

FLYING THE JET CITY AIRCRAFT DC-9 SERIES 40

The DC-9 Series 40 is a fairly forgiving airplane provided you understand some basic fundamentals about it. The purpose of this brief guide is to walk you through a flight in the DC-9, pointing out some key features and characteristics of the airplane that will help you to pilot it successfully.

This document is not intended for real world flight and is by no means a complete “how to fly” document, as many specific aspects of flying involve specific settings in the cockpit that we won’t cover here. Because users of this airplane could be using a variety of cockpit environments, we will do our best to keep descriptions as generic as possible and will omit panel-specific procedures where we can. Please note that the speeds and figures listed below are only for general reference only; your airplane may need slight adjustments to account for aircraft weight, engine thrust, and weather conditions, but overall the figures below will work in most situations.

Are you ready? Let’s get started!

PREPARATION

One of the most important parts of a successful flight is being prepared. Plan your flight, know your routing, and plan your fuel load accordingly.

COMPUTING MINIMUM DISPATCH FUEL

The following flight plan factors must be considered to determine the dispatch minimum fuel requirements:

- Flight plan fuel as calculated
- Alternate fuel as calculated
- Taxi fuel: 400 lbs for each stop
- Reserve: 3500 lbs
- Holding Fuel: 4400 lbs
- Instrument Approach: 500 lbs for each approach

The sum of all factors will provide the minimum fuel requirements for the flight and should not be less than 5,000 lbs.

We have provided a fuel and flight planning quick reference chart at the end of this document to assist you with your fuel planning.

Once in the cockpit, prepare the airplane for the flight as per cockpit procedure. At this time, load up the fuel you’ll need for your flight. When you’re ready to go, turn on the rotating beacons and switch to external view to do a quick visual check of the airplane to make sure your doors are all closed and ground service equipment is out of the way. Since you are outside the airplane, now is a good time to check the movement of your flight controls – rudder, elevators, stabilizer trim, ailerons, and spoilers should all move freely. Switch back to cockpit view and let’s get going.

PUSHBACK, STARTUP, and TAXI

Push back from the gate and go ahead and start your left (No. 1), or port engine. When it’s stable, you can start the right (No. 2), or starboard engine. In the DC-9, you can start engines at the gate and powerback (at certain airports), start them during the pushback process, or push back, set the parking brake, and start them at that point. Whichever way, once your engines are running and you are cleared to taxi, the fun begins.

Turn on your taxi lights, release the parking brake, and advance the throttles to approximately 45% N1. The airplane will slowly move forward. You may need slightly more or less N1 depending on winds and aircraft weight.

Keep the nose wheel centered until the aircraft starts rolling then apply pressure to the nose wheel steering to make the desired turn. Differential power or wheel braking may be used for sharp turns but do not lock the pivot wheels as this causes premature tire wear.

Keep engine RPM below 45% N1 when departing the gate where possible. Once clear of the gate area, you can increase thrust to achieve a taxi speed of between 10 and 20 knots. Taxiing at around 40-45% N1 should allow you to maintain a fairly consistent taxi speed (this is a higher N1 setting than in the real plane, but the simulator doesn't model ground handling well). After leaving the ramp, verify that your stabilizer trim and flaps are at the proper takeoff settings, and spoilers are retracted. Normal takeoff flap setting for the Series 41 is Flaps 5. In certain circumstances, a takeoff setting of Flaps 0 (long runways) or Flaps 15 (short and/or slick runways) can also be used.

TAKEOFF AND CLIMBOUT

When clearance is received for takeoff, scan the annunciator panel and taxi onto the runway. Set the heading bug on the runway heading as an aid in maintaining directional control in the event an engine fails after V1.

Turn on your landing lights, and press SHIFT-W to extend them into position out of the wingtips. Turn on your strobes at this time as well.

When beginning your takeoff roll, smoothly advance throttles to around 50% N1 and allow your engines to spool up a bit. Scan your engine instruments for abnormal indications. If all is OK, continue advancing the throttles until reaching takeoff EPR (See Chart). Have your takeoff power set by 60 knots.

