PART 9 - MISSION PLANNING

TABLE OF CONTENTS

INTRODUCTION 9-1
DEFINITIONS 9-1
MISSION PLANNING - ALL ENGINES OPERATING 9-2
IN-FLIGHT DIVERSION - ONE ENGINE INOPERATIVE 9-4

LIST OF FIGURES

9-1 Fuel and Time Prediction at Long Range Speed. 2 Engines 9-6
9-2 Mission Planning at Maximum Cruise. (CRZ1). 2 Engines 9-8
9-3 Mission Planning at Maximum Endurance. (CRZ2). 2 Engines 9-10
9-4 Mission Planning at Long Range. 1 Engine 9-12

INTRODUCTION

This part presents charts for use in determining both the time and total fuel required to accomplish the typical mission identified below.

The typical mission considered herein is defined as a transport mission of a given cargo weight between two airfields located at sea level; climb; cruise at either maximum speed, long range speed, or maximum endurance speed; descent; approach and landing to destination airfield; deviation to alternate airfield. The reserve fuel may account for a deviation to an alternate airfield, or for a holding flight during a given time, or for a percentage of the trip fuel.

When the mission profile under consideration is different from the typical mission shown above, the foregoing charts may nevertheless be used together with the performance data of parts from 4 to 7 to determine the time and fuel required to accomplish the mission.

Additionally, charts are provided for use when consideration of the typical in-flight diversion after an engine failure in flight is required.

The typical in-flight diversion after engine failure assumed herein, consists of driftdown; cruise; descent; approach and landing.

In case of an emergency condition, i.e. failure of one engine during cruise operation, the charts shown in paragraph for one engine inoperative may be used to determine the fuel and time required to accomplish the in-flight diversion to a given airfield.

DEFINITIONS

Taxi-out fuel

Taxi-out fuel is the fuel burned from engine start to brake release prior to takeoff. A typical value is 20 Kg (44 lb) for a 5 minutes taxi-out.

Trip Fuel

It is the fuel required to fly from the departure airfield to the destination airfield. This part includes the following phases:

- Takeoff: A typical value is 25 Kg (55 lb) for 2 minute at takeoff power.
- Climb
- Cruise
- Descent
- Approach and landing: A typical value is 10 Kg (22 lb) for 2 minutes.

The corresponding values of fuel and time for climb, cruise and descent phases may be determined from the appropriate charts of Figure 9-1, Figure 9-2 and Figure 9-3.

Reserve Fuel

There are three types of reserve fuel:

1. A given percentage of the total mission fuel.
2. Fuel for deviation to an alternate airfield including:
   - Climb
   - Cruise: At long range cruise.
   - Descent.
   - Approach and landing.
3. Holding: It is the fuel required to fly during a given interval time at holding speed and at a given altitude over the destination/alternate airfield. The fuel required for holding may be determined from fuel flow values shown on charts of part 6.

MISSION PLANNING - ALL ENGINES OPERATING

The mission planning data for 2 engines operating case are presented on Figure 9-1, Figure 9-2 and Figure 9-3. These charts are used to predict fuel required and time required for a given mission distance at long range speed, maximum cruise speed and maximum endurance speed respectively.

The following table shows the power/speeds schedule assumed for each part of the mission:

	Speed at cruise portion of the mission		
	Long Range Speed (*)	Maximum Cruise Speed	Maximum Endurance Speed
Climb	Maximum Climb Power (CLB - 95% N_P) 140/130 KIAS		
Cruise	Long Range Power (CRZ1 - 90% N_P)	Maximum Cruise Power (CRZ1 - 90% N_P)	Maximum Endurance Power (CRZ2 - 80% N_P)
Descent	200 KIAS - flight idle - 90% N_P		
Charts (**)	Figure 9-1	Figure 9-2	Figure 9-3

(*) The long range speed is corrected due to the wind as described in part 5.

(**) The charts are presented in two sheets:

- Sheet 1 presents the fuel and time required for long mission distances (distance scale is shown up to 3000 NM).
- Sheet 2 presents the fuel and time required for short or medium mission distances (mission scale extends up to 600 NM).

The charts may be used in two ways:

- Direct way: For a given mission distance and initial gross weight, the fuel and time required may be predicted.
- Inverse way: For a given gross weight and fuel quantity allowable, the distance travelled and time required may be predicted.

