Per 400 Pounds Decrease in Gross Weight: Time of Climb	Climb Distance	Climb Fuel	Rate of Climb
500								
1,000								
2,000	Not available from operators.				Not available from operators			
3,000								
4,000								
5,000	16 7%	8.5%	9 1%	12 9%	16 7%	14.3%	9.1%	32.0%
10,000	25 0%	12.5%	12 5%	15 7%	"	12 5%	6.7%	21 6%

Deviation With 10° Change From Standard Temperature

	Each 10° C Above Std Temp	Each 10° C Below Std. Temp
Rate of Climb	Not available from operators.	
Time of Climb		
Climb Distance		
Climb Fuel		

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

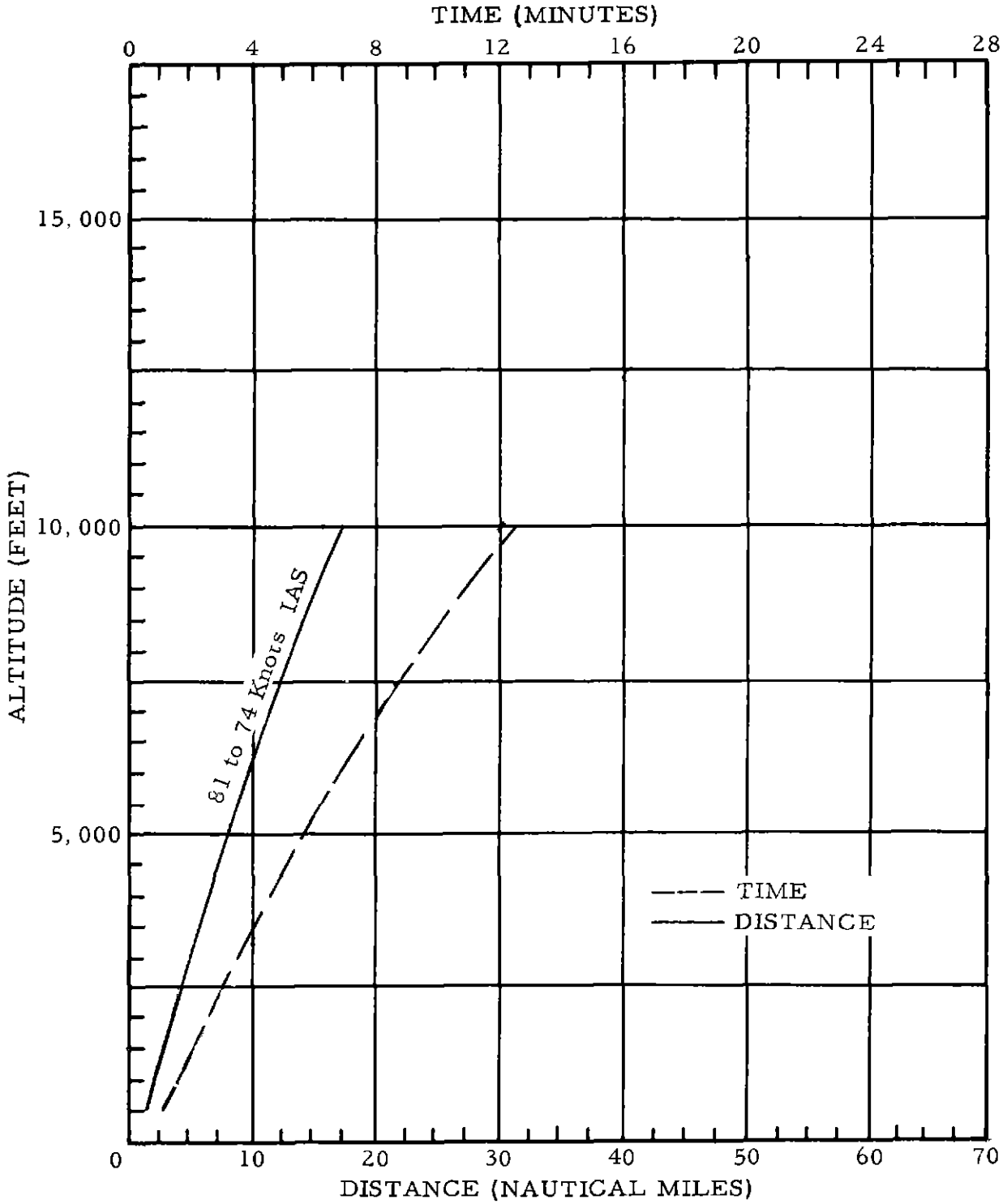


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 200 feet a constant climb airspeed of 80 knots IAS is maintained until cruise altitude is attained Speeds plus or minus 5 knots from the optimum will not materially affect performance

Table I and Figure 1 present climb data

TABLE I, CLIMB
(Climb Schedule for Normal Power at 8,000 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)
200	0.3	0 4	750	8	80	80
1,000	1.4	2.0	725	18	"	81
2,000	2 8	4 2	700	28	"	82
3,000	4 3	6 4	650	38	"	83
4,000	5 9	8.6	625	48	"	84
5,000	7 5	11 0	600	58	"	86
10,000	16 5	26 0	500	108	"	93

NOTE. These airspeeds apply for all gross weights Also for every 10 degrees centigrade temperature change, time to climb changes by 5 0%, distance changes by 7 0%, and fuel used changes by 3 0%.