At VR, initiate a smooth pull back on the yoke to create a five to six second interval to rotate to approximately 15° pitch attitude.

Minimum altitude for engaging the autopilot is 600 feet AGL.

With a positive rate of climb indicated on the altimeter, retract the landing gear. Continue the climb to 1,000 feet AGL at minimum V2+10 airspeed. No turns are to be made below 300ft AGL.

Passing 3,000 feet, set climb thrust (approx 1.8 EPR) and accelerate to 250 knots at a 500 to 1,000 ft/min climb rate. Once at 250 knots, increase your climb rate to maintain 250 knots to 10,000 feet. Your climb rate should be between 1,500 and 3,500 ft/min depending on the aircraft weight, engine performance, and weather.

At 10,000 feet, turn off your landing lights and retract them by pressing SHIFT-W. Lower the climb rate to approximately 1,000 ft/min and let the airplane accelerate to a climb speed of 290 knots. At 290 knots, raise the nose again and maintain a 290 knot climbout to FL 280. You may need to increase EPR to maintain speed, but not more than an EPR of 2.3. Above 280, maintain a mach speed of .72 - .74 up cruise altitude.

If you are using the autopilot to maintain your climb rate, about 1,000 feet before capturing your cruise altitude, lower the vertical speed setting in the autopilot to 500-700 ft/min. This will enable a nice, smooth altitude capture (as the ability of the simulator to capture an altitude is less than optimal in most aircraft).

***NOTE:** Because of the design limitations of the autopilot in the simulator, many self-taught virtual pilots think that climbing up to cruise altitude is as simple as setting the autothrottle, altitude, and vertical speed, then kicking back and enjoying the ride. This is NOT a realistic way to climb in an airliner! Operating a large jet requires constant monitoring of EPR or N1 fan speed, air speed, and climb rate; it's not a "Set it and forget it" type of deal. As you are learning, it's almost easier to control the airplane's climb manually than with the autopilot vertical speed settings. What you want to do is set your climb EPR and then adjust your rate of climb higher or lower in order to maintain a certain air speed. Remember that as you get higher, it takes more power to climb and maintain that airspeed... The reaction is to give it more throttle, but you need to do avoid touching the throttles and instead reduce your rate of climb, which will in turn allow you to maintain your*

airspeed. You may be able to climb at 3,000 ft/min at FL100 and by the time you are at FL280, your climb rate may be as little as 500 ft/min in order to maintain 290 knots and your climb EPR setting. This is perfectly normal when flying airliners. And of course, the settings you use today may not be the same as what you need tomorrow, as aircraft weight and weather impact performance greatly. That's part of the fun of flying... it's always different!

CRUISE

Do not normally exceed .76 mach during cruise. Max cruise speed is .78 mach, normal cruise speed is .76 mach, and econo cruise is .74 mach.

DESCENT

From cruise altitude, rotate the vertical speed wheel on the AP to between -500 and -1,000 ft/min. Maintain Mach cruise speed until FL280. At FL280, set IAS to 280 knots and set the sink rate to -1,000 ft/min. Do not exceed 1000 ft/min above FL250, as the DC-9 requires this due to cabin pressure issues. As you pass FL250, adjust the descent rate to descend at idle thrust and 280 knots. Reduce your descent rate to about 1000 ft/min at 12,000 feet to start bleeding off speed as you need to be at or below 250 knots at 10,000 feet. At 10,000 feet, turn on your landing lights, and press SHIFT-W to extend them. Set your IAS for 250 knots. Maintain 250 knots for the remainder of your descent until advised by ATC to reduce speed.

APPROACH AND LANDING

Determine aircraft landing weight from the fuel totalizer gauge. If the totalizer is inoperative, subtract the fuel consumed by both engines from the ramp gross weight.

By the time you turn onto final approach, you should be at approximately 210 knots at flaps 5. As you capture the localizer, set flaps 10 and let speed bleed to maintain 190-200 knots.

