Rev #	Date	Author	Change	Version
001	09-Sep-2015	MK	Start of documentation	0.50
002	18-Sep-2015	MK	Alpha Candidate	0.90
003	18-Sep-2015	MK	Adding Manager details	0.91
004	21-Sep-2015	MK	Spellchecked and many small things changed	0.92
005	23-Sept-2015	MK	Dave tweaks / Tiller info added	0.93
006	29-Sept-2015	MK	Some tweaks suggested by client	0.94
007	02-Mar-2015	MK	Updated to latest state	0.95
008	26-Dec-2016	MK	Final tweaks	0.99
009	27-Dec-2016	MK	Closing the manuals	1.00
010	20-Apr-2017	MK	Changing section on DAVE	1.00
011	02-May-2017	MK	Adding state default	1.00
012	02-May-2017	MK	Adding FSUIPC calibration & RAAS	1.00
013	25-May-2017	MK	P3d V4 information added	1.00

On behalf of Authority

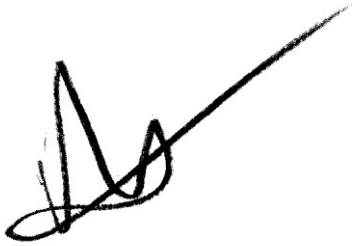

TABLE OF CONTENTS

INTRODUCTION

Thank you very much for purchasing Digital Aviation & Aerosoft CRJ700/CRJ900 package. Development of the package went through a lot of highs and lows. Thank you for bearing with us.

The CRJ is a typical regional jet to connect smaller airports or remote areas with the bigger hubs. Hence the CRJ can get fast up to cruise altitude and stay there pretty long, but is not designed for world record cruise speeds.

The CRJ's history goes back into the 80's, when first studies were made regarding options to create a regional jet out of the Challenger 600 business jet. Near the end of the 80's Lufthansa pushed the idea again and the project was actually started in 1989 with the maiden flight in 1991 and certification in 1992: the CRJ100 was born. The CRJ200 was developed later based on the CRJ100 and equipped with better engines. Both versions carry 50 passengers.

When the CRJ700 was developed, the fuselage was stretched further to accommodate 70 passengers. Accordingly, the wings needed to be modified, and furthermore new winglets and new engines were attached. Its maiden flight was in May of 1999. On basis of the CRJ700 the CRJ900 was developed. The fuselage was stretched again to accommodate 90 passengers.

The CRJ700 / 900 by Digital Aviation & Aerosoft comprises the CRJ700ER and CRJ900ER models with flight dynamics modelled according the respective flight performance data and of course 3d representations as close as possible in FS to the real thing. Accurate systems programming reflects behaviour of the real CRJ within normal operations.

CREDITS

- Programming: Hans Hartmann (Digital Aviation)
- 3d Modelling, Texturing: Stefan Hoffmann (Aerosoft)
- Flight dynamics: Alexander Metzger (Digital Aviation)
- Sound: Turbine Sound Studios, Aerosoft
- Documentation: Ingo Voigt (Digital Aviation), Mathijs Kok, Alexander Metzger
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- Advisory pilots: Frank Docter, Colin Levy, Victor Mourao, Mitch Lucas, Christian Haupt, Zach Woock, Elijah Hoyt
- Livery Manager: Hauke Fehr (Fehrware.de)
- Additional Liveries: Holger Sobl
- Video: Jeroen Doorman (Jerdoo)
- GSX Config files: Brandon Promeneur

The beta testers of this product deserve special mentioning. In this development, we experimented extensively with involving them directly in the production, they often tested code minutes after it was written, gave feedback and got new code almost immediate. Without them the product would not be where it is now.

We like to thank the following people for their patience and assistance: Daniel Desjardins, Emanuel Hagen, Finn Jacobsen., Thomas Lindner, Matt Parker, Brandon Promeneur, Aku Ronkainen, Tobias Timm, Otto Schafer.

We are too late to thank Andreas Kraft as he passed away unexpectedly during this production. Let it be known his assistance was very important.

WHY WAS THIS PRODUCT SO DELAYED?

Normally not something that is part of a manual, but let's be honest, this was the most delayed project we ever managed. The delay was caused by underestimating the complexity. That caused the project to fall behind the schedule.

Now fast forward a year (keep in mind these are projects that normally span 30 months) and we noticed that what we considered state-of-the-art at the beginning was outdated and surpassed by many of our favorite competitors. So, you start to make plans to catch up, throw out stuff that is old and make new and better things. For example, the exterior of the aircraft was almost completely redone. But now you are not only developing but also catching up and that is devastating to any major project. All the time pressure is building and the project gets a bad reputation with management and customers. Not really the conditions that make a project flourish.

There were times we thought it was better to drop the whole thing and take our loss. It was the kindness of potential customers, who whacked trolls on the forum and told us to keep on working, that saved the project. They have no idea how important they were at certain crucial moments.

In the end, it is the project manager who is responsible. Nobody else. So, blame the author (MK) of this text and nobody else.

INSTALLING & REMOVING

Installing the product correctly is the first step to getting airborne. Please follow the steps below to avoid problems.

DOWNLOAD

The downloaded file can be unpacked to any location on your system. We **strongly** recommend using these steps to install:

1. Reboot your computer
2. Log in with administrative rights
3. Disable the anti-virus software temporary
4. Install the product
5. Enable the anti-virus software
6. Defragment your disk (NOT if you are using an SSD)

BOXED

After inserting the DVD, the installer will start automatically (if not navigate to the DVD and start the setup.exe). We strongly recommend using these steps to install:

1. Reboot your computer
2. Log in with administrative rights
3. Disable the anti-virus software temporary
4. Insert the DVD
5. Install the product
6. Enable the anti-virus software
7. Defragment your disk (NOT if you are using an SSD)

REMOVING

Never remove this product by manually removing the files but to use the Windows Software applet.

FSX VERSUS P3D

This product follows the guidelines of Lockheed Martin for the installation in P3D. So where the main installation path in FSX (SP2 and FSX:STEAM) will be **FSX Main Folder\Aerosoft\Digital Aviation CRJ** it will be **P3D Main Folder\Ecosystem\Aerosoft\ Digital Aviation CRJ** in P3D. In this manual, we use the FSX path where needed.

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www.aerosoft.com

MANUALS

The documentation for the CRJ700 / CRJ900 comprises of several documents:

- **Vol.1: AOM part I – General Information**. You are reading this manual at the moment. Contains information on installation, where to find support, manual structuring, some basic information on the CRJ, a transition guide for experienced users, an introduction to loading the CRJ, the external model, its cockpit, keyboard commands, tools coming along with the CRJ, and some flight suggestions apart from the tutorial.
- **Vol.2: Quick Reference Handbook, QRH.** Contains information on procedures, limitations and aircraft performance.
- **Vol.3: Tutorial**. Tutorial flight which takes you from Los Angeles to Monterey guiding you through a flight from preparation to shut down.
- **Vol.4: Normal Ops Checklist.** Short checklists on two pages – for experienced pilots
- **Vol.5: AOM part II - Systems Manual.** Introduction and explanation on the CRJ's systems.
- **Vol**.6: Flight Management System. Detailed description of the FMS.

You will find that we discuss the project in FSX a lot. If you are using Prepar3D V3 it should not be a problem finding the same locations and settings. If there is a problem, just contact us and we'll assist!

Also note that the readme.txt always contains the information on the latest updates. Before contacting support do make sure you installed the latest version!

CONTACT SUPPORT

Support for this product is done by Aerosoft. We prefer to do support on the support forum for one simple reason, it is fast and efficient because customers help customers when we are sleeping. **It's also the difference between one support person reading the question and 500 people, some of why know a LOT about the aircraft.**

- CRJ Support Forums: http://forum.aerosoft.com/index.php?/forum/747-crj-700900/
- If you prefer support by email: https://aerosoft.zendesk.com/anonymous_requests/new
  Please note that email support can be slow when things are busy (shortly after a major release form example). We try to get back to you in 24 hours, but if you want an answer fast, got to the forums.

We feel strongly about support. Buying one of our products gives you the right to waste our time with questions you feel might be silly. They are not. We supply support in English, German, Dutch, French, Spanish and Portuguese.

NAVIGATION DATABASE

With this CRJ comes a complete copy of the NavDataPro navigation database. This database contains the May 2017 LIDO data and is the worlds most used navigation database in aircraft. The database is fully updateable; check its product page on our websites: www.aerosoft-shop.com/products/navdatapro/navdatapro.html

The CRJ is fully compatible with the well-known Navigraph database. Although these databases come from a different source and have some differences they are basically the same and you should not see any differences between the two.

VERSION NUMBERS

- The release version number will be **1**.00.
- A service pack will show in the tens, 1.**1**0 (first service pack) -> new full build
- A hotfix will show in in the hundreds 1.1**1** (first hotfix to be put on service pack 1)

When there are many hotfixes we will also make full new builds. If you are ever in doubt which version you have, check the product.cfg that you can find in FSXMainFolder\Aerosoft\CRJ*.