*Fuel consumed from start engines through lift-off 22 pounds

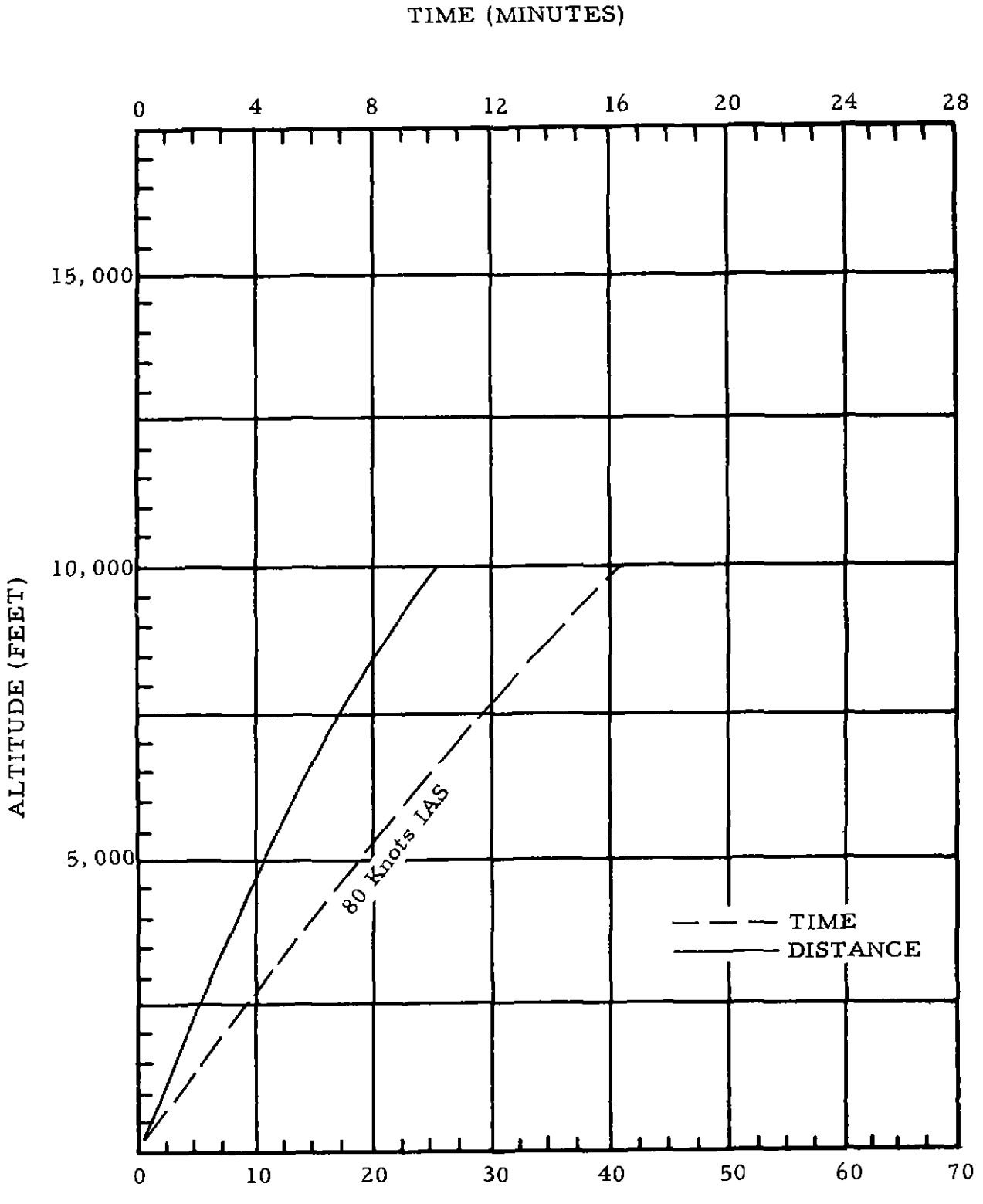


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 500 feet a constant climb speed of 104 knots IAS is maintained until cruise altitude is attained. Speeds plus or minus 5 knots from the optimum will not materially affect performance.

Table I and Figure 1 present climb data.

TABLE 1, CLIMB
(Climb Schedule for Normal Power at 2,444 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)
500	0.8	1.0	600	1.0	104	105
1,000	1.6	2.4	"	1.9	"	106
2,000	3.3	5.4	"	3.8	"	107
3,000	4.9	8.3	"	5.7	"	109
4,000	6.6	11.4	"	7.6	"	111
5,000	8.3	14.6	"	9.5	"	112
10,000	16.7	31.0	"	19.0	"	121

* Fuel consumed from start engines through lift-off: 5 pounds

NOTE Deviation with change from gross weight not available from manufacturer.

