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iPad 737NG Landing Distance Calculator App User's Manual

1.0 Summary

The iPad 737NG Landing Distance Calculator App allows the user to accurately and quickly calculate the landing distance required and approach speed (V_{REF}) based on aircraft configuration, airport and runway selection, runway surface condition, and airport weather data. The runway wind components are also calculated. The app is based on the Boeing 737-800W equipped with CFM56-7B26 engines and Category C brakes. Failure cases are not included.

- Aircraft Configuration:
 - Autobrake Mode
 - Flap Configuration
 - Reversers Operative
 - Margin Setting (Dry Runway Only)
 - Aircraft Weight
 - Speed Increment
- Airport, Runway and RSC Selection
 - Airport Code
 - Runway Selection
 - Runway Surface Condition or Reported CRFI
- Airport Weather Data (ATIS/AWOS)
 - Wind Direction (deg.)
 - Wind Speed (kts)
 - Temperature (deg.C)

The airport selection also includes the ability to add, edit, or removed stored runways and to manually input basic runway information, such as airport elevation, runway heading, runway gradient and landing distance available (LDA) for one-time use. This latter function is useful if a NOTAM is issued or if there is a need to land at an alternate airport. The app relates these inputs to aircraft performance data contained in the 737-800W Quick Reference Handbook (QRH) to provide the approach speed, landing distance available, landing distance required, and a status message indicating whether the landing distance available is sufficient or not. The headwind or tailwind and left or right crosswind components are also calculated.

The application was designed to be "pilot-friendly" by incorporating the following features:

- Black text on a light grey background for the labels
- Black text on a light green background for the input fields

- Blue segmented control button with a light green background
- Blue text on a light green background for the “Calculate” button
- Black text on a light blue background for the output fields
- In-app brightness control

The 737NG Landing Distance Calculator App is designed and optimized for the iPad running iOS 9.0. To increase simplicity and ease of use, the app is composed of a single view with two popover views. The main view is for input of aircraft configuration, airport, runway and runway surface condition selection, as well as airport weather data, and outputs of approach speed (V_{REF}), landing distance available, landing distance required, as well as runway wind components. The popover views are for the Edit/Add Runway and Runway Manual Input functions.

Note: The accuracy of the results depends on the accuracy of the data input by the user. This app is designed for evaluation purposes only.

2.0 Aircraft Configuration, Airport, Runway and RSC Selection, Airport Weather Data, and Results of Calculation [Main View]