AES & GSX

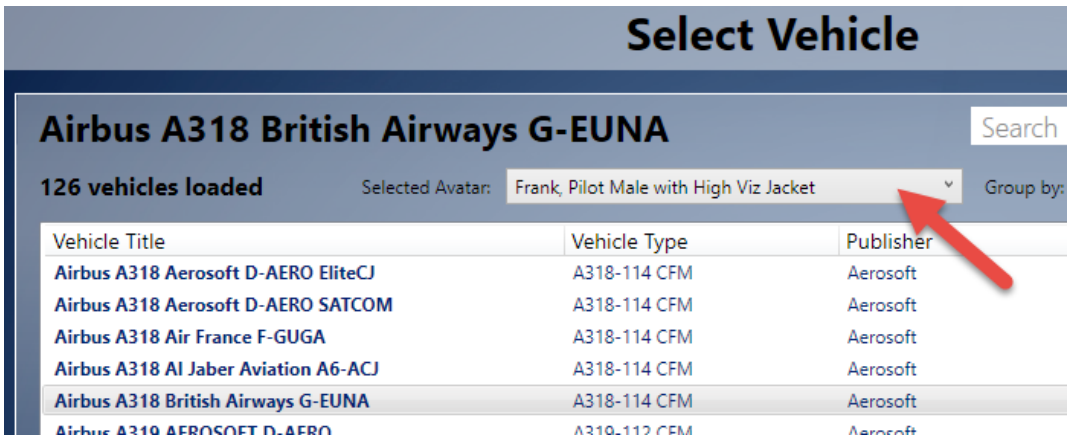
The configuration files for AES are standard installed in the aircraft folders.

The GSX configuration files are not standard installed because the folder for those files is not a standard folder of Windows, FSX or the CRJ. You will find the GSX configuration files in the *FSXMainFolder\aerosoft\Digital Aviation CRJ* folder. You must copy these to *C:\Users\[User's Name]\AppData\Roaming\Virtuali\Airplanes.*

A profile for EZDOK EZCA v2 can be found in *FSXMainFolder\aerosoft\Digital Aviation CRJ*

FRANK, OUR AVATAR

If you are using PREPAR3D v3 you will be able to use Frank, our pilot, as the avatar (see the P3D v3 documentation about information on avatars). When selecting an aircraft, you can also select the avatar to be loaded. You can load Frank with any aircraft btw. He is able to stand idle (duh..), walk, run, stand to crouch, walk while crouching, crouch to stand, jump, swim and fall, all using the default P3D v3 commands. To spawn the avatar, go to any external view and use the [shift]-[control]-[e] command. You can then use the avatar to explore the scenery.



THE CRJ

As we already considered the CRJ's history during the introduction this chapter provides some basic facts on the CRJ.

BASIC FACTS

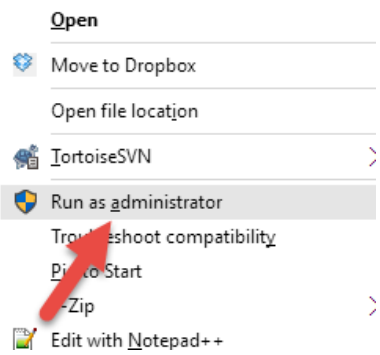
	CRJ700		**CRJ900**	
Length	32,3 m	106 ft 1 in.	36,2 m	118 ft 11 in.
Wingspan	23,2 m	76 ft 3 in.	24,9 m	81 ft 7 in.
Height	7,6 m	24 ft 10 in.	7,5 m	24 ft 7 in
Dry Operating Weight	20‘290kg	44‘731lbs	22‘131kg	48‘790lbs
Maximum zero fuel weight (MZFW)	28‘259kg	62‘300lbs	31‘751kg	70‘000lbs
Maximum Payload	8‘190kg	18‘055lbs	9‘907kg	21‘840lbs
Cargo Weight	2‘438kg	5‘375lbs	2‘756kg	6‘075lbs
Maximum Ramp Weight	34‘133kg	75‘250lbs	37‘735kg	82‘750lbs
Maximum take-off weight (MTOW)	34‘019kg	75‘000lbs	37‘421kg	82‘500lbs
Maximum landing weight (MLW)	30‘391kg	67‘000lbs	33‘340kg	73‘500lbs
Maximum Seat Capability	70		90	
Maximum range	2‘553 km	1‘378 nm	2‘439 km	1‘317 nm
Max. Cruise Speed	473 kts	0.825 Mach	470 kts	0.82 Mach
Takeoff field length (ISA, Sea Level, Max. Takeoff Weight)	1‘605 m	5‘040 ft	1‘847 m	6‘060 ft
Landing field length (ISA, Sea Level, Max. Landing Weight)	1‘536 m	5‘040 ft	1‘603 m	5‘260 ft

THE CRJ IN FLIGHTSIM

The following chapter describes how to load the CRJ700 or CRJ900 in your flight simulator, which animations (like opening doors, cargo hatches) are available, a brief tour of the virtual cockpit with a short overview of available panels and pre-defined views, closing with the concept of operation (i.e. how do switches, pushbuttons, etc. work in your flight sim).

LOADING THE CRJ

It's important that your simulator is running with Administrative rights to avoid problems. This is especially important when your simulator is installed in the default location (Program Files). If you are not logged in with administrative rights, you can still have the simulator running with Administrative rights by right clicking and selecting [Run as administrator].



Before loading the CRJ we STRONGLY advise you to load one of the default FSX aircraft with the engine running. This will avoid a load of problems.

THE VIRTUAL COCKPIT OVERVIEW

To prevent pilots searching the entire cockpit for a certain knob, the entire cockpit is divided into several logical panels. The following picture shows a view of the entire virtual cockpit and numbers indicate the respective panels. Note that elements described in grey are not simulated.

1.Overhead	2.Glareshield/Autopilot	3. Centre Instrument Panel
4. Captain Instrument Panel	5. Captain Side Panel/Side console	6. First Officer Instrument Panel
7. First Officer Side Panel/Side Console	8. Upper Pedestal	9. Lower Pedestal

OVERHEAD PANEL

1. Electrical Power	2. Fire Detection Test System	3. Hydraulic Shutoff Valves (SOV)
4. External Lighting Controls	5. Fuel Controls	6. Pneumatic Controls
7. Auxiliary Power Unit Controls	8. Engine Start Panel	9. Hydraulic Controls
10. Emergency Locator Transmitter	11. Cabin Pressure Controls	12. Air Conditioning Controls
13. Anti-Ice Controls	14. Internal Lighting Controls	

GLARESHIELD / AUTOPILOT PANEL

1. Standby / Whiskey Compass. Traditional compass, normally only used to check alignment of electronic compasses.	2. Seat Position Sight Gauge. Used to position the seats so your eyes are always in the same location. They gray ball should hide the gold balls.
3. Warning / Annunciator Lights Captains Side	4. Navigation / Flight Director / Autopilot Panel
5. Warning / Annunciator Lights First Officers Side	

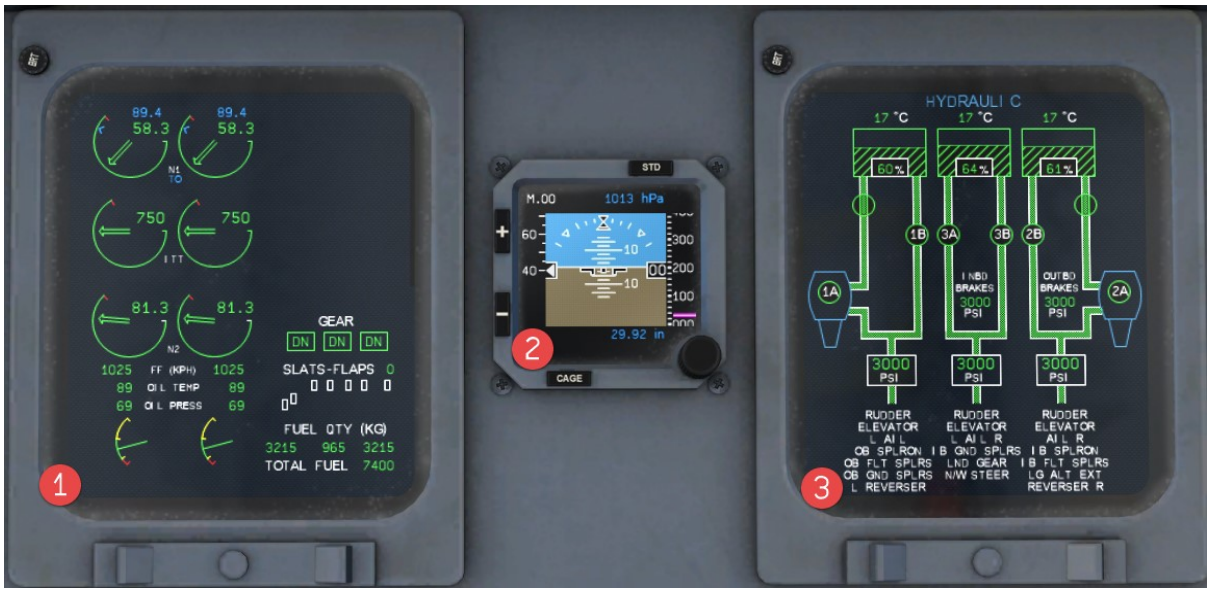
WARNING / ANNUNCIATOR LIGHTS PILOTS SIDE