Effect of ISA Deviation

The charts presents data for a standard day. The variation of fuel and time required for a given mission, due to the temperature variation from a standard day is as follows:

		Long Range Cruise	Maximum Cruise	Maximum Endurance
Fuel increase per each 10°C	Above standard day	Negligible	-2.5 %	+1 %
	Below standard day	Negligible	+2.5 %	-1 %
Time increase per each 10°C	Above standard day	-1 %	+3 %	-2 %
	Below standard day	+1%	-3 %	+2 %

Drag Index Correction

The correction of fuel and time required due to drag index for a given mission distance is as follows per each 50 units of DI:

	Long Range Cruise	Maximum Cruise	Maximum Endurance
Fuel Increase	+5 %	+5 %	+5 %
Time Increase	+4 %	+5 %	+2 %

Effect of Engine Anti-ice

The change in the fuel and time required to perform a given mission due to the operation of this system are shown in the following table:

	Long Range Cruise	Maximum Cruise	Maximum Endurance
Fuel Increase	Negligible	Negligible	+1 %
Time Increase	Negligible	Negligible	Negligible

Use of Graphs

Figure 9-1, Figure 9-2 and Figure 9-3, sheet 1. Enter on the bottom scale with a given distance. If the correction due to wind is applicable, move parallel to the guidelines (to the left, tailwind; to the right, headwind) until the wind speed is reached, and then, vertically upwards to intersect the appropriate flight level curve on both graphics (fuel and time required). From these points move horizontally towards the right to the next reference line. The move parallel to the guidelines until the appropriate initial weight is reached, and then, horizontally towards the right to read the fuel required (on the vertical scale at bottom) and time (on the top vertical scale).

Figure 9-1, Figure 9-2 and Figure 9-3, sheet 2. Proceed in the same way that in the before paragraph. This graph is used for short and medium distances.

Example

Given:

1. Maximum Cruise, all engines operating.
2. Flight level: 250.
3. Cruise Distance: 1400 mn.
4. Initial Weight: 21500 kg.
5. ISA Deviation: -10°C.
6. Engine A/I: off.
7. Headwind: 80 Knots.
8. Flaps: UP

Results:

1.	Fuel (Figure 9-2) 4550×1.025	4664 kg
2.	Time (Figure 9-2) 520×0.97	504 min

IN-FLIGHT DIVERSION - ONE ENGINE INOPERATIVE

One engine inoperative in-flight diversion chart is presented on Figure 9-4. This chart is used to predict fuel required and time required to reach a given distance to the airfield, at a given initial gross weight. The chart apply to in-flight diversions conducted at long range speeds. Assuming that the diversion consist of:

- Cruise: At long range speed (100% N_P).
- Descent: At 170 KIAS and flight idle power (100% N_P).

The chart shown is valid only for either short and medium mission distances (distance scale extends up to 600 NM). The chart may be used in two ways:

- Direct way: For a given mission distance and initial gross weight, the fuel and time required may be predicted.
- Inverse way: For a given gross weight and fuel quantity allowable, the distance travelled and time required may be predicted.

Effect of ISA Deviation

The charts present data for a standard day. The variation of fuel and time required for a given mission, due to the temperature variation from a standard day is as follows:

Fuel increase	Negligible
Time increase	+1.5 %

Drag Index Correction

The correction of fuel and time required for a given mission distance per each 50 units of DI is:

Fuel increase	+6 %
Time increase	+3 %

Effect of Engine Anti-ice

The effect of Engine Anti-ice is negligible.

Use of Graphs

Figure 9-4. Proceed as the same way as the Figure 9-1, Figure 9-2 and Figure 9-3.