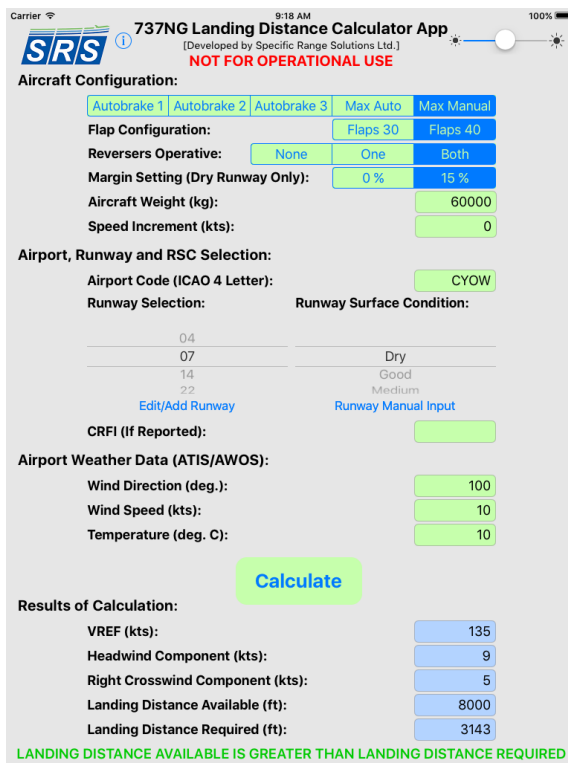


Figure 2.1: 737NG LDC

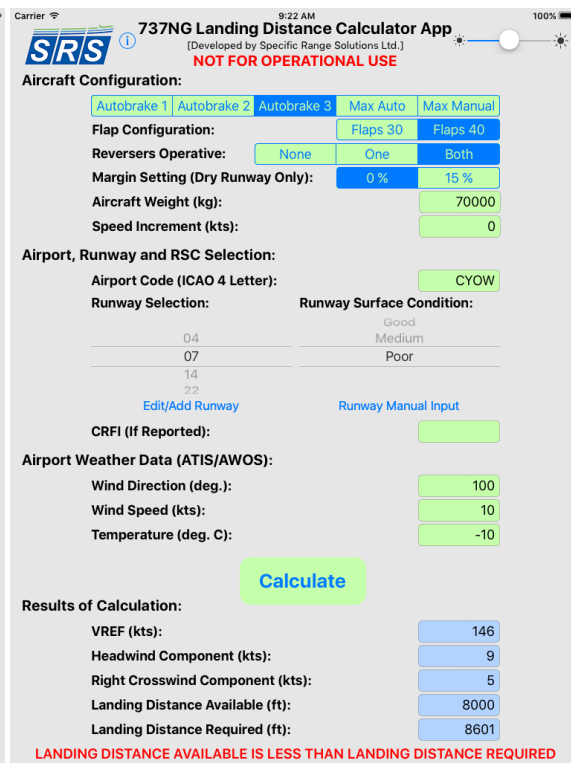


Figure 2.2: 737NG LDC

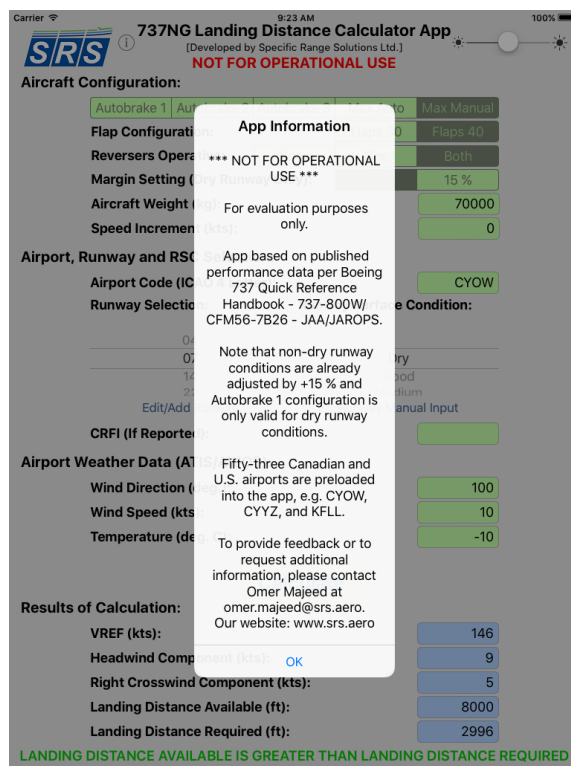


Figure 2.3: 737NG LDC – App Information

App Information: The app information is available by selecting the information icon next to the title. The app information message is:

*** NOT FOR OPERATIONAL USE *** For evaluation purposes only.

App based on published performance data per Boeing 737 Quick Reference Handbook – 737W/CFM56-7B26 – JAA/JAROPS.

Note that non-dry runway conditions are already adjusted by +15% and Autobrake 1 configuration is only valid for dry runway conditions.

Fifty-three Canadian and U.S. airports are preloaded into the app; e.g., CYOW, CYYZ and KFL.

To provide feedback or to request additional information, please contact Omer Majeed at omer.majeed@srs.aero. Our website: www.srs.aero”

Brightness Control: The built-in control function allows the brightness to be adjusted for day or night lighting conditions according to the user’s preference.

2.1 Aircraft Configuration

Autobrake Mode: The user selects the autobrake mode to be used for the landing. The options are Autobrake 1, Autobrake 2, Autobrake 3, Max Auto and Max Manual.

Max Manual results in the shortest landing distance and Autobrake 1 results in the longest distance.

Flap Configuration: The user selects the aircraft configuration, either Flaps 30 or Flaps 40.

