

V. OPERATIONAL ANALYSISA. BASIC CONSIDERATIONS

1. FUEL - USABLE (Including outboard fuel tanks - total usable capacity approximately 7630 gals.)

a. Fuel Consumed - 110% Maximum Range Speed

Trip Length, miles (D)	529	965	1212	2187	3270	4110
BHP _{climb}	10600	10600	10600	10600	10600	10600
BHP _{cruise} (Average)	7100	7300	7500	7100	6700	6300
S.F.C.climb (Lb/BHP/Hr)	.71	.71	.71	.71	.71	.71
S.F.C.cruise (Lb/BHP/Hr)	.456	.459	.462	.456	.452	.448
Time to climb, hrs (T _C)	.42	.46	.48	.48	.48	.48
Time to Maneuver, hrs (T _t)	.17	.17	.17	.17	.17	.17
Distance of climb, mi.(D _C)	99	108	115	115	115	115
Cruising ground speed, mph (V _G) (0 mph headwind)	314	316	318	313	307	303
Total fuel consumed (lbs)*	7677	12698	15712	25546	35201	42180

b. Fuel Consumed - 1900 BHP per Engine

Trip Length, miles (D)	513	947	1210	2097	3017	3697
Altitude (Ft)	25000	25000	25000	25000	25000	25000
BHP _{climb}	10600	10600	10600	10600	10600	10600
BHP _{cruise}	7600	7600	7600	7600	7600	7600
S.F.C.climb (Lb/BHP-Hr)	.71	.71	.71	.71	.71	.71
S.F.C.cruise (Lb/BHP-Hr)	.464	.464	.464	.464	.464	.464
Time to climb, hrs (T _C)	.42	.46	.48	.48	.48	.48
Time to maneuver, hrs (T _t)	.17	.17	.17	.17	.17	.17
Distance of climb, mi (D _C)	99	108	115	115	115	115
Cruising ground speed, mph (V _G) (0 mph headwind)	325	322	320	324	327	329
Total fuel consumed (lbs)*	7677	12698	15712	25546	35201	42180

*Fuel consumption at 8.5 gals per hr has been included for operation of engine driven generators, cabin heating, and cabin cooling equipment.

- c. Reserve Fuel - 600 gallons
- 2. FUEL - AUXILIARY POWER
 - a. Fuel consumption at 8.5 gallons per hour has been included for operation of engine driven generators, cabin heating, and cabin cooling equipment.
- 3. OIL ON BOARD
 - a. Oil is 1/35 by volume of fuel.
- 4. WEIGHT CONSIDERATIONS
 - a. Maximum takeoff weight 135,000 lbs
 - b. Maximum payload (weight limit) 41,000 lbs
- 5. OPERATIONS CONDITIONS
 - a. Engine Power - 1900 BHP/ENG Cruising
 - (1) Maximum cruising power - Operation is shown from 513 miles to 3697 miles.
 - b. Engine Power - 110% speed for Maximum Range Cruising
 - (1) Operation is shown from 529 to 1110 miles.
 - c. Engine Power - Climb
 - (1) 2650 BHP/ENG
 - d. Winds
 - (1) 0 mph headwind for climb and cruising conditions
 - e. Altitude
 - (1) Trip length of 500 miles or over, 25,000 ft flight altitude.
 - f. Payload Factor
 - (1) 100% payload factor is used for all conditions.
 - g. Payload Determination
 - (1) Operation at 110% speed for maximum range.

(a) For ranges up to 1212 miles (0 mph headwind), for 7630 gal usable fuel, the payload is determined by the weight limit. For longer ranges the payload is determined by a takeoff weight of 135,000 lbs. For extreme ranges the fuel tank capacity is limiting.

(2) Operations at 1900 BHP/ENG

(a) For ranges up to 1210 miles (0 mph headwind) for 7630 gal usable fuel, the payload is determined by the weight limit. For longer ranges the payload is determined by a takeoff weight of 135,000 lbs. For extreme ranges the fuel tank capacity is limiting.

6. BLOCK SPEED DETERMINATION

The block speed is computed as follows:

$$V_b = \frac{D}{T_c + T_t + \left(\frac{D - D_c}{V_G}\right)}$$

See page 78 for terms in the above equation.

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B. PAYLOAD DATA

PAYLOAD DETERMINATION
Cruise at 110% Maximum Range Speed

1. Trip length, miles	529	965	1212	2187	3270	4110
2. Cruising true airspeed, mph	314	316	318	313	307	303
3. Block speed, mph	263	285	292	299	299	297
4. Operating weight empty, lbs	74324	74324	74324	74324	74324	74324
5. Fuel reserve, lbs	3600	3600	3600	3600	3600	3600
6. Fuel consumed, lbs	7677	12698	15712	25546	35201	42180
7. Payload (weight limit) lbs	41000	41000	41000	30789	20789	13564
80 pass. lbs.	16,000					
Cargo, lbs.	9,000					
8. Takeoff weight, lbs	126700	131800	135000	135000	135000	135000
9. Landing weight, lbs	119223	119402	119488	109654	100000	93020

Conditions:

Altitude - 25,000 ft cruising altitude

Wind - 0 mph headwind

The specific fuel consumption is based on the data given on page 66 of this report.