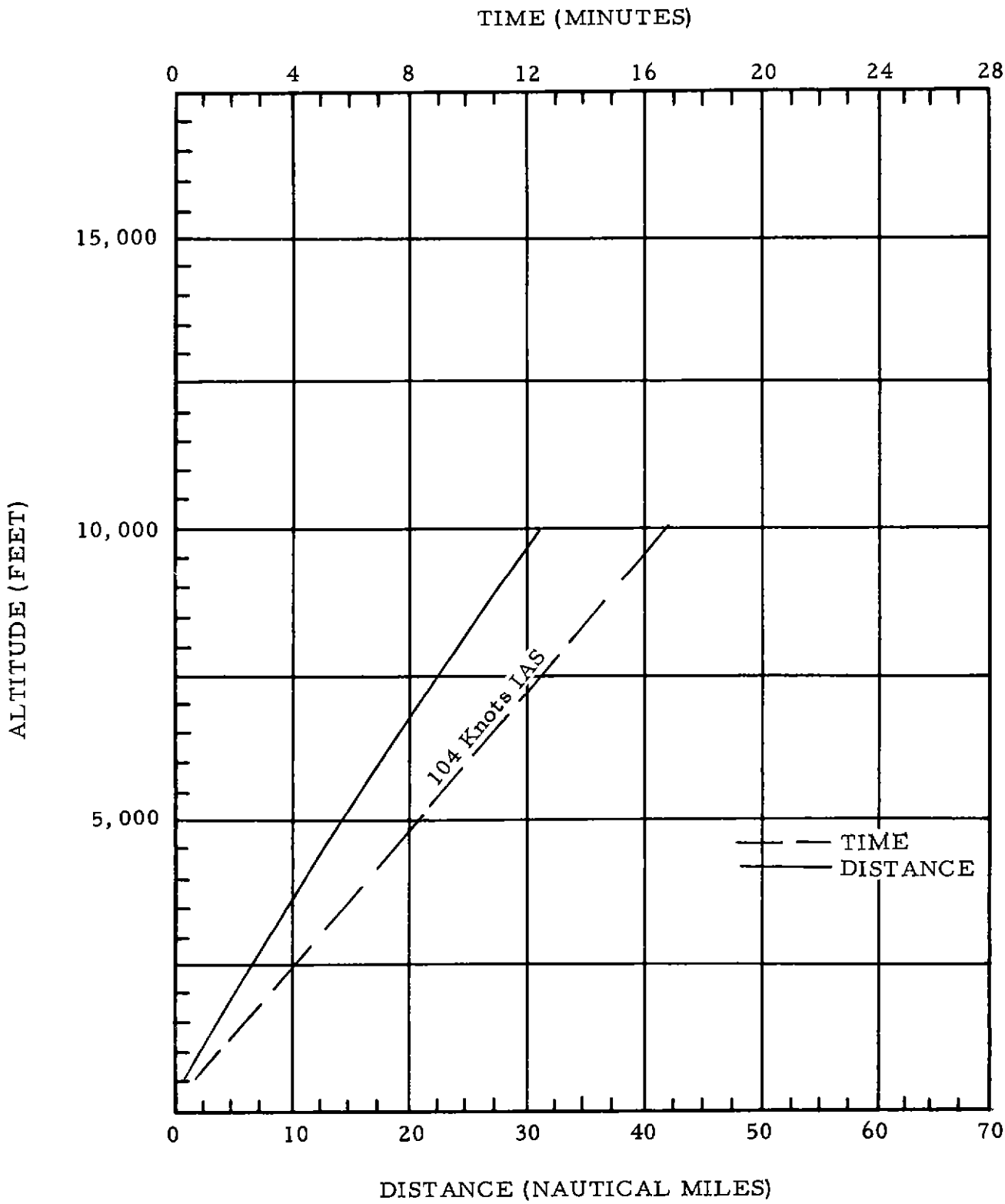


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 500 feet a constant climb airspeed of 74 knots IAS is maintained until cruise altitude is attained. Speeds plus or minus 5 knots from the optimum will not materially affect performance.

Table I and Figure 1 present climb data.

TABLE I, CLIMB
(Climb Schedule for Normal Power at 1,800 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)
500	1.0	1.2	800	Not available from manufacturer.	74	74
1,000	1.7	2.1	"		"	75
2,000	2.9	3.6	"		"	76
3,000	4 2	5.2	"		"	77
4,000	5.4	6.8	"		"	78
5,000	6.7	8.5	"		"	80
10,000	12.9	17.1	"		"	86

NOTE. Deviations with change in gross weight not available from manufacturer.