The approach speed (V_{REF}) is a function of the selected flap configuration, aircraft weight and speed increment.

The default flap setting is Flaps 40 which gives the lowest V_{REF} and landing distance.

Reversers Operative: The user selects whether none, one or two thrust reversers are operative. With two reversers operative, the landing distance required is the less than if both were not operative.

Margin Setting: The user selects a margin of either 0% or 15%. The margin is applied to the total landing distance required. The default setting is set to 15% to ensure a conservative result for dry runway conditions **or if CRFI is used.**

Aircraft Weight: The user inputs the aircraft weight in kg. The app has a valid aircraft landing weight range of 40,000 kg to 85,000 kg.

Speed Increment: The user inputs the speed increment above the approach speed in knots. The speed increment is used to adjust the approach speed (V_{REF}).

2.2 Airport Selection

Airport Code: The user inputs the desired arrival airport's four-letter ICAO code. This code is used to populate the runway selection picker view, as well as to determine the airport elevation correction to be added to the landing distance required. It should be noted that the app is preloaded with the following twenty-two Canadian airports and their runways per Table 2.1 and thirty-one U.S. airports and their runways per Table 2.2.

ICAO Code	Airport
CYDF	Deer Lake Airport
CYEG	Edmonton International Airport
CYBK	Kingston Airport
CYHZ	Halifax Stanfield International Airport
CYOW	Ottawa Macdonald-Cartier International Airport
CYQF	Red Deer Regional Airport
CYQL	Lethbridge Airport
CYQX	Gander International Airport
CYTT	St. John's International Airport
CYTZ	Billy Bishop Toronto City Airport
CYUL	Montréal-Pierre Elliot Trudeau International Airport
CYVR	Vancouver International Airport
CYWG	Winnipeg James Armstrong Richardson International Airport
CYWK	Wabush Airport
CYXC	Cranbrook Canadian Rockies International Airport
CYXH	Medicine Hat Airport
CYYC	Calgary International Airport
CYYG	Charlottetown Airport
CYYJ	Victoria International Airport
CYR	Goose Bay Airport
CYYZ	Toronto Pearson International
CYZR	Sarnia Chris Hadfield Airport

Table 2.1: Canadian Airports Preloaded in Database

ICAO Code	Airport
KATL	Hartsfield-Jackson Atlanta International Airport
KBDL	Bradley-Windsor Locks International Airport
KBNA	Nashville International Airport
KCLT	Charlotte Douglas International Airport
KCVG	Cincinnati/Northern Kentucky International Airport
KDEN	Denver International Airport
KDFW	Dallas/Fort Worth International Airport
KDTW	Detroit Metropolitan Wayne County Airport
KEWR	Newark Liberty International Airport
KFLL	Fort Lauderdale Hollywood International Airport
KIAH	George Bush Intercontinental Airport
KIND	Indianapolis International Airport
KJFK	John F. Kennedy International Airport
KLAS	McCarran International Airport
KLAX	Los Angeles International Airport
KLGA	LaGuardia Airport
KMCI	Kansas City International Airport
KMCO	Orlando International Airport
KMDT	Harrisburg International Airport
KMIA	Miami International Airport
KMKE	Milwaukee General Mitchell International Airport
KMSP	Minneapolis-St Paul International/Wold-Chamberlain Airport
KORD	O'Hare International Airport
KPHL	Philadelphia International Airport
KPHX	Phoenix Sky Harbor International Airport
KRDU	Raleigh-Durham International Airport
KROC	Greater Rochester International Airport
KSEA	Seattle-Tacoma International Airport
KSFO	San Francisco International Airport
KSYR	Syracuse Hancock International Airport

Table 2.2: U.S. Airports Preloaded in Database

Runway Selection: The user selects the active runway. The runways listed correspond to the airport's ICAO code. The runway selection provides the runway heading, the runway gradient and the landing distance available.

Runway Surface Condition: The user selects the runway surface condition for the landing runway. As described in the FAA TALPA/ARC document, the landing distance performance data is determined during flight tests, and demonstrate the shortest landing distance required as a function of aircraft weight. This can result in high touchdown sink rates and approach angles, and maximum manual braking being initiated as soon as possible. The TALPA/ARC also indicates that the contaminated runway landing distance data is determined analytically using the dry runway data.