PAYLOAD DETERMINATIONCruise at 1900 BHP per Engine

1. Trip length, miles	513	947	1210	2097	3017	3697
2. Cruising true airspeed, mph	325	322	320	324	327	329
3. Block speed, mph	267	287	293	308	315	318
4. Operating weight empty, lbs	71324	71324	71324	71324	71324	71324
5. Fuel reserve, lbs.	3600	3600	3600	3600	3600	3600
6. Fuel consumed, lbs.	7677	12698	15712	25546	35201	42180
7. Payload (weight limit) lbs.	41000	41000	41000	30789	20789	13564
8. Takeoff weight, lbs.	126700	131800	135000	135000	135000	135000
9. Landing weight, lbs.	119223	119402	119488	109654	100000	93020

Conditions:

Altitude - 25,000 ft cruising altitude

Wind - 0 mph headwind

The specific fuel consumption is based on the data on page 66
of this report.

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C. DIRECT FLYING COST DATA

C. DIRECT FLYING COSTS

The direct flying costs are computed in accordance with the Air Transport Association 1944 "Method for Presentation of Data for Proposed Aircraft." The cost of the airplane, less engines and propellers is assumed at \$1,040,000. The cost of each engine is assumed at \$40,000 and the propellers at \$12,500 each. These figures, which represent estimated cost for a sizable production order, are believed reasonable for the purpose of computing operating costs, however, should not be considered a firm indication of actual selling price. The price of 115-145 grade fuel is assumed to be 16 cents per gallon. No allowance for headwind is made.

C. DIRECT FLYING COST DATA

1. Fixed Hourly Flying Costs

Dollars per hour (based on ATA method).

Oil Cost	\$4.85
Airframe Depreciation	32.38
Engine Depreciation	13.33
Engine Overhaul and Repair	21.87
Airframe overhaul and Repair	28.88
Airplane and Engine Ground Service	15.25
Pay: Pilot's	7.00
Co-Pilot's	2.33
Airplane Insurance	<u>24.66</u>
TOTAL FIXED HOURLY COSTS	\$150.25

2. Fixed per Mile Flying Costs

Dollars per mile (based on ATA method).

Pay: Pilot's	\$.02010
Co-Pilot's01155
Crew Expenses00450
Airplane Insurance	<u>.00130</u>
TOTAL FIXED PER MILE FLYING COSTS	\$.04045

3. Fuel Costs

Dollars per mile (based on ATA method).

$$\text{Fuel Cost} = \frac{2.667 \times \text{fuel consumed for range in lbs.}}{\text{Range in miles}}$$