Just before glidepath capture, set flaps 15 and then flaps 25 and slowly bleed off speed to maintain 160 knots to the outer marker. Lower the landing gear. Once the gear is down and locked, arm the ground spoilers. Set flaps 30.

Passing the outer marker, set flaps 40 and establish your final approach speed as listed in the speed booklet. You should be in full landing configuration at this point.

You should not have to touch the throttles much during the final approach phase of flight, as the added drag from the gear and flaps will slow the aircraft down gradually.

Minimum altitude for disengaging autopilot is approximately 60 feet AGL.

Plan to pass over the runway numbers at 50 feet AGL. At approximately 20 feet AGL, slowly reduce throttles to idle and initiate the flare.

When the main gear touches down, the spoilers will extend, but they may not immediately extend if the runway is wet or slippery because of lack of wheel spin up. Spoilers must then be extended manually.

Pull the throttle levers immediately to the idle position while gently lowering the nose to the runway. Once the nose wheel is on the ground, reverse thrust power may be used up to 80% N1.

Upon reaching 70 knots, gradually reduce reverse thrust so as to reach reverse idle detent position by 60 knots and then use manual braking to reduce to taxi speed. Leave throttles in reverse idle detent until forward thrust is needed, however, they must be stowed before turning off the runway. Delay application of the wheel brakes until below 80 knots if possible.

Vacate the runway at the first available turnoff. When clear of the active runway, turn off your landing lights and press SHIFT-W to retract them, and turn off your strobes. Turn on your taxi lights, retract your spoilers and raise flaps to 0.

Upon reaching the parking area, set the parking brake, shut down both engines, and turn off your rotating beacons.

That's the general procedure for flying the DC-9 Series 40.

Most of the settings listed in this document were taken directly from official flight/aircraft documents, and only modified where necessary to compensate for shortcomings in the simulator.

DC-9 SERIES 40 LIMITATIONS

WEIGHT LIMITATIONS:

Maximum Ramp Weight: 115,000
Maximum Takeoff Weight: 114,000
Maximum Landing Weight: 102,000
Maximum Zero Fuel Weight: 96,000

Takeoff and landing weights may be further restricted by runway lengths and performance requirements.

AIRSPEED LIMITATIONS:

Vmo: 350 KIAS
Mmo: 0.84 Mach

MANEUVERING SPEED

Do not operate aileron controls to full throw above speeds listed:

Sea Level: 235 KIAS
30,000 Ft: 270 KIAS
35,000 Ft: 255 KIAS

FLAPS EXTEND SPEEDS

Slats: 280 KIAS / 0.57 Mach
Flaps 0-10: 280 KIAS / 0.57 Mach
Flaps 10-20: 240 KIAS / 0.57 Mach
Flaps 20-25: 220 KIAS / 0.57 Mach
Flaps 25-50: 190 KIAS / 0.57 Mach

LANDING GEAR OPERATING SPEEDS

Extension: 300 KIAS
Retraction: 250 KIAS

TURBULENCE PENETRATION SPEED

285 KIAS / 0.79 Mach, whichever is lower

TIRE LIMITS

Do not exceed 195 knots ground speed

MAXIMUM OPERATIONAL ALTITUDE

35,000 feet

ENGINE REVERSERS

Reverse taxiing is prohibited

In-flight reversing is prohibited

WIND COMPONENTS

Maximum tailwind for takeoff and landing: 10 knots

Maximum crosswind for takeoff and landing: 38 knots

SPOILERS

The speed brakes must only be used in the 0° flaps configuration.