FUEL AND TIME PREDICTION
MISSION PLANNING 2 ENGINES
LONG RANGE SPEED (90% N_P)- LARGE DISTANCES

DATE: JUL. 2000
DATA BASIS: FLIGHT TEST

AIRCRAFT: C-295M
ENGINES: PW 127-G
PROPELLERS: HS 568F-5

FLAPS: UP (0º)
CLIMB: 140/130 KIAS, CLB
CRUISE: LONG RANGE (90% N_P)
DESCENT: 170/190 KIAS FLIGHT IDLE

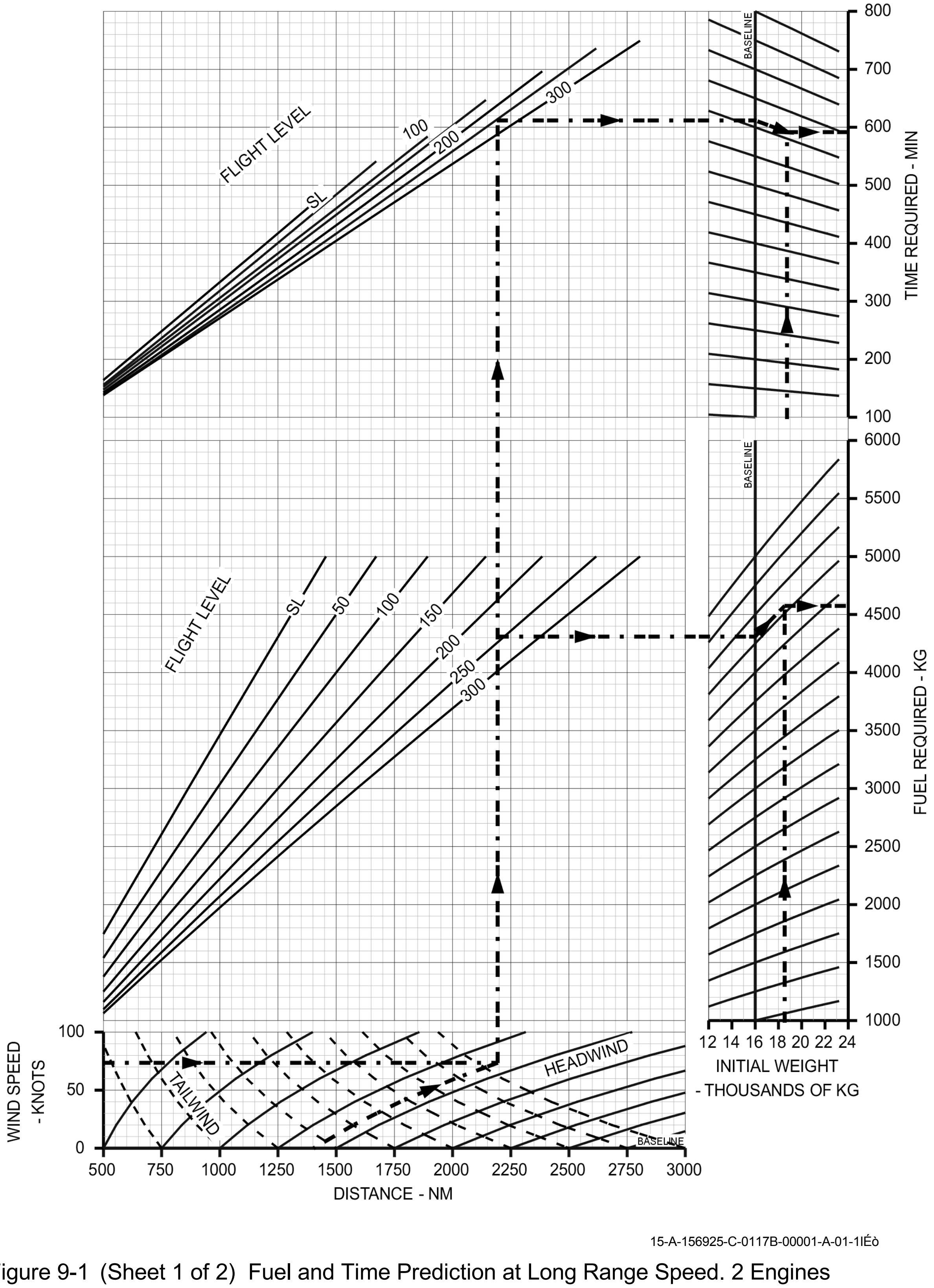

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Figure 9-1 (Sheet 1 of 2) Fuel and Time Prediction at Long Range Speed. 2 Engines

FUEL AND TIME PREDICTION
MISSION PLANNING 2 ENGINES
LONG RANGE SPEED (90% N_P)- MEDIUM AND SHORT DISTANCES

DATE:	JUL. 2000	**AIRCRAFT:**	C-295M	**FLAPS:**	UP (0º)
DATA BASIS:	FLIGHT TEST	**ENGINES:**	PW 127-G	**CLIMB:**	140/130 KIAS, CLB
		PROPELLERS:	HS 568F-5	**CRUISE:**	LONG RANGE (90% N_P)
				DESCENT:	170/190 KIAS FLIGHT IDLE