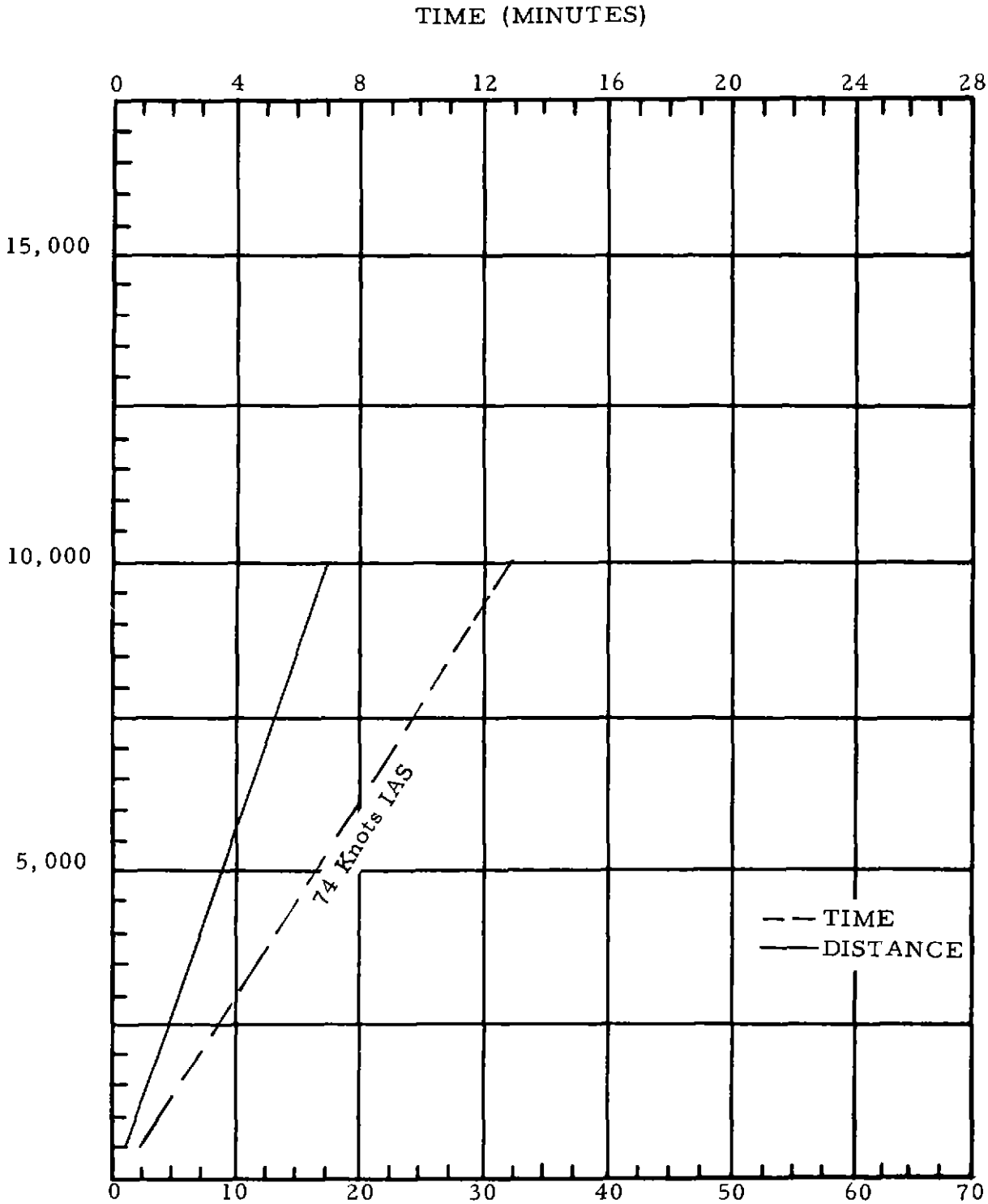


FIGURE 1 - CLIMB-DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 500 feet, a constant climb airspeed of 86 knots IAS is maintained until cruise altitude is attained During climb, speed plus or minus 5 knots will not materially affect performance.

Table I and Figure 1 present climb data

TABLE I, CLIMB
(Climb Schedule for Normal Power at 3,800 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)
500	0 8	1 0	1,050	2	86	86
1,000	1 3	1 7	1,000	3	"	87
2,000	2 3	3.2	945	6	"	88
3,000	3 4	4 8	850	8	"	90
4,000	4.6	6.6	765	11	"	91
5,000	6.0	8 8	688	14	"	93
10,000	15 2	23.6	400	37	"	100

*Fuel consumed from start engines through lift-off 22 pounds

Note Deviations with change in gross weight not available from manufacturer.