Do not extend the gear with the speed brakes deployed

Do not arm the ground spoilers prior to gear extension

FUEL REQUIREMENTS

Minimum fuel for dispatch: 5,000 lbs

FAA required reserve fuel: 3,500 lbs

Fuel Capacity (density of 6.7 ppg)

Main Tanks: 1386 gallons each (9286 lbs)

Center Tank: 907 gallons (6077 lbs)

Forward Fuselage Auxiliary Tank (If Installed): 580 gallons (3886 lbs)

Aft Fuselage Auxiliary Tank (If Installed): 780 gallons (5226 lbs)

Total: 3679 gallons (24,649 lbs) with standard tanks

Total: 5039 gallons (33,761 lbs) with auxiliary tanks

AUTOPILOT LIMITATIONS

Do not use the autopilot ILS mode with an engine inoperative

Minimum altitude for engaging the autopilot is 600 feet AGL

Minimum altitude for disengaging the autopilot is 60 feet AGL

DC-9 SERIES 40 REFERENCE CHARTS

FUEL AND FLIGHT PLANNING REFERENCE

(Includes 400lbs taxi fuel and figures are based on an 104,000 lb cruise weight. Be sure to add in reserve, alternate, and holding fuel to the totals below when fuel planning.)

TRIP LENGTH (nm)	FUEL REQUIRED (lbs)	TRIP TIME	OPTIMAL ALTITUDE
100	3700	0:27	FL 180
150	4600	0:34	FL 240
200	5500	0:40	FL 280
250	6100	0:47	FL 300
300	6700	0:54	FL 310
350	7400	1:01	FL 340
400	8100	1:08	FL 350
500	9400	1:22	FL 350
600	10800	1:35	FL 350
700	12100	1:49	FL 350
800	13400	2:03	FL 350
900	14800	2:16	FL 350
1000	16200	2:30	FL 350
1100	17600	2:44	FL 350
1200	18900	2:57	FL 350
1300	20300	3:11	FL 350
1400	21600	3:24	FL 350
1500	23000	3:38	FL 350
1600	24400	3:51	FL 350

TAKEOFF EPR/N1 RPM

RAT °C	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	35	40
Sea Level	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.14	2.10	2.05
1000 feet	2.21	2.21	2.21	2.21	2.21	2.21	2.21	2.21	2.21	2.21	2.19	2.18	2.18	2.17	2.14	2.10	2.05
2000 feet	2.26	2.26	2.26	2.26	2.26	2.26	2.26	2.26	2.26	2.22	2.20	2.20	2.19	2.17	2.14	2.10	2.05
Above 3000 feet	2.28	2.28	2.28	2.28	2.28	2.28	2.28	2.28	2.26	2.22	2.20	2.20	2.19	2.17			

DC-9-40 FLAP SETTINGS

0
SLATS
5
10
15
25
30
40
50

TAKEOFF SPEEDS

WEIGHT (lbs)	FLAPS 0 V1	FLAPS 0 VR	FLAPS 0 V2	FLAPS 5 V1	FLAPS 5 VR	FLAPS 5 V2	FLAPS 15 V1	FLAPS 15 VR	FLAPS 15 V2	VF	VH	VZF
70,000				116	116	119	103	103	112	125	150	164
72,000				116	116	121	103	103	113	126	151	166
74,000				116	116	123	103	104	115	128	153	169
76,000				116	116	124	103	106	116	130	155	171
78,000				116	116	126	103	108	118	132	157	174
80,000				116	117	128	104	110	119	134	159	176
82,000				116	119	129	106	111	121	135	160	178
84,000				116	121	131	107	113	122	137	162	181
86,000				118	123	132	109	115	124	139	164	183
88,000				120	125	134	111	117	125	140	165	186
90,000				122	126	136	113	118	127	142	167	188
92,000				124	128	137	115	120	128	144	169	190
94,000				126	130	138	116	122	129	145	170	192
96,000				128	132	140	118	123	131	147	172	194
98,000				129	133	142	120	125	132	148	173	197
100,000	145	149	156	131	135	143	122	126	134	150	175	199
102,000	147	151	158	133	137	145	123	128	135	151	176	201
104,000	148	153	159	135	138	147	125	129	136	153	178	203
106,000	150	155	161	137	140	148	127	130	137	154	179	206
108,000	152	156	162	138	141	149	128	132	139	156	181	208
110,000	154	158	164	140	143	150				157	182	210
112,000	156	160	166	142	144	152				158	183	212
114,000	158	161	167	143	146	153				160	185	214