1. ROLL SEL and PLT / CPLT ROLL. The ROLL SEL light comes on, to indicate that roll priority selection is necessary.	2. Master Warning Light. The red Master Warning Light is illuminated and an aural warning sounds, in case a EICAS warning message is triggered.
3. Master Caution Light. The amber Master Caution Light is illuminated and an aural warning sounds, in case an EICAS caution message is triggered.	4. Stall Warning Light / Switch. Illuminates in case a stall warning is triggered. After opening the switch protection, the stall warning switch may be pressed to trigger the stall warning test sequence.
5. Pull Up / GND PROX Warning Light. The Ground Proximity Warning System, GPWS, may trigger the Pull Up / GND PROX warning light depending on the current mode.	6. LH ENG FIRE Switch. The LH/RH ENG FIRE Switch illuminates in case an engine fire is detected. Pushing the switch cuts engine fuel, bleed air and closes the hydraulic shutoff valves.
7. BOTTLE 1 and 2 ARMED PUSH TO DISCH The CRJ is equipped with 2 squibs which contain halon to at least try and extinguish an engine fire. After pressing the ENG FIRE switch the squib is armed and the BOTTLE 1 and 2 ARMED PUSH TO DISCH switch illuminates.	

AUTOPILOT PANEL

1. Course 1 Selector	2. Flight Director Switch	3. Auto Pilot Engage Switch
4. Auto Pilot Disengage Switch	5. XFR Mode Switch	6. Turbulence Mode Switch
7. Speed Mode Selector	8. Speed Selector	9. Approach Mode Selector
10. B/C Mode Switch	11. Heading Mode Selector	12. Heading Selector
13. NAV Mode Selector	14. Half Bank Mode Switch	15. Altitude Mode Selector
16. Altitude Selector	17. Vertical Speed Mode Selector	18. Vertical Speed Selector
19. Course 2 Selector	20. Flight Director Switch	

CENTER INSTRUMENT PANEL



1. EICAS Display (Engine Indicating and Crew Alerting System) shows Engine, Gear, Flaps, Warnings and Cautions	2. Integrated Standby Instrument Panel Backup instrument for the attitude direction indicator, speed indicator and altitude indicator.
3. EICAS Display (Engine Indicating and Crew Alerting System) shows information on other aircraft systems. Also can show Advisory and Status messages.	

CAPTAINS INSTRUMENT PANELS

1. Nose wheel Steering Switch	2. Cockpit Light Controls	3. Windshield Wiper Switch
4. Stall Protection Pusher Switch. Controls the Stick Pusher.	5. Clock / Stopwatch	6. Bearing Selector Switch. Upper switches between OFF, NAV1 and ADF1. Lower switches between OFF, NAV2 and ADF2.
7. Format and Range Selector. Controls MFD format (PLAN, MAP HSI, weather radar, TCAS) and range.	8. Navigation Source Selector. Switches navigation source between FMS1, FMS2, NAV1, NAV2.	9. Vertical Speed Selector. Used to set V-Speeds (V1, V2, VR, VT).
10. Decision Height / Minimum Descent Altitude selector. Enables to select whether the decision height (DH) or minimum descent altitude (MDA) is indicated and adjust the value.	11. Barometric selector. Allows selection in Hg or mbar and adjust the value.	12. Revisionary Panel. Used to switch the MFD to PFD, NORM (navigation information) or EICAS mode.
13. Primary Flight Display, PFD Combines several instruments in one: attitude direction indicator, airspeed indicator, altimeter, vertical speed indicator, horizontal situation indicator, V-Speed bugs.	14. Multi-Function-Display, MFD Offers several display modes (Map, Plan, Horizontal Situation Indicator, Weather radar, TCAS) and may be switched to different navigation sources (FMS, VOR)	15. Voice Recorder Control Panel

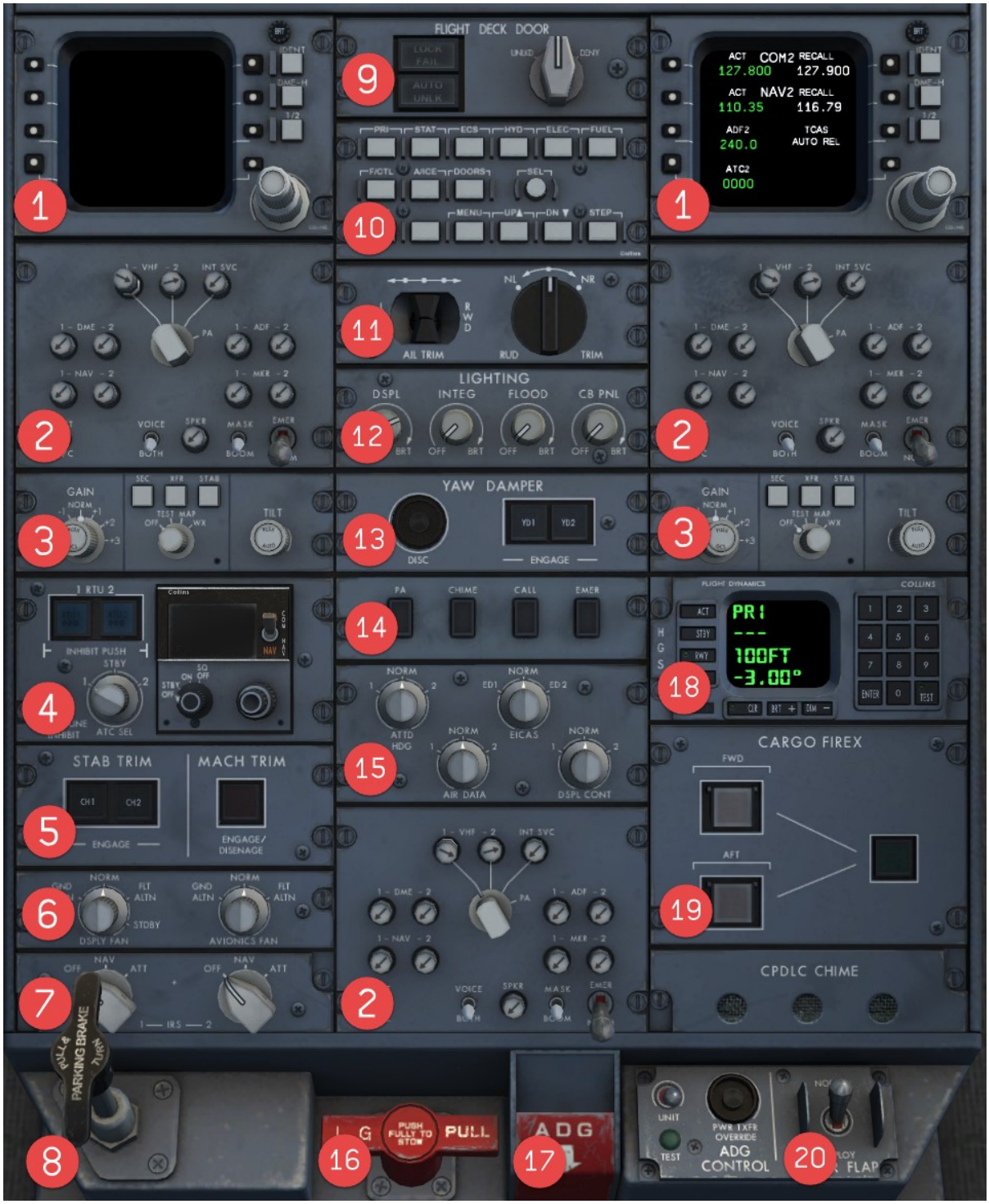
CAPTAIN SIDE CONTROL

1. Skycam. Used to monitor different camera's, for example to see who is at the cockpit door.	2. Steering Tiller. Used to steer the nose wheel on the ground at low speed.
3. Oxygen Mask: Click to test the flow of Oxygen.	

UPPER PEDESTAL

1. Captain side Flight Management System	2. First Officer side Flight Management System
3. Brake Temperature Monitor System. Used to reset the system and silence the horn.	4. Anti-Skid Switch. Arms or deactivates the anti-skid system.
5. MLG BAY Test switches. Test switches for Main Landing Gear Bay Overheat	6. Gear Lever.
7. Engine Synchronization Switch. The left and right engine's rpm may be synchronized automatically for noise abatement.	8. Ground Proximity Warning Switch. Illuminate depending on the activated GPWS mode pressing the switch silences the associated warning.
9. Pitch Disconnect. Disconnects the control wheels in case one yoke is jammed.	10. Spoiler Switch. To arm automatic extension of the ground spoilers after touchdown.
11. Reverser Switches. Arms the reversers so that they may be deployed during landing roll.	12. Spoiler lever. To extend and retract the spoilers.
13. Thrust Lever. To control thrust (from fuel shutoff to full power).	14. Roll Disc Handle. Disconnects the control wheels in case one yoke is jammed.
15. Flap Lever. Used to extend and retract the flaps.	