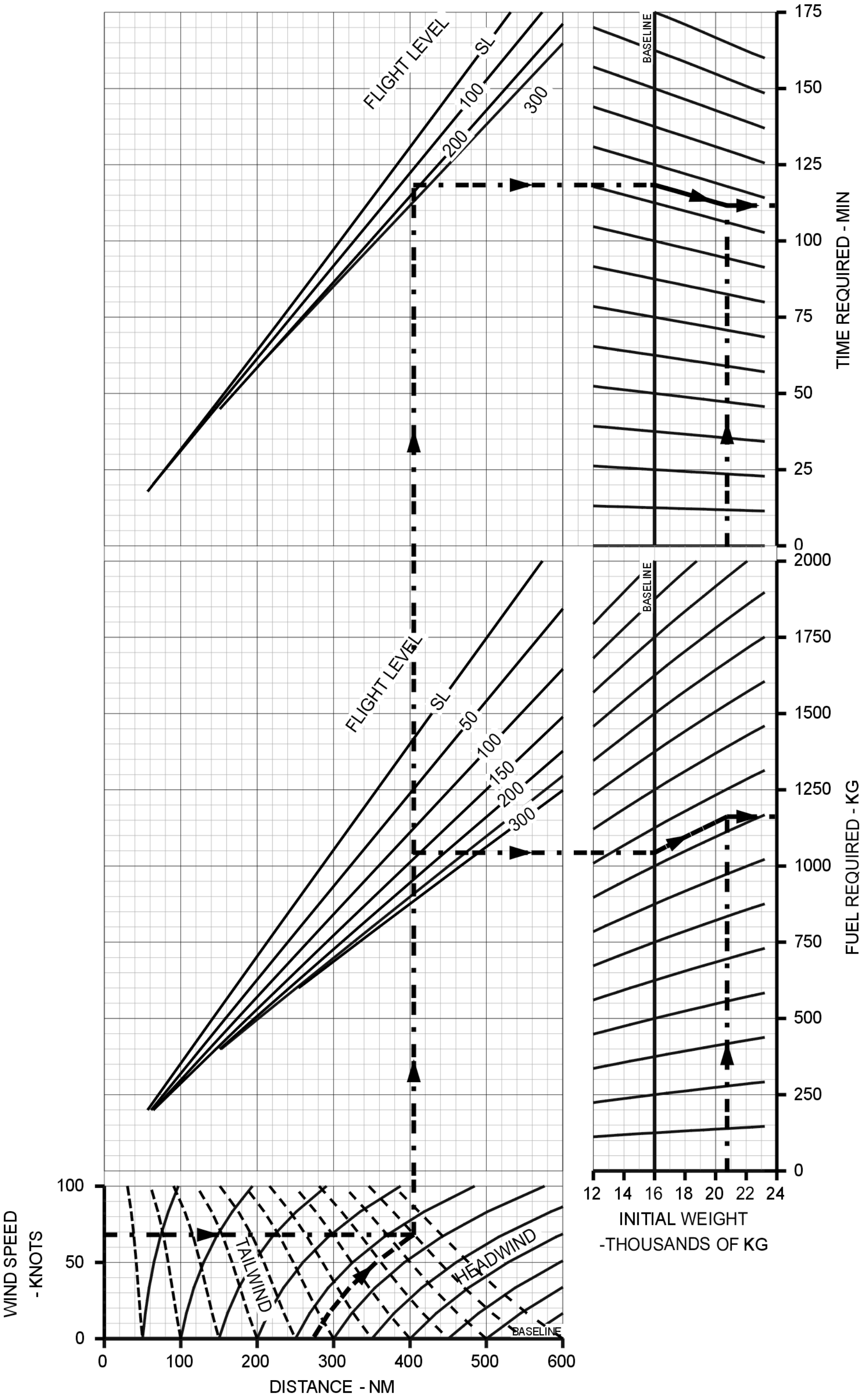

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Figure 9-1 (Sheet 2 of 2) Fuel and Time Prediction at Long Range Speed. 2 Engines