If over 100 degrees F or over 4,000 feet altitude, add +2 to V1 / VR

- V1** = Take-off decision speed. Before V1, the pilot can abort take-off. After V1, the pilot MUST take off
- VR** = Take-off rotation speed at which the pilot pulls the flight controls to raise the nose and take off
- V2** = Take-off safety speed to be reached before passing 35 ft above runway altitude
- VF** = Speed to begin flap retraction
- VH** = Slat retraction speed
- VZF** = Speed that flaps should be fully retracted

LANDING SPEEDS

WEIGHT (lbs)	FLAPS	VREF	VGA	VA
70,000	40	108	119	113
72,000	40	110	121	115
74,000	40	112	123	117
76,000	40	114	124	119
78,000	40	115	126	120
80,000	40	117	128	122
82,000	40	119	129	124
84,000	40	120	121	125
86,000	40	122	132	127
88,000	40	124	134	129
90,000	40	125	136	130
92,000	40	127	137	132
94,000	40	128	139	133
96,000	40	130	140	135
98,000	40	131	142	136
100,000	40	133	143	138
102,000	40	134	145	139

- FLAPS** = Recommended flaps setting for landing
- VREF** = Speed at which the aircraft should cross the runway threshold during landing
- VGA** = Speed to maintain over the runway should a go-around be required
- VA** = Approach speed

DC-9 SERIES 40 CHECKLISTS

PRESTART

Master Battery Switch	On
Electrical	On
Anti-Collision Lights	On
Recognition Lights	On
Air Conditioning System	On
Radios	On

ENGINE START

Parking Brakes	Check
Fuel Quantity	Check
Beacons	On
Doors	Check
Air Conditioning Supply	Check
Fuel Boost Pumps	Check On
Ignition	Both
Pneumatic Pressure	Check
Fuel Heat	Set
Port Engine	Start
Starboard Engine	Start

AFTER START/BEFORE TAXI

Electrical Power	Check
Electrical Bus	Check
Ignition Switch	Off
Yaw Damper	On
Air Conditioning Temperature Switches	Check
Emergency Lights / Cabin Signs	Check
Hydraulic Pressure Indicators	Check

TAXI

Flight Instruments	Check
Taxi Lights	On
Fuel Heat	As Required
Flaps	Set Takeoff
Takeoff EPR	Set
Stabilizer Trim	Check
Flight Controls	Check
Brake Temperature	Check

TAKEOFF

Landing Lights	On
Strobes	On
Ignition	Both
Ice Protection	Check
Hydraulic Booster Pumps	On
Transponder	On
Radio Altimeter	Set

CLIMB AND CRUISE

Flaps	Full Up
Taxi Lights	Off
Landing Gear	Up
Ignition	Off
Boost Pumps	As Required
Air Conditioning Shutoff	Override
Hydraulic Boost Pumps	Off
Radio Altimeter	Check
Cabin Pressurization	Set
Passing 10,000ft - Landing Lights	Off

DESCENT

Cabin Pressure	Set
EPR Bug	Set
Hydraulic Boost Pumps	On
Passing 10,000ft - Landing Lights	On

APPROACH

Hydraulic Boost Pumps	Check On
Cabin Signs	On
Altimeters	Set
Nav aids	Check
Flight Instruments	Check

LANDING

Landing Gear	Down / 3 Green
Ignition	Both
Spoilers	Auto
Annunciator Panel	Check
Landing Weight and Data	Check
Hydraulic Indicators	Check
Flaps	Set
Landing Lights	On

AFTER LANDING

Hydraulic Boost Pumps	Off
Flaps	Full Up
Spoilers	Retract
Landing Lights	Off
Strobes	Off
Ignition	Off
Anti-Ice Switches	Off
Taxi Lights	On

PARKING

Brakes	Release
Emergency Lights / Cabin Signs	Off
Air Conditioning Supply	As Needed
Taxi Lights	Off
Beacons	Off
Parking Brake	Set
Engines	Off
Flight Recorders	Off

SECURE

External Lighting	Off
Air Conditioning System	Off
Radios	Off
Electrical	Off
Master Battery Switch	Off