LOWER PEDESTAL

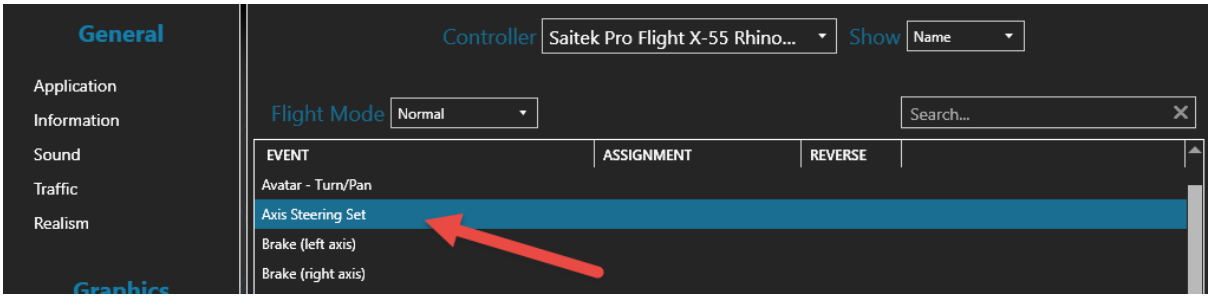


1. Radio Tuning Units. Used to tune communication, navigation stations as well as the transponder. The TCAS mode is also set here.	2. Audio Control Panels. Used to control sound volume for several audio sources like navigation station aural identifiers.
3. Weather Radar Controls.	4. Backup Tuning Unit and ATC Selector Switch. Used to select the active transponder and a backup tuning unit in case the RTU fails.
5. Stab / Mach trim Switches. Controls for the Mach and stabilizer trim.	6. Avionics Fan Controls.
7. Inertial Navigation System Controls, IRS Switches. Selector knobs for the modes of the IRS system	8. Parking Brake Lever. To set and release the parking brake.
9. Flight Deck Door Control. Controls for the flight deck door to deny or allow access to the cockpit.	10. EICAS Control Panel. Panel to select different EICAS pages.
11. Aileron and Rudder Trim Controls.	12. Cockpit Lightings Controls.
13. Yaw damper switches. Used to activate / deactivate the yaw dampers.	14. Intercom Control Panel. Used on the real plane to control communication within the aircraft like passenger addressing, crew calls, emergency calls and sounding a chime.
15. Source Selector Panel. The source selector panel allows to select air data sources as well as switching the displays to different modes in case a display fails.	16. Landing Gear Alternate Extension. In case the gear does not extend when selecting gear down via the gear lever, the alternate gear extension lever may be used to extend the gear.
17. Air Driven Generator Controls. In case the CRJ's engine and the APU fail a little propeller might be extended which produces sufficient electrical power to supply the most important aircraft systems.	18. Head-up Guidance System Controls.
19. Cargo Fire Panel. Controls for fire extinguishing systems for the cargo areas.	20. Emergency Flap Lever. In case controlling the flaps via the flap lever is not working the CRJ provides an emergency flap control.

NOSEWHEEL STEERING

At low speeds the CRJ is controlled with the tiller, a control device on the left console. It is possible to link this control to any available control axis in FSX. You could for example link a rotary control on your joystick to the Throttle 3 channel and then select Throttle 3 on the control option on the Options page of the CRJ Manager. For more information see the chapter on the Configurator. Of course, it is also possible to disable it here and use the standard FSX rudder channel.

If you are using Prepar3D V4 the Nose Wheel Steering Axis is one of the default axis and you can define it in the simulator.



PRE-DEFINED VIEWS

The CRJ700 / CRJ900 has limited 2d-panels. Instead a set of pre-defined views is available which are like a 2d-panel. The following list shows the available views and their respective key assignment / hot key. Of course, these views can be undocked and moved to other monitors.

You can click all the displays to undock them to 2d panels.

Hot Key	View
Shift + 1	Captain's VFR View
Shift + 2	CPT Overhead Panel
Shift + 3	CPT Standard View
Shift + 4	CPT FCP (Autopilot)
Shift + 5	CPT Full Panel (like CPT Standard with CDU in view additionally)
Shift + 6	CPT MCDU
Shift + 7	CPT Engine Controls
Shift + 8	CPT Centre Console
Shift + 9	MCDU Popup window
Ctrl + Plus	MFD decrease range (CPT)
Ctrl + Minus	MFD increase range (CPT)
Shift + Q	Toggle HUD
Ctrl + W	Toggle Yoke
F10	Overhead Panel (like a 2d panel)
F11	FCP (like a 2d panel)
F12	MCDU (like a 2D panel with PFD/MFD in view)
Ctrl + Shift + 1	Toggle MCDU Keyboard Input (CPT)
Ctrl + Shift + 2	Toggle MCDU Keyboard Input (FO)
Ctrl + Shift + 3	Switch MFD to HSI format
Ctrl + Shift + 4	Switch MFD to NAV format
Ctrl + Shift + 5	Switch MFD to MAP format
Ctrl + Shift + 6	Switch MFD to PLAN format
Ctrl + Shift + 7	Switch MFD to TCAS format
Ctrl + Shift + 8	Switch MFD to WXR format

MCDU KEY INPUT

As soon as you activated MCDU keyboard input (Ctrl + Shift + 1 or +2) you may use your keyboard to enter data into the keyboard. The following table shows the assignment of key functions and MCDU function.

Function	German Keyboard	U.S. Keyboard
Left MCDU Kybd ON/OFF	Strg + Umschalt + 1	Ctrl + Shift + 1
Right MCDU Kybd ON/OFF	Strg + Umschalt + 2	Ctrl + Shift + 2
LSK 1L	F1	F1
LSK 2L	F2	F2
LSK 3L	F3	F3
LSK 4L	F4	F4
LSK 5L	F5	F5
LSK 6L	F6	F6
LSK 1R	F7	F7
LSK 2R	F8	F8
LSK 3R	F9	F9
LSK 4R	F10	F10
LSK 5R	F11	F11
LSK 6R	F12	F12
MSG	Strg + F1	Ctrl + F1
Dir/Intc	Strg + F2	Ctrl + F2
Fpln	Strg + F3	Ctrl + F3
Dep/Arr	Strg + F4	Ctrl + F4
Hold	Strg + F5	Ctrl + F5
MCDU Menu	Strg + F6	Ctrl + F6
Index	Strg + F7	Ctrl + F7
Fix	Strg + F8	Ctrl + F8
Legs	Strg + F9	Ctrl + F9
Sec Fpln	Strg + F10	Ctrl + F10
VNAV	Strg + F11	Ctrl + F11
Exec	Return oder Strg + F12	Return or Ctrl + F12
Radio	Umschalt + F1	Shift + F1
Prog	Umschalt + F2	Shift + F2
Perf	Umschalt + F3	Shift + F3
MFD Data	Umschalt + F4	Shift + F4
MFD Menu	Umschalt + F5	Shift + F5
MFD Adv	Umschalt + F6	Shift + F6
A-Z	A-Z	A-Z
0-9	0-9	0-9
.	.	.
+	+	+
-	-	-
/	/	/
SP	Leertaste	Space
DEL	Entf	Delete
CLR	Zurück	Backspace

THROTTLE HOTKEYS

For people who need it we have programmed a way to control the throttle with key commands:

- F1 sets the throttles to idle
- F2 sets them to the next lower detent (MAX -> TOGA; TOGA -> CLB) or decreases throttle in the manual range
- F3 sets them to the next higher detent (CLB -> TOGA; TOGA -> MAX) or increases throttle in the manual range
- F4 sets them to the next higher detent (IDLE/manual range -> CLB; CLB -> TOGA; TOGA -> MAX)

ADDITIONAL TOOLS / OPTIONS

Several tools and options are provided to configure the product or to assist you in flight.

SAVING AND LOADING A FLIGHT

When you save a flight using the standard FSX menu option while flying the CRJ, an 'Aircraft State' file will be created as well. This Aircraft State file contains all the settings that are normally not saved by FSX. When you load a flight the accompanying Aircraft State file will be loaded so you can continue your flight exactly as you left off. However, this ONLY works if you load a flight using the standard FSX menu and not when you load it via the 'Free Flight' menu.

USING PANEL STATES

You can also use Aircraft State to configure the aircraft. There are three default Aircraft States:

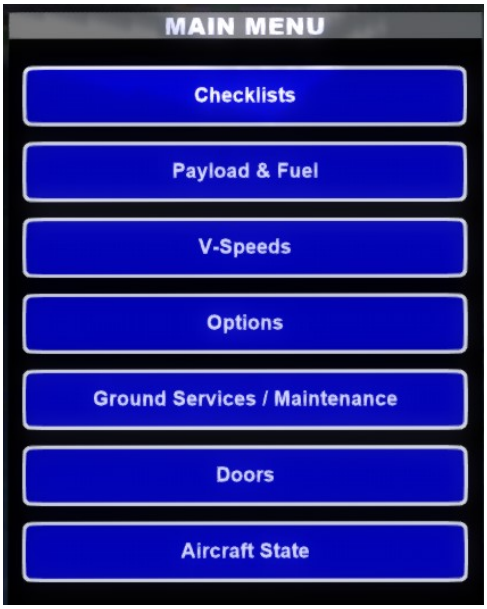
- COLD & DARK: As the aircraft is left when the last flight of the day is done. All systems are powered down.
- ENG STARTUP: Aircraft configured to the state just before engines are started.
- ENG RUNNING: Aircraft is configured to the state where engines have just been started (you could consider this a 'ready for taxi' state. Brakes are set and all lights are set.