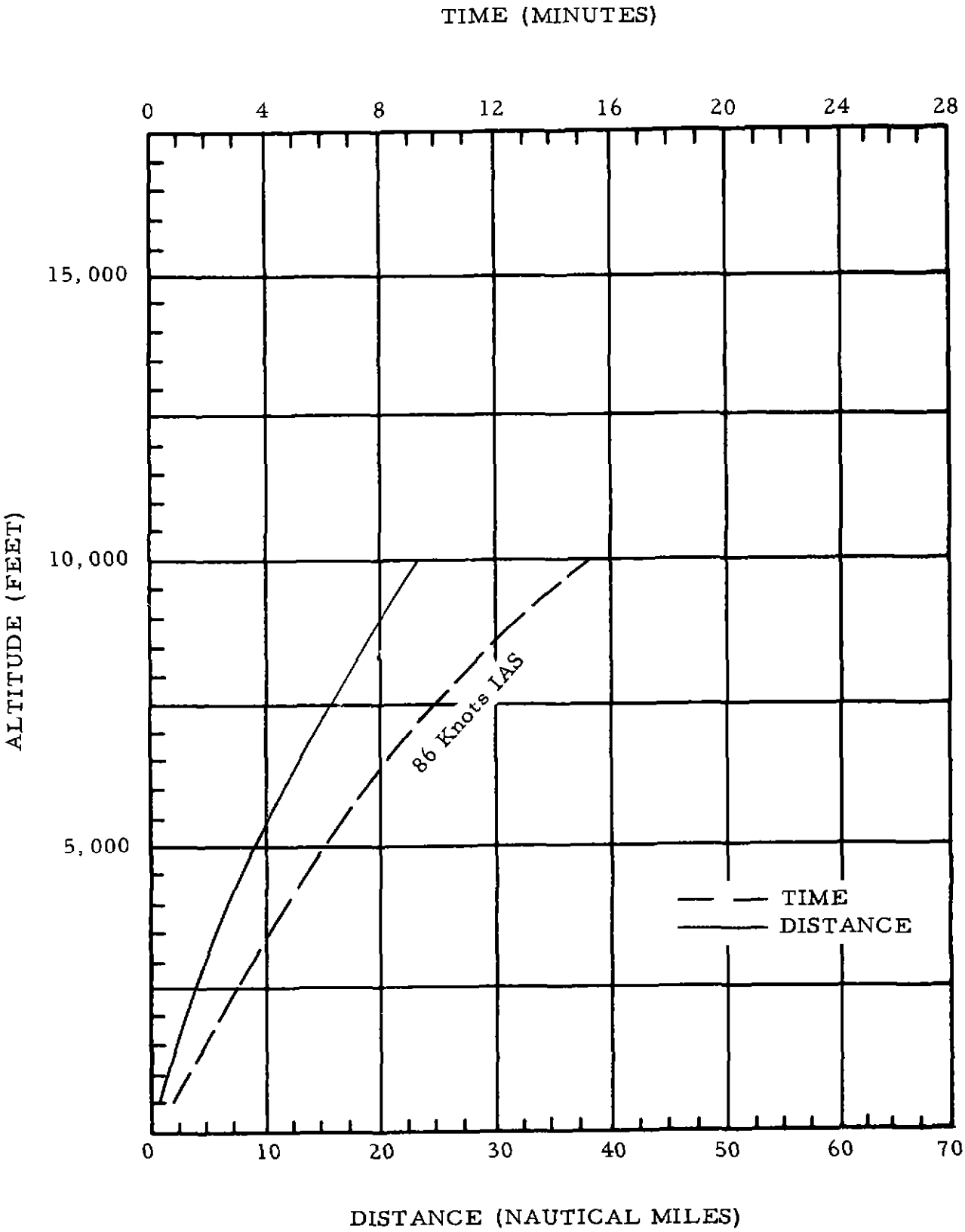


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

NARRATIVE SUMMARY

Sequence of Operations

From an altitude of 500 feet, the climb airspeed varies between 75 and 85 knots IAS. Climb airspeed is reduced approximately 5 knots IAS per 5,000 feet of climb.

Table I and Figure 1 present climb data

TABLE I, CLIMB
(Climb Schedule for Normal Power at 2,550 Pounds Gross Weight)

Altitude (Feet)	Time of Climb (Minutes)	Climb Distance (Nautical Miles)	Rate of Climb (Feet per Minute)	*Climb Fuel (Pounds)	Climb Speed IAS (Knots)	Climb Speed TAS (Knots)
500	0 6	0 8	900	2.0	85	85
1,000	1.2	1 6	860	3 0	"	"
2,000	2 4	3.3	820	4 7	"	86
3,000	3.6	5 1	780	6 7	"	"
4,000	4 9	7.0	740	8 7	"	"
5,000	6.3	9.1	700	10.8	80	"
10,000	14 7	21.3	490	23 4	75	87