Therefore, the performance data landing distances are shorter than those achieved under normal operations, hence the use of 15% of margin.

Canadian Runway Friction Index: The user has the option to directly input the reported CRFI value in lieu of selecting the runway surface condition. The CRFI data is taken directly from the Canada Flight Supplement and is based on the unfactored dry runway landing distance. If reverse thrust is not selected, Table 1 data from the CFS is employed. If reverse thrust is selected, Table 2 data from the CFS is employed. Margin (15%), if selected is then applied to the landing distance required.

2.3 Airport Weather Data

Wind Direction: The user inputs the reported wind direction at the arrival airport in degrees magnetic or true if the runway is designated as such.

Wind Speed: The user inputs the reported wind speed at the arrival airport in knots.

Temperature: The user inputs the reported temperature at the arrival airport in degrees Celsius.

2.4 Results of Calculation

Calculate: Once the user presses the calculate button, the results of calculation are displayed.

VREF: The approach speed is output in knots and is a function of selected aircraft configuration, aircraft weight, and speed increment. It is output once these three inputs are completed.

Headwind (Tailwind) Component: Based on the reported wind direction and speed, and the selected runway, the headwind or tailwind component is calculated and then displayed.

Left (Right) Crosswind Component: Based on the reported wind direction and speed, and the selected runway, the left or right crosswind component is calculated and then displayed. The **Left Crosswind Component (kts)** or **Right Crosswind Component (kts)** message is displayed as required.

Landing Distance Available: The landing distance available is displayed based on the input airport code and selected runway. This value is also used in order to determine which status message to display.

Landing Distance Required: The landing distance required is displayed based on the inputs of aircraft configuration, weight, airport and runway selection, runway surface condition, airport wind data, and includes all corrections.

Status Message: The status message displays whether the selected runway length is sufficient. If the landing distance available is greater than or equal to the landing

distance required a **Go** message is displayed. However, if the landing distance available is less than the landing distance required, a **No-Go** message is displayed. The three status messages are,

- "LANDING DISTANCE AVAILABLE IS LESS THAN LANDING DISTANCE REQUIRED"
- "LANDING DISTANCE AVAILABLE IS EQUAL TO LANDING DISTANCE REQUIRED"
- "LANDING DISTANCE AVAILABLE IS GREATER THAN LANDING DISTANCE REQUIRED"

3.0 Edit/Add Runway [Popover View]

The Edit/Add Runway popover view displays add, edit, or remove runway options.

This includes inputs of airport code, airport elevation, runway reference, runway heading, runway gradient and landing distance available. In order to add or edit a runway, the user completes the six text fields, and presses the save button. The **Save** button then either edits or creates a new runway based on if the inputted runway at the corresponding airport already exists. In order to remove an airport, the user completes the airport code and runway reference texts fields and presses the remove button. The **Remove Runway** button deletes the runway at the corresponding airport from the database.

The screenshot displays the '737NG Landing Distance Calculator App' interface. At the top, it shows the SRS logo and a warning: 'NOT FOR OPERATIONAL USE'. The 'Aircraft Configuration' section includes buttons for 'Autobrake 1', 'Autobrake 2', 'Autobrake 3', 'Max Auto', and 'Max Manual'. Below this are 'Flap Configuration' (Flaps 30, Flaps 40), 'Reversers Operative' (None, One, Both), and 'Margin Setting (Dry Runway Only)' (0%, 15%). The 'Aircraft Weight (kg)' field is also present. A central 'Edit/Add Runway' popover is active, containing input fields for 'Airport Code', 'Airport Elevation (ft)', 'Runway Reference', 'Runway Heading (deg.)', 'Runway Gradient (%)', and 'Landing Dist. Available (ft)'. It also features a 'Runway Surface Condition' dropdown (Dry, Good, Medium) and a 'Runway Manual Input' section. At the bottom of the popover are 'Save' and 'Remo...unway' buttons. The main app screen shows 'Airport Weather Data (ATIS/AWOS)' with fields for 'Wind Direction (deg.)', 'Wind Speed (kts)', and 'Temperature (deg. C)'. A large 'Calculate' button is positioned above the 'Results of Calculation' section, which includes output fields for 'VREF (kts)', 'Headwind (Tailwind) Component (kts)', 'Left (Right) Crosswind Component (kts)', 'Landing Distance Available (ft)', and 'Landing Distance Required (ft)'.