FUEL AND TIME PREDICTION
MISSION PLANNING 2 ENGINES
MAXIMUM SPEED (CRZ1)- LARGE DISTANCES

DATE: JUL. 2000
DATA BASIS: FLIGHT TEST

AIRCRAFT: C-295M
ENGINES: PW 127-G
PROPELLERS: HS 568F-5

FLAPS: UP (0º)
CLIMB: 140/130 KIAS, CLB
CRUISE: MAXIMUM SPEED (CRZ1)
DESCENT: 170/190 KIAS FLIGHT IDLE

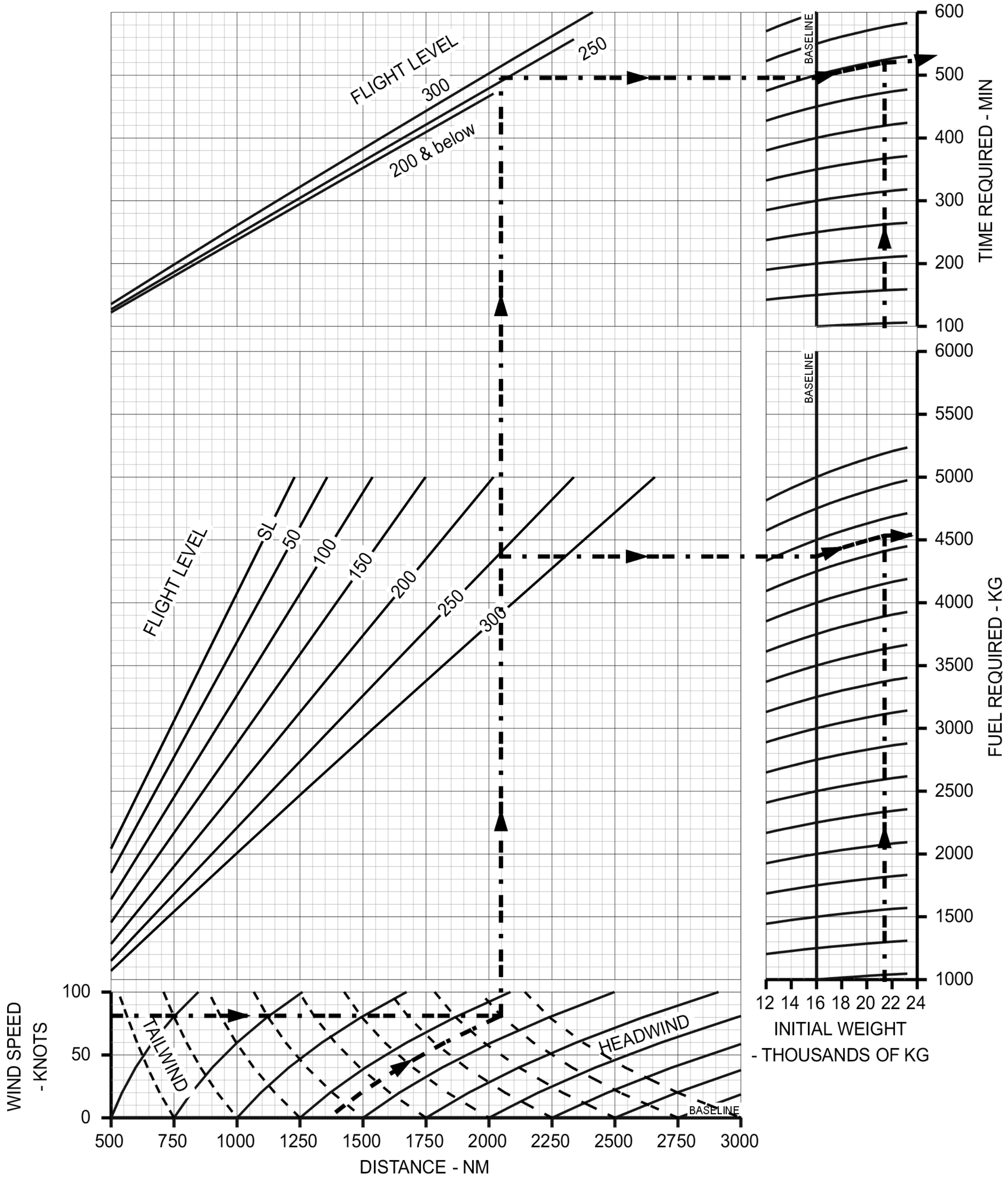

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Figure 9-2 (Sheet 1 of 2) Mission Planning at Maximum Cruise. (CRZ1). 2 Engines