*Fuel consumed from start engines through lift-off 12 pounds

NOTE Deviation with change from gross weight not available from manufacturer

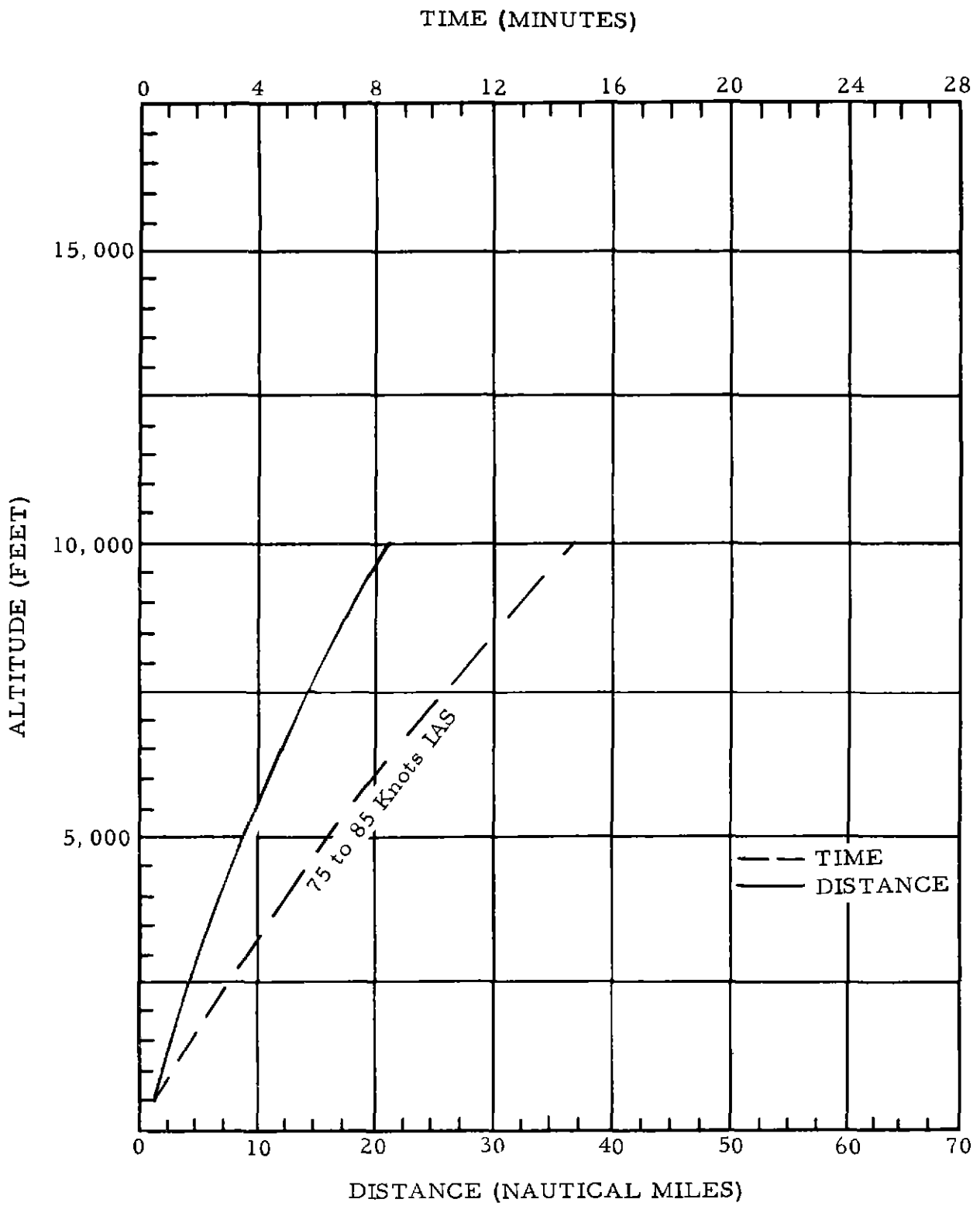


FIGURE 1 - CLIMB - DISTANCE AND TIME DATA

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.

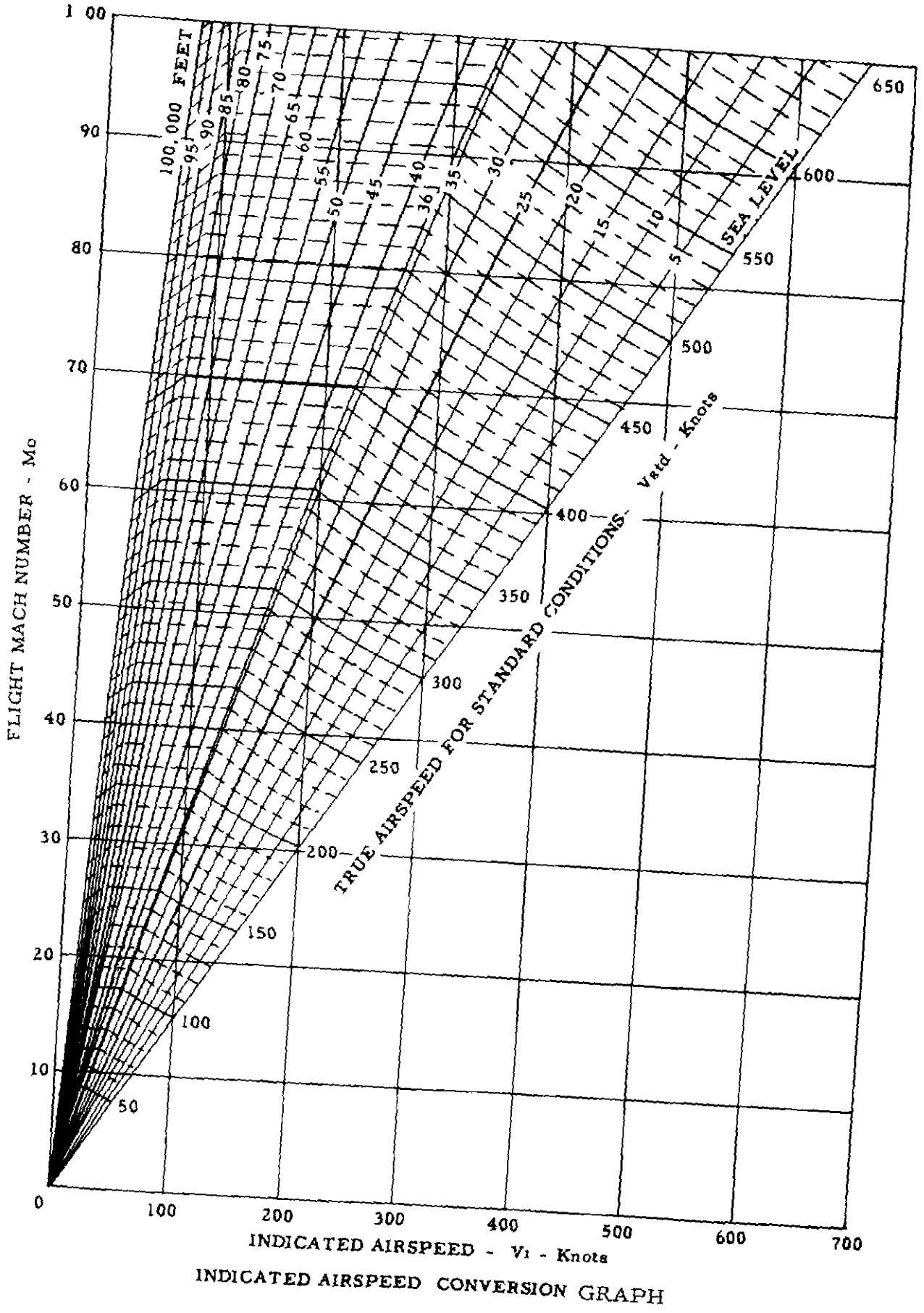
SPEED BRAKES Any aerodynamic device designed for slowing down an airplane in flight