Figure 3.1: 737NG LDC – Edit/Add Runway

Airport Code: The user inputs the airport code corresponding to the runway they wish add, edit, or remove.

Airport Elevation: The user inputs the elevation in feet corresponding to the airport. It should be noted that if the airport exists in the database, this field will autocomplete.

Runway Reference: The user inputs the runway reference they wish to add, edit, or remove. This field accepts integers between 0 and 36, as well as the letters C, G, L, R, T.

Runway Heading: The user inputs the runway heading corresponding to the runway reference. It should be noted that if the runway exists in the database, this will autocomplete.

Runway Gradient: The user inputs the runway gradient in percent (%).

Landing Distance Available: The user inputs the landing distance available corresponding to the runway reference. It should be noted that if the runway exists in the database, this field will autocomplete.

Save: Once the six text fields are completed, the save button must be selected in order to add or edit the runway in the database.

Remove Runway: Once the airport code and runway number are input, the remove runway button will remove the runway for the database.

4.0 Runway Manual Input [Popover View]

The Runway Manual Input popover view displays the runway manual input option.

This includes airport elevation, runway heading, runway gradient and landing distance available. This function takes precedence over the Add/Edit Runway popover because it is used as an override function to permit landing at a runway not in the database. When the user presses the Runway Manual Input button, airport code text field clears. The user then completes the airport elevation, runway heading, runway gradient and landing distance available text fields, and presses the save button. Once the save button is pressed a status message appears on the main view indicating the entered values and that they are appropriately saved.

The screenshot shows the '737NG Landing Distance Calculator App' interface. At the top, it displays the SRS logo, the app name, and a warning: '[Developed by Specific Range Solutions Ltd.] NOT FOR OPERATIONAL USE'. The interface is divided into several sections:

- Aircraft Configuration:** Includes buttons for Autobrake 1, 2, 3, Max Auto, and Max Manual. Below are fields for Flap Configuration (Flaps 30, Flaps 40), Reversers Operative (None, One, Both), and Margin Setting (Dry Runway Only) (0%, 15%).
- Aircraft Weight and Speed:** Fields for Aircraft Weight (kg) and Speed Increment (kts).
- Airport, Runway and RSC Selection:** A modal dialog box is open, showing input fields for Airport Code (IC), Airport Elevation (ft), Runway Selection, Runway Heading (deg.), Runway Gradient (%), and Landing Dist. Available (ft). A 'Save' button is at the bottom of the dialog.
- Airport Weather Data (ATIS/AWOS):** Fields for Wind Direction (deg.), Wind Speed (kts), and Temperature (deg. C).
- Results of Calculation:** A 'Calculate' button is present. Below it are fields for VREF (kts), Headwind (Tailwind) Component (kts), Left (Right) Crosswind Component (kts), Landing Distance Available (ft), and Landing Distance Required (ft).

Figure 4.1: L73NG LDC – Runway Manual Input

Airport Elevation: The user inputs the airport elevation in feet (ft).

Runway Heading: The user inputs the runway heading in degrees (deg.).

Runway Gradient: The user inputs the runway gradient in percent (%).

Landing Distance Available: The user inputs the landing distance available in feet (ft).

Save: Once the four text fields are completed. The save button must be selected in order to temporarily store the information. A status message appears on the main view indicating the entered values and that they are appropriately saved.

5.0 Support:

If you have any questions, would like to report a problem or make any comments, please send an email to omer.majeed@srs.aero.

Thank you for using iPad 737NG Landing Distance Calculator App.

We appreciate your support and encourage your feedback.

[Version 0.8, Build 2]