It is also possible to create your own states. Just configure the aircraft as you want and use the SAVE STATE option after you entered a name. The name can only be 10 characters (a-z,0-9). In the image a state 'Short Final' has been saved by the user.

The Aircraft States menu can be reached by pressing the MCDU MENU button on the MCDU. If the aircraft is in a Cold and Dark state, you must provide electrical power to the aircraft bus to activate the MCDU's. The easiest way to do this is to switch on the battery bus (Battery Switch on Overhead to ON) and to use Dave to provide Ground Power (under the Services option). On the Overhead Electrical panel, the AC Available light will be lit. Press the button to connect it to the aircraft bus.

DAVE

Named after one of the crew members in 2001: Space Odyssey *(would you believe we are not allowed to call the thing Hal 9000?).* It's a tablet computer mounted on the side of the cockpit. Dave runs of its own internal battery. And no, it is NOT held in place by the clip, there is Velcro behind it!



CHECKLISTS

The checklists (or more precise 'flows') will assist you in making sure the aircraft is safely operated. Every stage of the flight is included.

FUEL PLANNER

If you do not want to use the fuel planner you can use Dave to calculate the needed fuel.

Passengers:
-- decreases the number of passengers by 10
- decreases the number of passengers by 1
+ increases the number of passengers by 1
++" increases the number of passengers by 10

Cargo:
-- decreases cargo weight by 100kg/lbs
- decreases cargo weight by 10kg/lbs
+ increases cargo weight by 100kg/lbs
++ increases cargo weight by 10kg/lbs

Fuel:
-- decreases fuel weight by 1000kg/lbs
- decreases fuel weight by 100kg/lbs
+ increases fuel weight by 100kg/lbs
++ increases fuel weight by 1000kg/lbs

Set Payload and Fuel sends the weights to FS.
Copy Data to PERF INIT copies the weights to the PERF INIT page of the active, modified and secondary flight plans in the FMS.

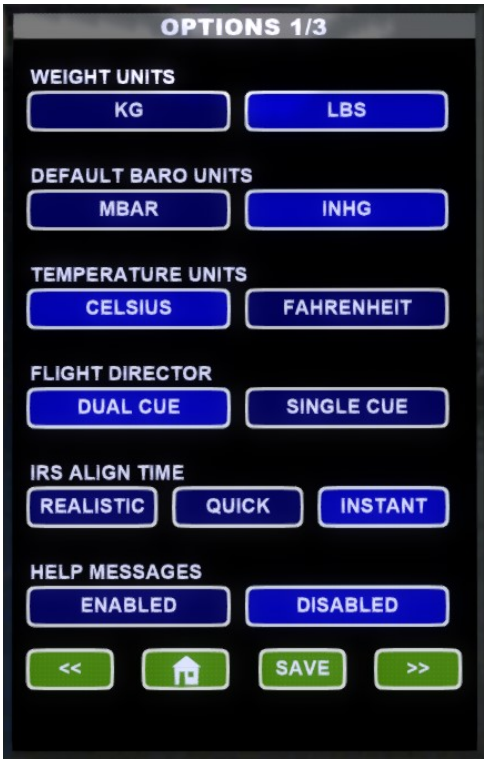
The changes don't need to be confirmed with EXEC.

V-SPEEDS

Of course the V-Speeds can be calculated and set using the cockpit controls but because that is complex we included a shortcut option to set V_1, Vr, V_2 and Vref.

OPTIONS

Diverse options can be set (and saved) in these three pages. Most will be self-explanatory, some guidance on these:

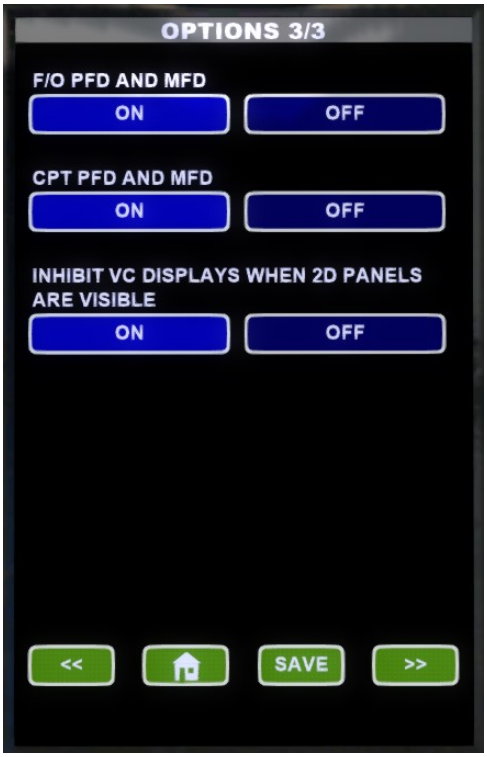


- IRS ALIGN TIME: The inertial reference system uses a system of gyroscopes to measure the movement of the aircraft. As it knows the starting location it can calculate the current position without any external references (for example from GPS satellites or radio navigation beacons). To be able to operate it needs time to spin up and align itself. Depending on conditions this can take quite some time. The settings here can be used to select realistic time, a compressed time or an instant IRS aligning.
- HELP MESSAGES: Toggles the display of additional EICAS messages. In the CRJ the messages on the EICAS can be rather cryptic, enabling this option makes them easier to understand. They are always shown in magenta.

- On some aircraft the Flight Number is shown in a different location, select this is you fly non Lufthansa models for sure.
- It is hard to know exactly what detent your throttle is in because there is no haptic feedback. If you like you can have PFD show what throttle detent you are. We advise this to be on at the start.

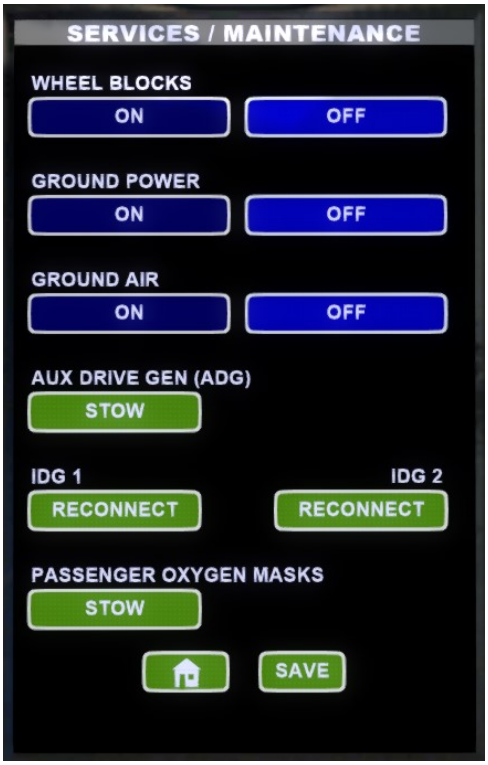
  This also means you do not have to look at the throttles to know if they are in the correct detent.
- FSX and P3D have a nasty bug that makes all ground handling cartoonlike. There is an option to fix this. If you have the FSUIPC ground friction tweak already active just keep this disabled
- PREPAR3D HDR LIGHTING: When HDR lighting is used in P3D this needs to be activated to make Dave readable.

- To increase frame rate, it is possible to deactivate PFD and MFD's. It's also possible to automatically disable the VC versions if you have the 2d panels open.



SERVICES / MAINTENANCE

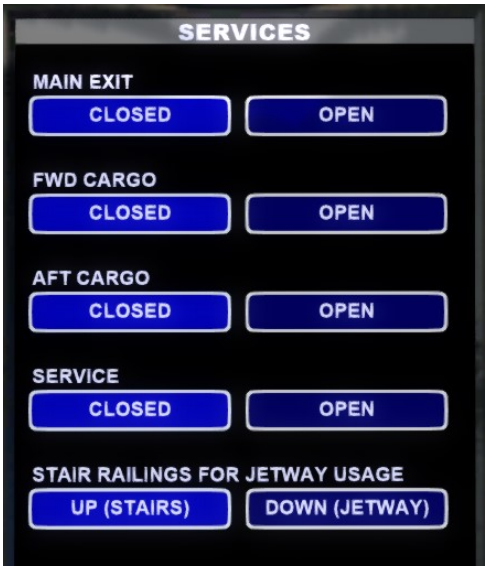
- WHEEL BLOCKS, GROUND POWER and GROUND AIR option will toggle the display of external objects but also the actual availability of Ground Power and Ground Air.
- AUX DRIVE GEN: When the Auxiliary Drive Generator (known as a Ram Air Turbine in other aircraft) is deployed it needs to be cranked into stowed position by ground staff.
- IDG: The Integrated Drive Generators are engine driven electrical power generating systems. When you disconnect them in flight they need to be reset by ground staff and this option simulates that.
- If the Passenger Oxygen Mask have been deployed there is also an option to stow them. This will remove the warning message from the EICAS.