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

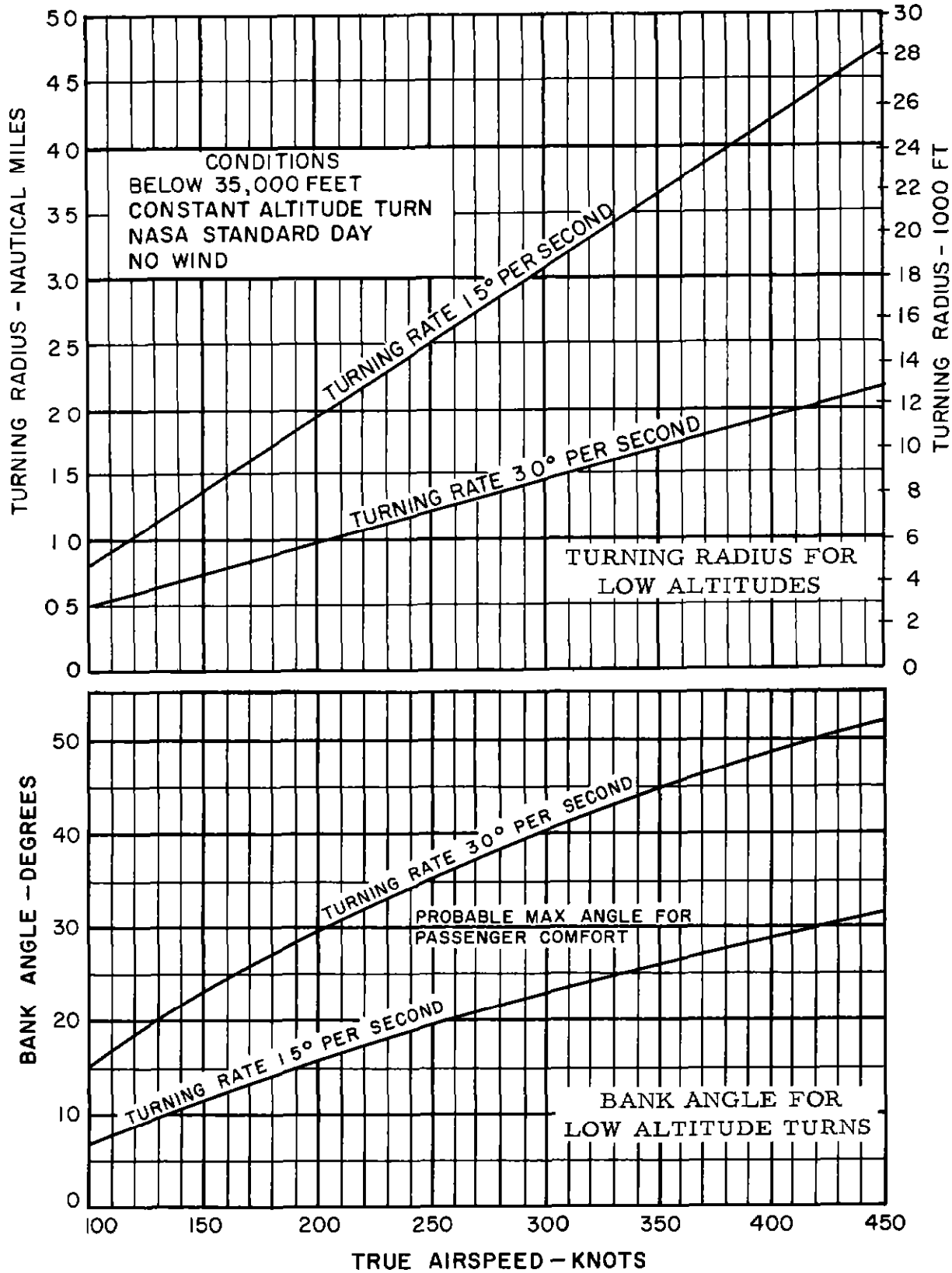
TRANSLATIONAL LIFT The lift force exerted on the rotor blades of a helicopter when increased speed is imparted to the blades or when their angle of attack is changed in going from one type of flight to another, such as from hovering to horizontal flight.