FUEL AND TIME PREDICTION
MISSION PLANNING 2 ENGINES
MAXIMUM SPEED (CRZ1)- MEDIUM AND SHORT DISTANCES

DATE: JUL. 2000
DATA BASIS: FLIGHT TEST

AIRCRAFT: C-295M
ENGINES: PW 127-G
PROPELLERS: HS 568F-5

FLAPS: UP (0º)
CLIMB: 140/130 KIAS, CLB
CRUISE: MAXIMUM SPEED (CRZ1)
DESCENT: 170/190 KIAS FLIGHT IDLE

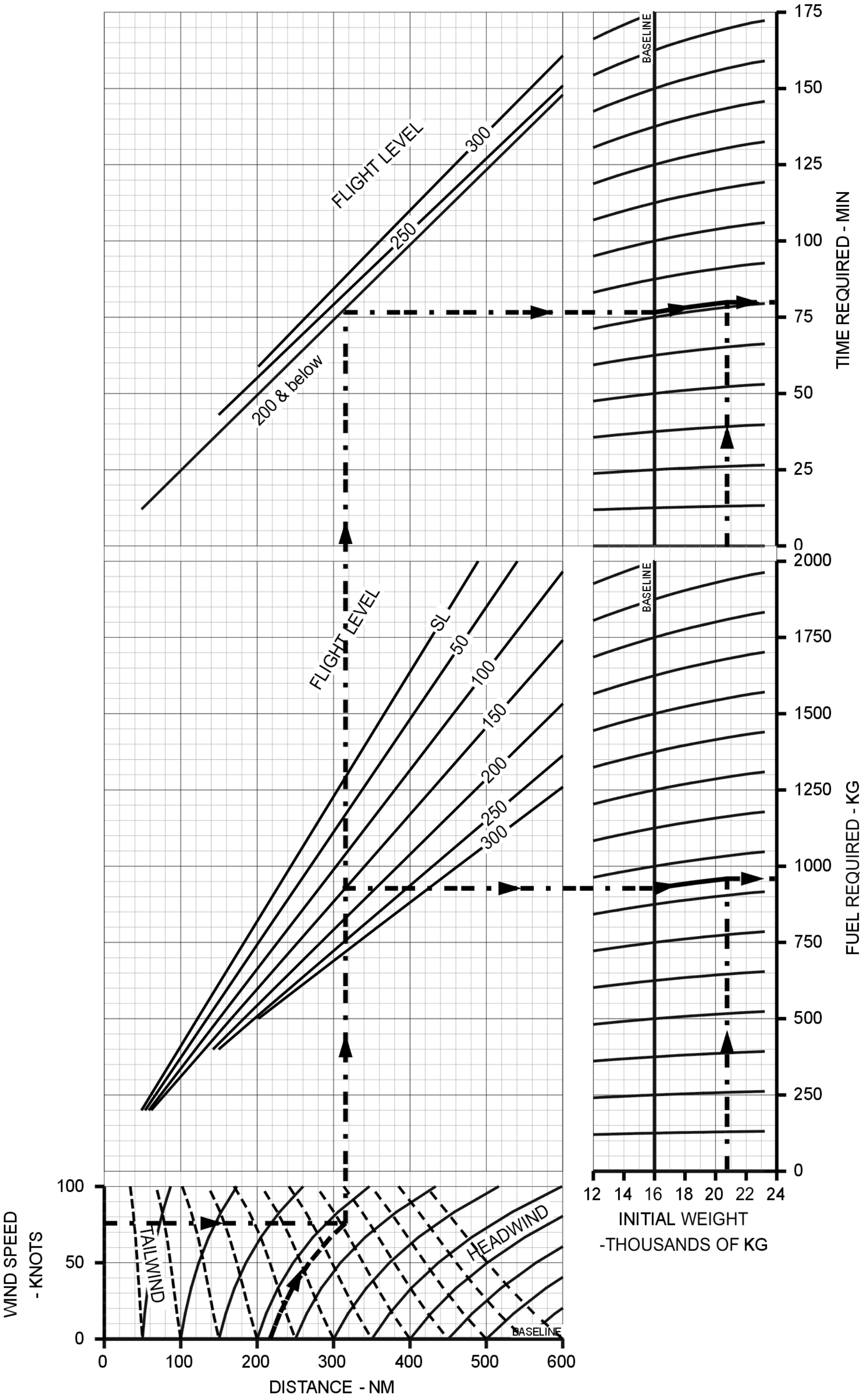

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Figure 9-2 (Sheet 2 of 2) Mission Planning at Maximum Cruise. (CRZ1). 2 Engines