DOORS

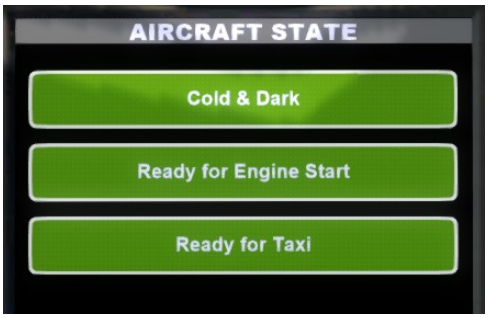
Allows you to open and close the doors and hatches. You can save the configuration so your aircraft will load with these settings when you load it next.

The STAIRS/JETWAY lets you choose if the railings of the main exit should be raised (STAIRS) or lowered (JETWAY). The latter option should be used if you are docking at a gate with a jetway.



AIRCRAFT STATE

A quick way to configure the complete aircraft into one of three states:

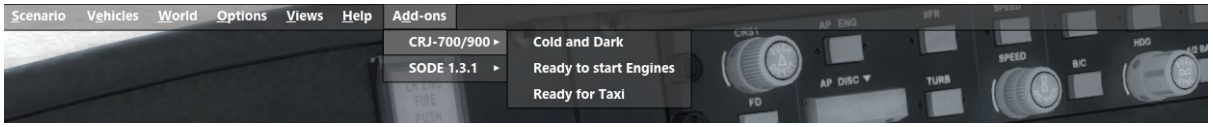


- COLD & DARK: As the aircraft is left when the last flight of the day is done. All systems are powered down.
- ENG STARTUP: Aircraft configured to the state just before engines are started.
- ENG RUNNING: Aircraft is configured to the state where engines have just been started (you could consider this a 'ready for taxi' state. Brakes are set and all lights are set.

Using Dave you can be in the air minutes after starting the simulator:

1. Activate Dave by clicking the on/off button
2. Select AIRCRAFT STATES
3. Select Ready For Taxi

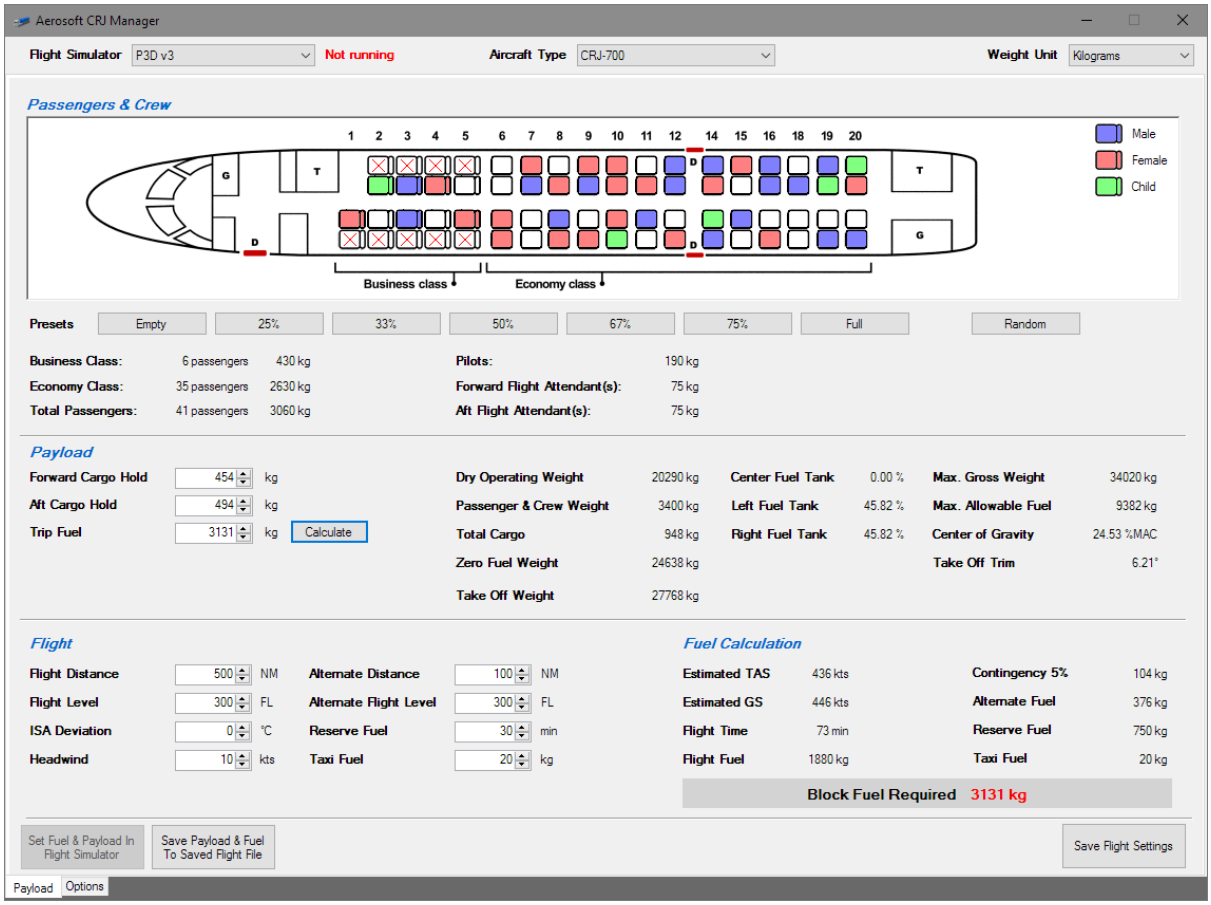
Please note that these same states can be selected from the FSX top menu:



CRJ MANAGER

You will find the CRJ manager in FSXMainFolder\Aerosoft\Digital Aviation CRJ (or for P3D: P3DMainFolder\ Aerosoft\Digital Aviation CRJ) . It allows you to load passengers and payload and to calculate the fuel load, Center of Gravity and Take-off trim.

Before starting it make sure your simulator is running and your CRJ is the active aircraft on your departure airport. Also make sure the right aircraft and simulator is selected in the top bar. When all is right a green 'Connected" should be visible in the top bar.



PASSENGERS & CREW

In this section, you set the number of passengers (note this is also possible via DAVE).

PAYLOAD

Here you can set he cargo (note this is also possible via DAVE). The Trip Fuel will be automatically calculated after you inserted more data in the FLIGHT section but can be changed. The rest of the fields will automatically filled.

FLIGHT

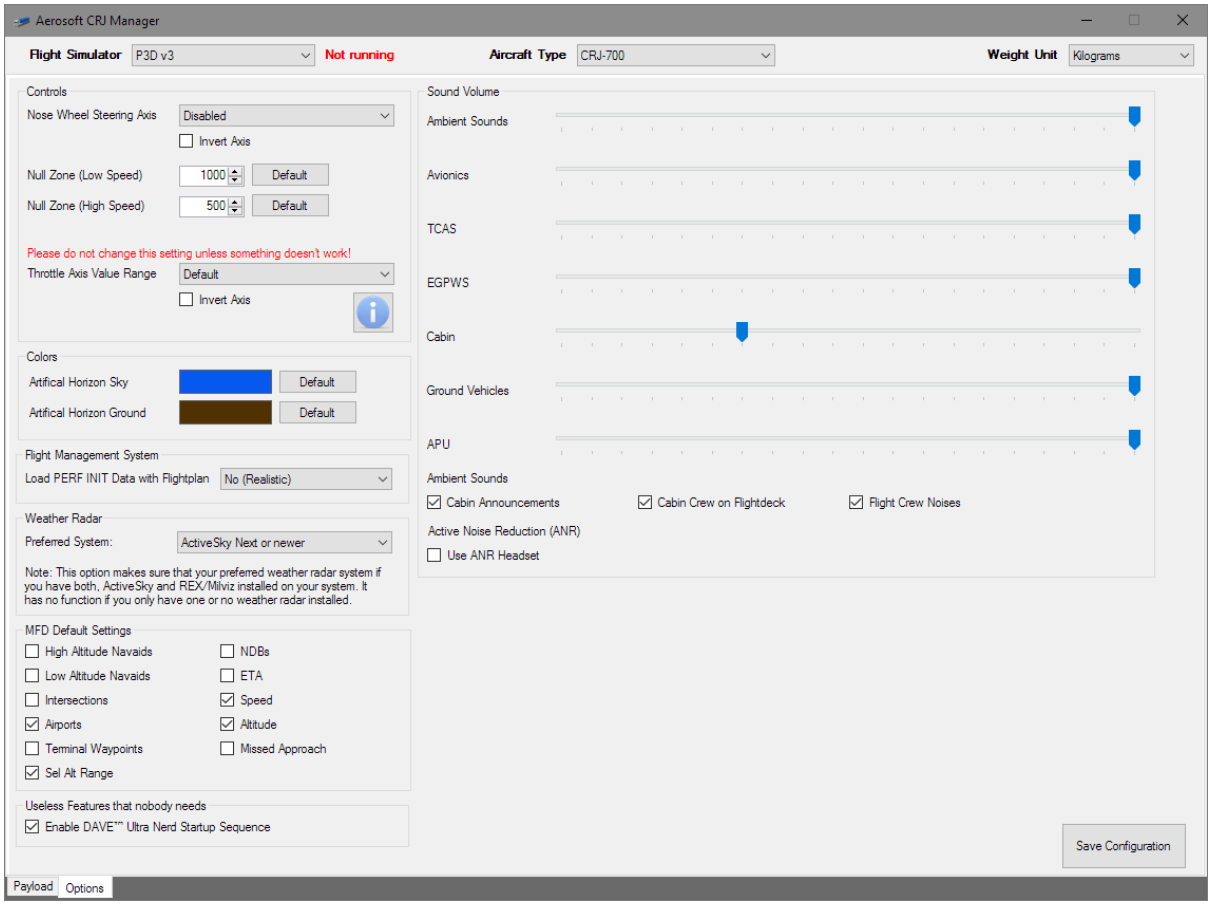
In this section, you insert the data that is needed to make the fuel calculations:

- **Flight Distance**: The total length of the flightpath
- **Flight Level**: Your planned flight altitude

- **ISA Deviation**: The difference between the 'standard' temperatures the International Standard Atmosphere and the actual expected temperatures. If you are not sure about this, just leave it at 0, it doesn't play a very large role
- **Headwind**: The wind component (+/-) for your flight
- **Alternate Distance**: The distance between your destination and the alternate
- **Alternate Flight Level**: The altitude you will fly at when you must go to your alternate
- **Reserve Fuel**: Normally set at 30 minutes
- **Taxi Fuel**: The amount of fuel you need to taxi, this depends on the airports but if you use 100 kg for small airports and 200 kg for very large airports you should be ok.

After you done all calculations you have three options to export the settings to FSX and one to store the setting so the manager loads with the correct parameters next time.

- **Set Fuel & Payload In Flight Simulator**: Writes payload and fuel data directly into FSX/FSX-SE/P3D
- **Save Fuel To Saved Flight File**: Writes fuel data into a .FLT or .FXML file (depending on which is simulator is selected)
- **Save Payload To Aircraft Configuration**: Writes payload data in the aircraft.cfg file
- **Save Flight Settings**: Saves the current payload/fuel settings into a configuration file so CRJ Manager shows the same data when you start it next time.



The Options Page of the configurator allows you to tweak the divers settings of the aircraft inside the sim.

CONTROLS

The tiller (used to steer the aircraft on the ground can be controlled by any standard axis of the sim and thus be controlled by hardware.

If this does not work as expected (as we have seen in some tests) you can change the behavior here as well.

COLORS

The CRJ's come with two color settings in the PFD, you can select your preference here.

FLIGHT MANAGEMENT SYSTEM

You can load the PERF INIT data automatically or insert it manually. Manually is the more realistic option.

WEATHER RADAR PREFERENCE

The build in weather radar can take its data from Active Sky. The CRJ will automatically select the source if only one weather add-on is installed, this selector is only needed it you have both installed.

MFD DEFAULT SETTINGS

You can select here what will be shown on the MFD by default on startup. Of course, you can always select this in the MFD MENU, this is just a quick way to set your defaults.

USELESS FEATURES…

If you are a SF nerd, leave this on. You will probably switch it off after a few startups.

SOUNDS

In this section, you can select what sounds are used and at what volume.

LIVERY MANAGER

You will find the livery manager in FSXMainFolder\Aerosoft\Digital Aviation CRJ\Livery Manager Folder.

Installing a livery is as simple as dragging the zip file you downloaded on top of the livery manager. For 90% of the additional liveries this will work. All other livery ZIP files that meet the following conditions will be handled automatic (*if this method does not work ask the livery designer to be compliant with our standards*):

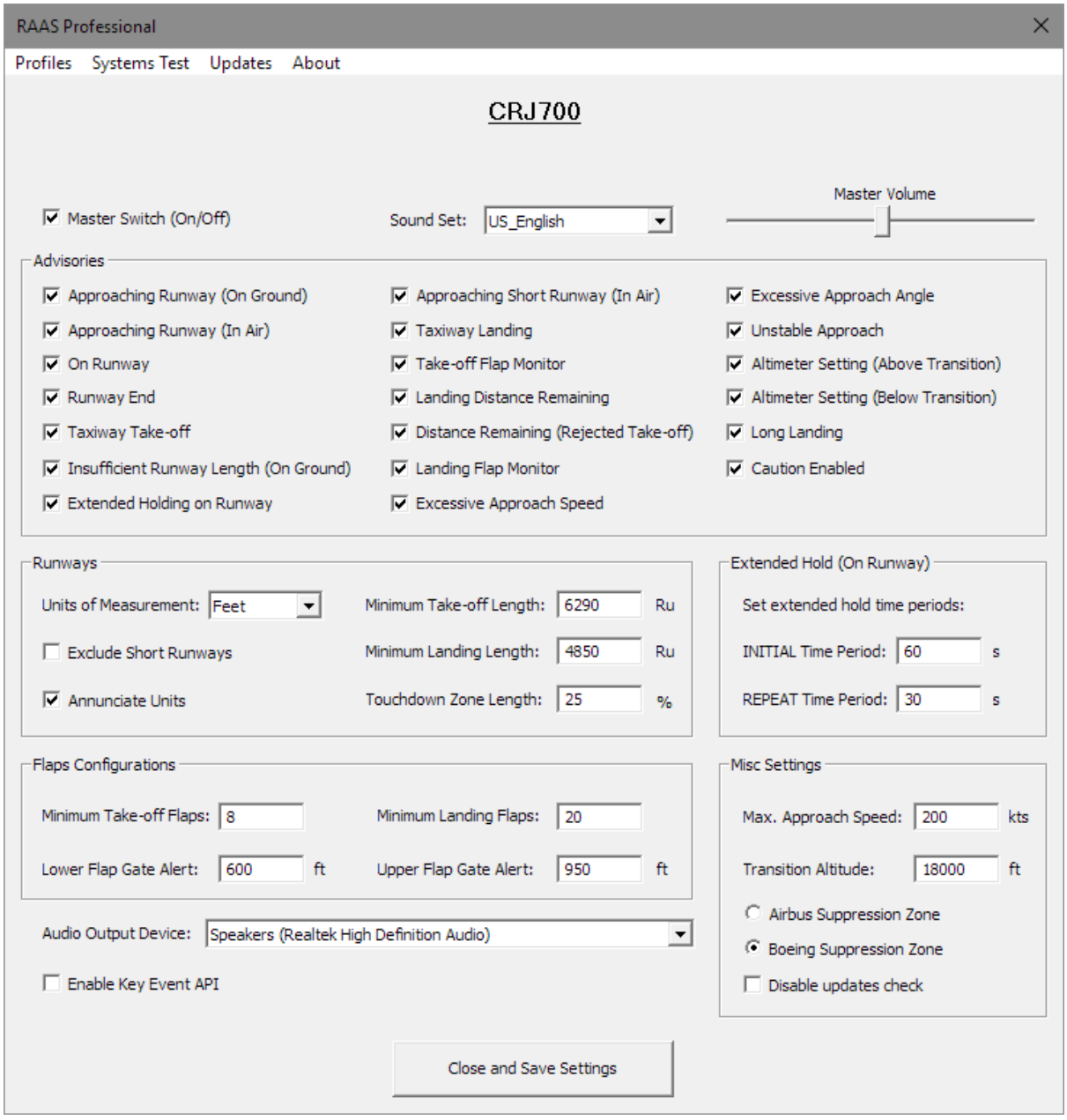
- There must be a txt-file ("readme.txt" or different name if it's the only txt-file) with the code snippet for the aircraft.cfg included.
- The snippet starts with [FLTSIM.X] and ends with a blank line.
- In this snippet, the line "ui-type=*aircraft type*" must be contained, otherwise the manager doesn't know which plane the livery should be added to.
- Each ZIP-file can only contain **one** livery / alternative versions must be separated into two ZIP files.
- The whole file must be a proper ZIP-file containing the file and folder structure on the first level. So do not zip the folder with the files but only the files themselves.
- Beside the text file there needs to be the texture folder with its extension name, containing a "thumbnail.jpg"

RAAS (RUNWAY AWARENESS AND ADVISORY SYSTEM)

This project contains a fully functional version of FS2Crew RAAS Professional, the only limitation is that is limited to the aircraft included in this project. After the installation of the CRJ the installation of RAAS Professional is started. If you have this product already installed you can cancel it, but it will not matter anyway.

RAAS Professional (Runway Awareness and Advisory System) models the aural 'Smart Landing' and 'Smart Runway' calls included in the real-world Honeywell RAAS unit. These calls offer improved situational awareness for pilots to help reduce the risk of runway incursions and accidents by providing aural alerts during taxi, takeoff, final approach and landing/roll-out operations.