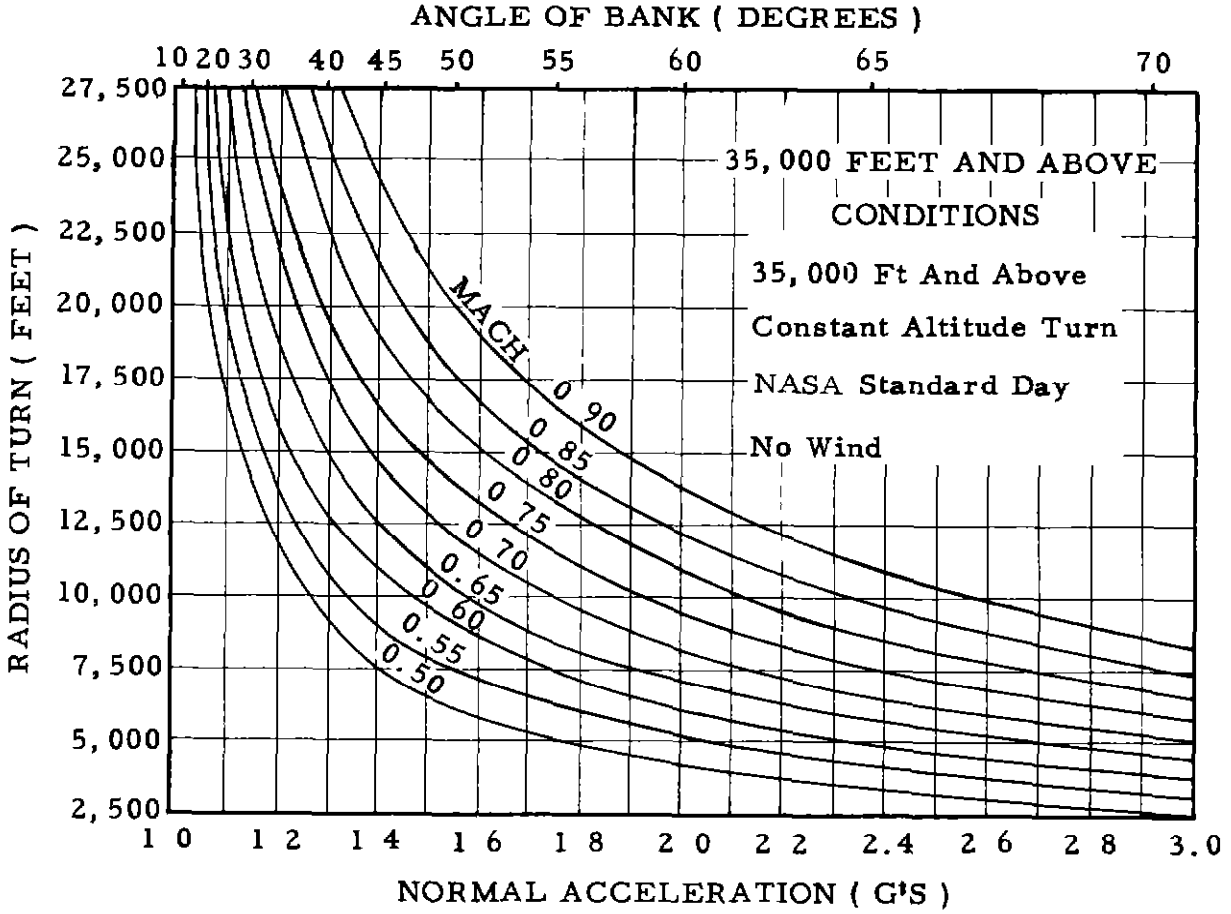
SYMBOLS AND ABBREVIATIONS

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



INDICATED AIRSPEED CONVERSION GRAPH


TURNING RADIUS - NAUTICAL MILES
TURNING RADIUS - 1000 FT
CONDITIONS
BELOW 35,000 FEET
CONSTANT ALTITUDE TURN
NASA STANDARD DAY
NO WIND
TURNING RATE 15° PER SECOND
TURNING RATE 30° PER SECOND
TURNING RADIUS FOR
LOW ALTITUDES
BANK ANGLE - DEGREES
TURNING RATE 30° PER SECOND
PROBABLE MAX ANGLE FOR
PASSENGER COMFORT
TURNING RATE 15° PER SECOND
BANK ANGLE FOR
LOW ALTITUDE TURNS
TRUE AIRSPEED - KNOTS



TURNING RADIUS GRAPH
HIGH ALTITUDES

CLIMB

The following equations are used in conjunction with the climb tables The equations will yield actual distance, time, rate of climb, and fuel consumed for given gross weight and atmospheric conditions. Normal values and deviations are contained in the tables. In substituting from the tables, divide all percentage values by 100

$$Da = Dn \left(1 + a \frac{Wa - Wn}{X}\right) \left(1 + b \frac{ta - ts}{10}\right)$$

$$Ta = Tn \left(1 + c \frac{Wa - Wn}{X}\right) \left(1 + d \frac{ta - ts}{10}\right)$$

$$Ra = Rn \left(1 - g \frac{Wa - Wn}{X}\right) \left(1 - j \frac{ta - ts}{10}\right)$$

$$Fa = Fn \left(1 + e \frac{Wa - Wn}{X}\right) \left(1 + f \frac{ta - ts}{10}\right)$$

Da - Actual climb distance
Dn - Normal climb distance
Ta - Actual climb time
Tn - Normal climb time
Ra - Actual rate of climb
Rn - Normal rate of climb
Fa - Actual fuel consumed
Fn - Normal fuel consumed
Wa - Actual gross weight
* Wn - Normal gross weight
ta - Ambient temperature (^{o} C)
ts - Standard day temperature (15^{o} C)
X - Unit pounds in which the deviation with gross weight is expressed

a - % Deviation in climb distance per X pounds change in gross weight
b - % Deviation in climb distance per 10^{o} change in temperature
c - % Deviation in climb time per X pounds change in gross weight
d - % Deviation in climb time per 10^{o} C change in temperature
e - % Deviation in climb fuel per X pounds in gross weight
f - % Deviation in climb fuel per 10^{o} C change in temperature
g - % Deviation in rate of climb per X pounds in gross weight
j - % Deviation in rate of climb per 10^{o} C change in temperature

* Symbol "Wn" refers to the gross weight given (either maximum, or normal) at the top of Table IA