FUEL AND TIME PREDICTION
MISSION PLANNING 2 ENGINES
MAXIMUM ENDURANCE SPEED (CRZ2)- LARGE DISTANCES

DATE: JUL. 2000
DATA BASIS: FLIGHT TEST

AIRCRAFT: C-295M
ENGINES: PW 127-G
PROPELLERS: HS 568F-5

FLAPS: UP (0º)
CLIMB: 140/130 KIAS, CLB
CRUISE: MAX. ENDURANCE (CRZ2)
DESCENT: 170/190 KIAS FLIGHT IDLE

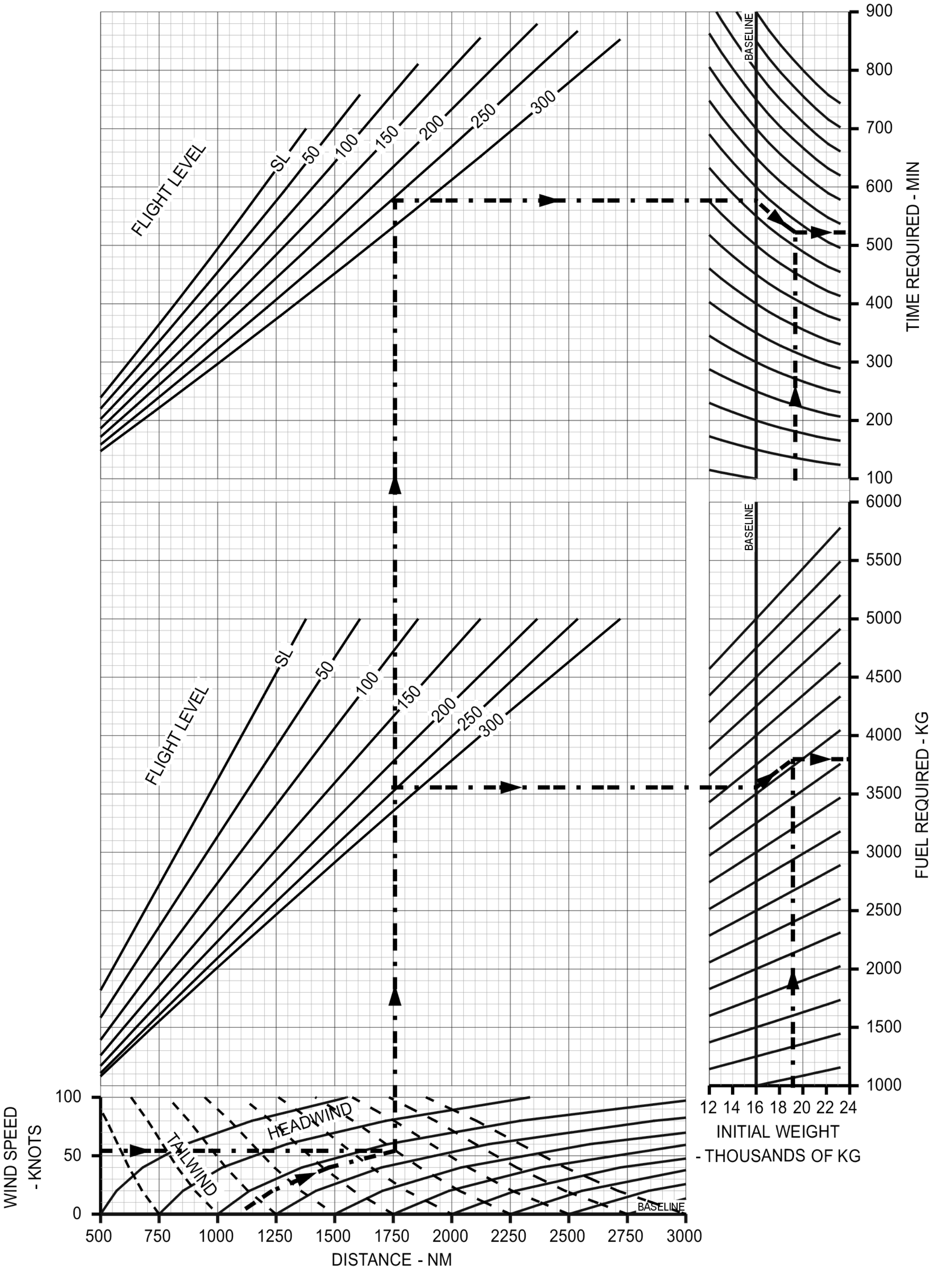

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Figure 9-3 (Sheet 1 of 2) Mission Planning at Maximum Endurance. (CRZ2). 2 Engines

FUEL AND TIME PREDICTION
MISSION PLANNING 2 ENGINES
MAXIMUM ENDURANCE SPEED (CRZ2)
MEDIUM AND SHORT DISTANCES

DATE: JUL. 2000
DATA BASIS: FLIGHT TEST

AIRCRAFT: C-295M
ENGINES: PW 127-G
PROPELLERS: HS 568F-5

FLAPS: UP (0º)
CLIMB: 140/130 KIAS, CLB
CRUISE: MAX. ENDURANCE (CRZ2)
DESCENT: 170/190 KIAS FLIGHT IDLE

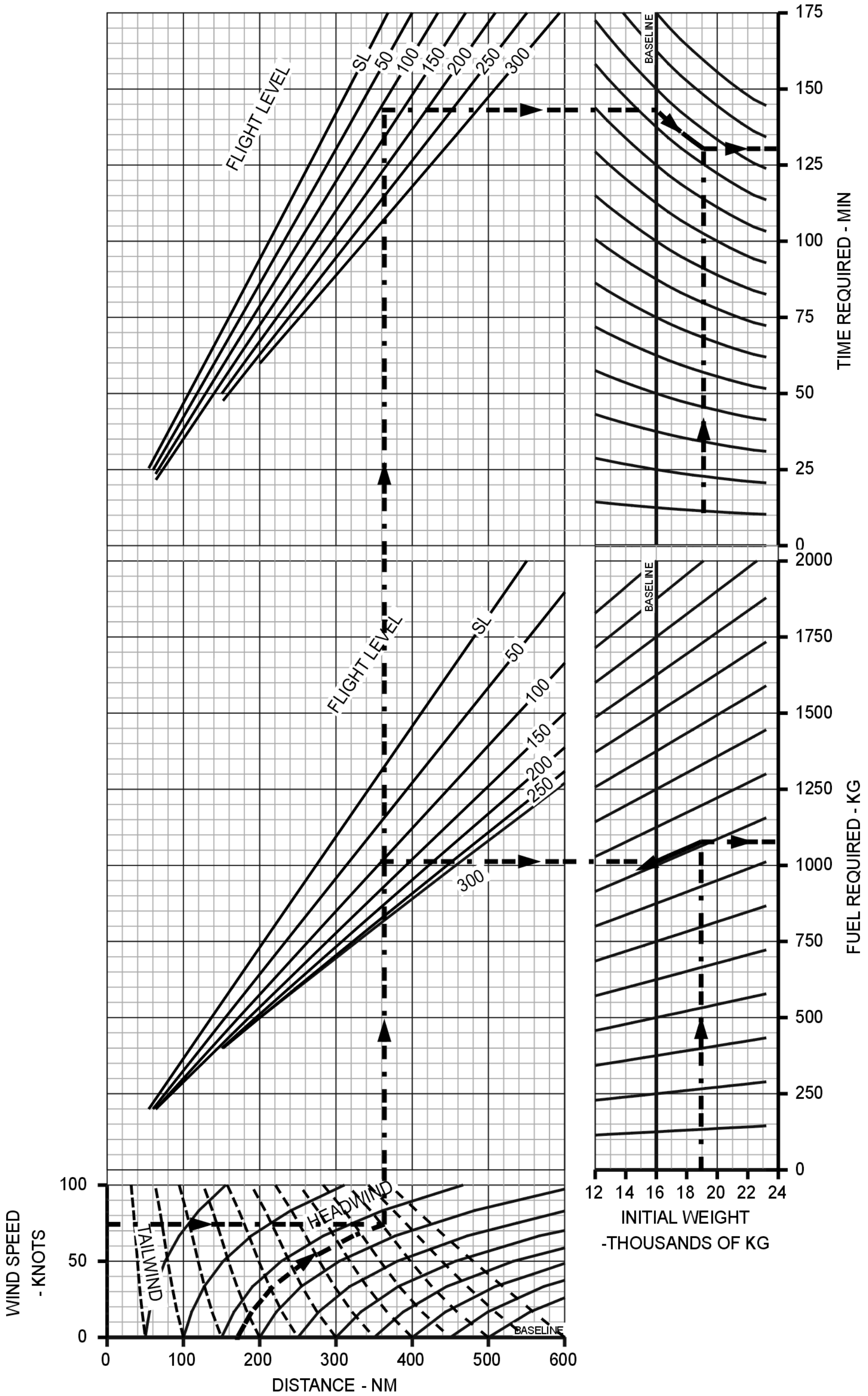

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Figure 9-3 (Sheet 2 of 2) Mission Planning at Maximum Endurance. (CRZ2). 2 Engines