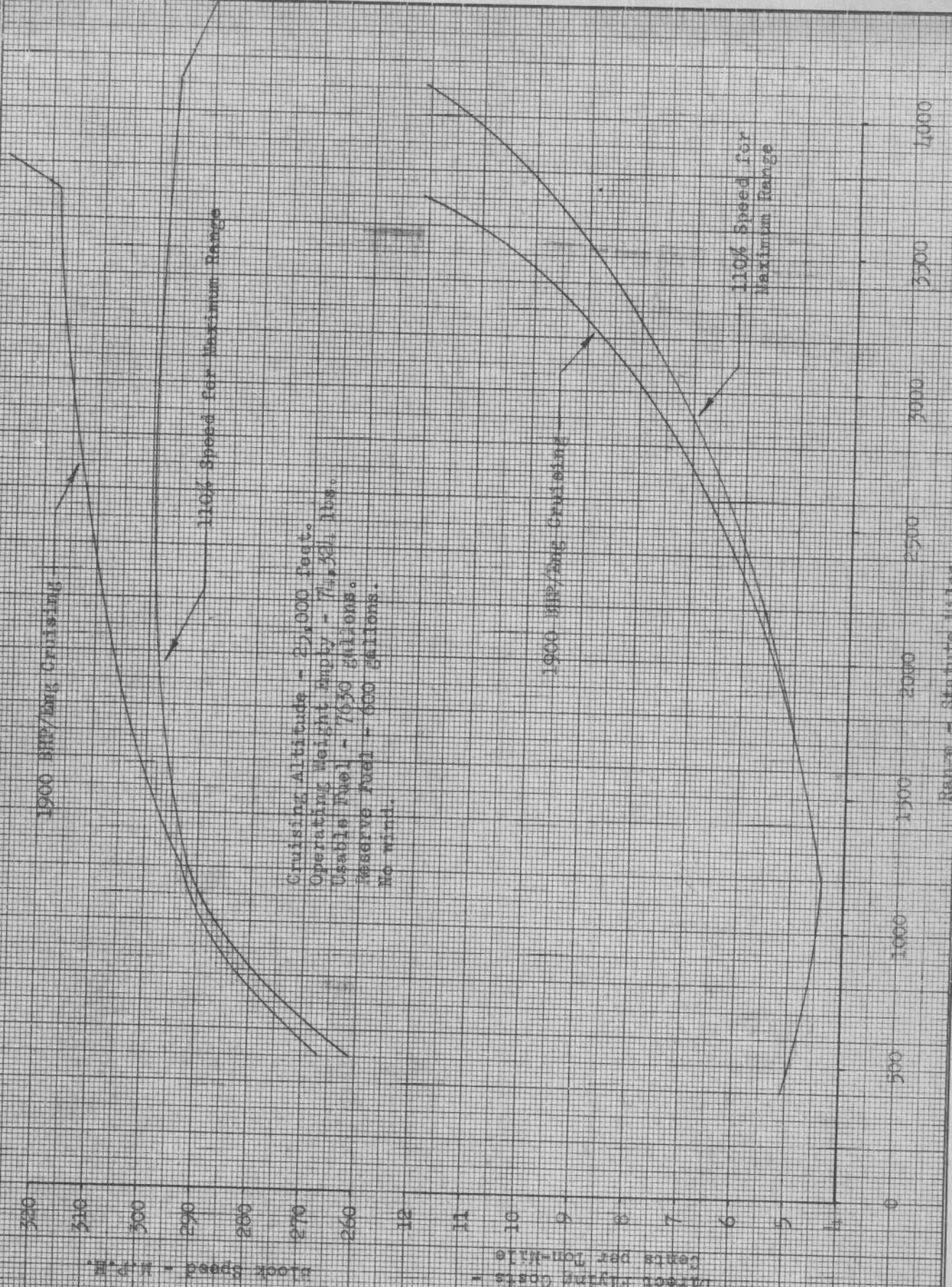
C. DIRECT FLYING COSTS DATA

4. DIRECT FLYING COSTS

	<u>110% Maximum Range Speed</u>					
Trip Length - Miles	529	965	1212	2187	3270	4110
Block Speed - m.p.h.	263	285	292	299	299	297
Payload - lbs.	41,000	41,000	41,000	30,789	20,789	13,564
Airplane Mile Costs (From Fixed Hourly Flying Costs)*	57.24	52.82	51.56	50.35	50.35	50.78
Fixed Per Mile Flying Costs	4.05	4.05	4.05	4.05	4.05	4.05
Fuel Cost (Per Airplane Mile)	38.68	35.07	34.58	31.16	28.71	27.37
Total Airplane Mile Cost (Cents per Airplane Mile)	99.97	91.94	90.19	85.56	83.11	82.20
Total Ton-Mile Cost (Cents per Ton Mile)	4.88	4.49	4.40	5.55	8.01	12.09

	<u>Maximum Cruising Power - 1900 BHP/Eng</u>					
Trip Length - Miles	513	947	1210	2097	3017	3697
Block Speed - m.p.h.	267	288	293	308	315	318
Payload - lbs.	41,000	41,000	41,000	30,789	20,789	13,564
Airplane Mile Costs (From Fixed Hourly Flying Costs)*	56.39	52.37	51.21	48.88	47.79	47.34
Fixed per Mile Flying Costs	4.05	4.05	4.05	4.05	4.05	4.05
Fuel Cost (per Airplane Mile)	39.89	35.73	34.63	32.49	31.12	30.43
Total Airplane Mile Cost (Cents per Airplane Mile)	100.33	92.15	89.89	85.42	82.96	81.82
Total Ton-Mile Cost (Cents per Ton Mile)	4.89	4.50	4.39	5.54	7.99	12.01

*Airplane Mile Costs = $\frac{\text{Total Fixed Hourly Costs}}{V_b \text{ for Given Range}}$



Cruising Altitude - 23,000 feet.
 Operating Weight empty - 74,361 lbs.
 Usable Fuel - 7650 gallons.
 Reserve Fuel - 600 gallons.
 No wind.

CALC	KJL	5-7-46	REVISED	DATE
CHECK	JSC	5-8-46		
APR	HAASE	5-9-44		
APR				

DIRECT FLYING COSTS AND BLOCK SPEED
 VS. RANGE

BOEING AIRCRAFT COMPANY
 SEATTLE WASHINGTON

377-10-33
 (Cargo)

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CONTRACT NO.