FUEL AND TIME PREDICTION
MISSION PLANNING 1 ENGINE
LONG RANGE SPEED

DATE: JUL. 2000
DATA BASIS: FLIGHT TEST

AIRCRAFT: C-295M
ENGINES: PW 127-G
PROPELLERS: HS 568F-5

FLAPS: UP (0º)
CRUISE: LONG RANGE SPEED
DESCENT: 170 KIAS FLIGHT IDLE

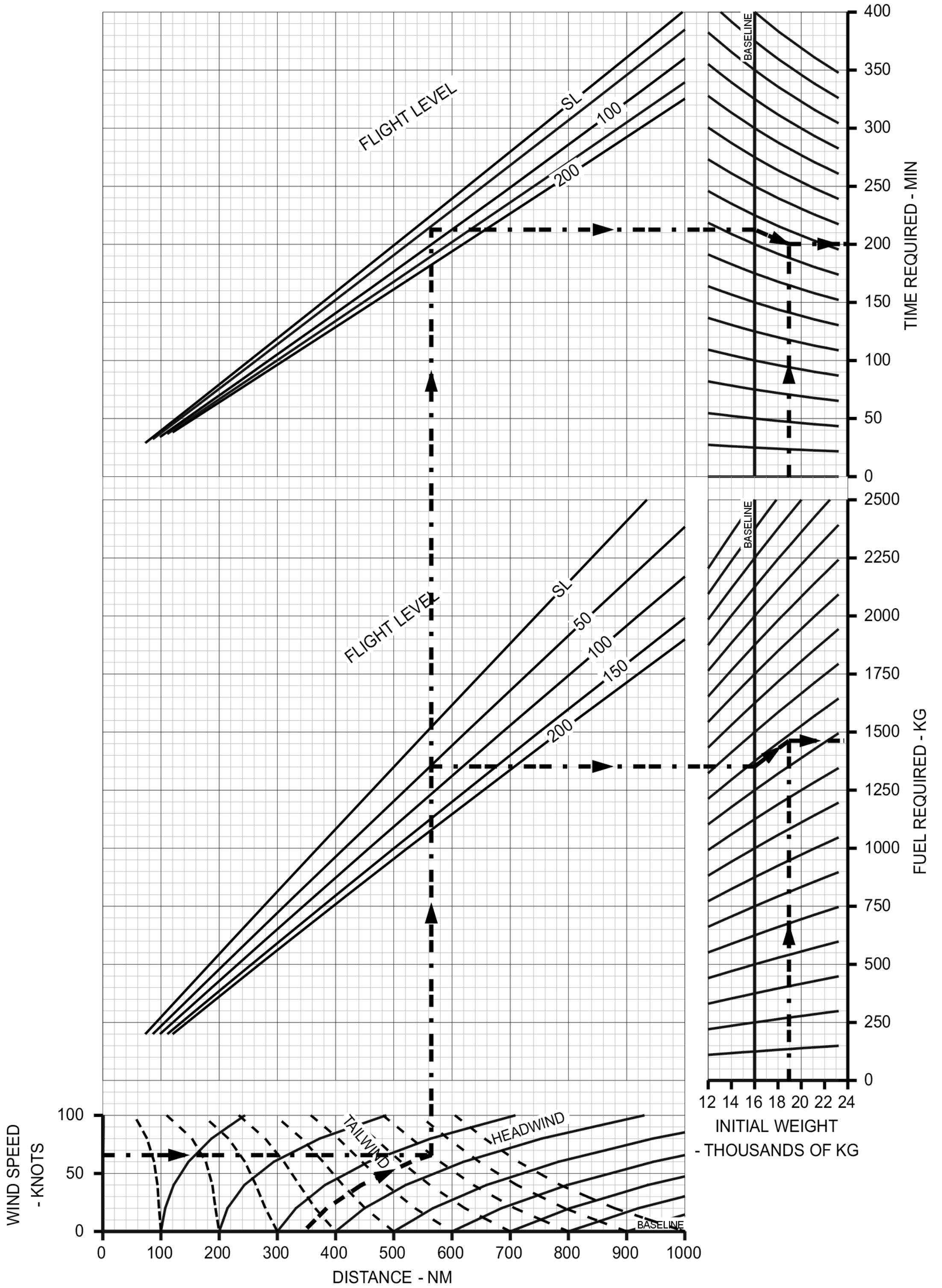

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Figure 9-4 Mission Planning at Long Range. 1 Engine