It is a system that has NO interface for the pilots in the cockpit and we advise you to simply not try to change it in any way as it is highly accurate and simulates the real system near perfectly. If it fails it is almost certainly because the scenery you are using is not correct! Should you want to tweak it, you can open the FS Add-ons drop down menu and select RAAS Professional to see this menu:



APPENDIX 1: TRANSITIONING TO THE BOMBARDIER CRJ700 AND 900

(By Alexander Metzger)

For those simulator pilots who transition from larger airliners, like an Airbus 320 or a Boeing 737, we would like to provide you with important information on the specific differences flying the Canadair Regional Jet (CRJ).

The aim of the development team was to properly transpose the real plane into a simulation that is enjoyable to beginners and advanced simulation pilots. This document is focused on the differences of the CRJ700 and CRJ900 in comparison to other airlines you may be familiar with. We encourage you to read the other manuals so that you will be familiar with the cockpit and the systems that have been simulated at a very high level of detail.

GEOMETRY

On the first look from outside, it is obvious that the CRJ has been realized with a different concept of engine arrangement in the back of the aircraft. As engines are relatively heavy, consequently the wing position, about the fuselage length, is also much more rearward, to assure that the centre of gravity of the empty or fully loaded aircraft is within the limits of the wing chord to assure a stable flight behaviour.

Loading the aircraft properly is therefore vital for sufficient control of the elevator which has less of an arm for pitch control than on a classical arrangement. Please refer to the trim tables to be properly trimmed for take-off depending on weight and centre of gravity index.

The big advantage of positioning the engines at the rear end of the fuselage is a lighter wing construction – no need to carry the heavy engines – and having the whole surface and shape available to produce the required lift in respect to aircraft weight. This wing is optimized for high speeds and supported by slats and flaps for the slower flying regime during take-off and approach/landing.

There is also a very noticeable difference while flying an aircraft with that engine arrangement when applying power changes. On the CRJ the engine thrust is pushing at a position higher than the centre of gravity and above the wing. This results in a pitch down moment when increasing power and consequently a pitch up moment when pulling engine levers to idle. While in cruise, the autopilot would eliminate this with trim commands, it is specifically important to bear this in mind during the final landing phase, especially the flare onto the runway. You need very little pull on the yoke when you slow the descent and retard the engines before touch down.

Do not retard the engines to idle 50 ft. or even higher, as this will lead to a pitch up of the CRJ and fast loss of speed too high above the runway and requires a corrective nose down push to avoid a hard landing.

Opposite to the landing, the full power during take-off pushes the nose down and you need pull the yoke substantially to initiate the rotation. The pitch down attitude, characteristic for these two planes while on ground, is not helping either to get airborne. Therefore, pull firmly, rotate with about 3°/s to 15-18° pitch and trim for the initial climb speed.

A specialty of the CRJ is its automatic trim movement when flying manually and extending or retracting flaps between the positions UP-1-8-20°. This automatic trim travel supports the pilot hand-flying the aircraft when there is a need to compensate the impact from changing flaps configuration with intense lift changes that require pitch control.

SYSTEMS

Regional jets are typically doing many flights per day and so does the crew. Bombardier has therefore automated many systems to release the pilots from routine procedures. Examples are the two button only start-up of the APU with automatic bleed air assignment. Similar the main engines single button start-up and thereafter fully controlled by the Full Authority Digital Engine Control (FADEC) system.

Fixed throttle detents for the take-off and climb help setting the correct power for these conditions of flight. On the other hand, the CRJs do not have an auto-throttle system and therefore the pilot flying needs to manage power in cruise and descent. It also has only advisory vertical navigation (VNAV) capability and therefore decent planning is in the pilots hand and experience.

In return, there is no need to worry about switching bleed air for controlling cabin pressure or during anti-ice operations. But due to the smaller engines, the loss of power from using bleed air for heating the wings leading edge is more noticeable than on a larger aircraft. The climb performance is significantly reduced despite the setting for N_1 targets are a bit higher.

Further, do not be surprised by the increase of N_1 and consequent thrust increase during a descent with idle power when switching on anti-ice. The engines need to turn faster to maintain cabin pressure while hot air from the turbine is deviated and guided to the engine cowlings and wing leading edges. This can ruin your planned descent path by picking up more speed and requiring lower rates of descent and it is better to anticipate icing early in the planning of the descent schedule than being forced to use spoilers to obtain required rate of descent and not exceeding speed limits.

The two screens in the centre of the panel provide you with a wealth of information on system status, error awareness or alerts. They also have dedicated screens for the controls and the monitoring role of the pilots during the start-up of the systems all the way to the engines. We have modelled these pages with great care and realism. Details can be found in the provided systems documentation and also in the tutorial flights.

FLIGHT CHARACTERISTICS

Beyond the above-mentioned specifics of a tail driven aircraft, the CRJ is very stable in flight with easy roll and pitch response in the speed range that may be typically flown by hand.

At cruise speed the response is very direct and minimal yoke input is required. The lower weights versus the bigger aircraft you may know make it also more receptive to air turbulence.

In the lower range of the speed band, the controls are becoming less sensitive, but remain more on the sportive side as it is a light aircraft with significant less inertia on roll versus an aircraft with wing mounted engines.

Due to the slats and efficient flaps, you typically have a high margin to stall speed and that enables low landing speeds and short runways. Pitch attitude during descent and on final is often negative and becoming slightly positive at reference speed providing a good forward view.

As soon as pitch establishes around +2° during the approach, it is time to select the next flaps setting.

The landing gear has very little drag and hardly any pitch effect. Slats and flaps shall be used to slow down the aircraft and the flight spoiler may assist when you have left little time to adjust speed – but don't expect miracles from them, especially on the CRJ900.

In flare, level pitch will not cause a nose gear first touchdown as it is shorter than the main gear. The low wing has a significant ground effect and the CRJ tends to float forever if you come in just a bit too fast for the

landing weight. You need to set down the nose gear gently and pay specific attention when you use reverse thrust immediately after ground contact.

On outbound taxi, the CRJ starts rolling with a little power push initially and maintains taxi speed close to idle. On inbound taxi, you may need to use the brakes from time to time to avoid exceeding apron speed limits.

AVIONICS AND FLIGHT MANAGEMENT SYSTEM (FMC)

Every major aircraft producer favours his avionics provider and even when you are used to a Dash 8-400 built by the same manufacturer Bombardier as the CRJ, you need to get familiar with the display and the programming technique of the FMS used on the CRJ700 and CRJ900.

Please refer to the information provided in the systems description and the procedures as part of the tutorial flights. Two main screens directly located in front of you provide you with a wealth of information on your flight situation from an aerodynamic point of you and from a navigational perspective. Again, please familiarize yourself with the many options of displaying data and graphical awareness displays for navigation and route following.

We would like to encourage you to properly fly the CRJ700 and CRJ900 by investing some time to build a knowledge base for proper operation.

APPENDIX 2: CRJ900 FLIGHT FROM DÜSSELDORF (DUS) TO BASEL (BSL)

This is a description of Germanwings flight 4U9712 according the schedule as published on their webpage for Saturday March 7, 2015. We will be flying one of their Bombardier CRJ900 registered under D-ACNN belonging to Eurowings (now Lufthansa CityLine) which will execute this flight as operator. The planned departure time is 07:00 am and the arrival should be 70 minutes later at 8:10 am.

We will start with our flight planning. Have a safe flight!

Please note that Vol 3 of the manual includes a more in-depth step by step flight.

FLIGHT PLANNING

ROUTING

Departure airport: Düsseldorf (IATA: DUS – ICAO: EDDL)
Destination airport: Basel (IATA: BSL – ICAO: LFSB)
Alternate airport: Zurich (IATA: ZRH – ICAO: LSZH)

For European flights, VATroute http://www.vatroute.net/ is a good and simple flight planning page to obtain a typical route. The query result for EDDL-LFSB at our predicted flight reads like this:

FL196-FL315 MODRU Z283 SUMAS UZ283 RITAX UT27 GTQ UN852 ARPUS

We select flight level 290 (FL290) and the route distance has been calculated to 280 nautical miles (NM). An additional 20 NM are added to cover departure and arrival routes. As alternate airport, we selected Zurich (LSZH). The distance from LFSB is 45 NM plus 20 NM for the arrival route. We do expect taking off from runway 23L and following the Standard Instrument Departure route (SID) called MODRU 1T.

WEATHER

This is a typical spring morning with refreshing 3 °C, light clouds and a moderate, south-easterly wind on ground.

Based on this data we expect to be taking off from runway 23L. For flight planning we conclude an average wind component of eleven knots from 032 degrees (11/032) at FL290 and a headwind component of -22 knots (tailwind) according the weather forecast at cruise altitude.

WEIGHT AND FUEL

For this flight, we will be using the following data:

	Weight in kg	Weight in pounds	Comment
Dry Operating Weight (DOW)	22'471 kg	49'540 lbs.	
Passengers: 72 Adult	72 * 84 = 6'048 kg	72 * 185 = 13'320 lbs.	
Luggage in front compartment	462 kg	1'020 lbs.	
Cargo in rear compartment	339 kg	748 lbs.	
Zero Fuel Weight (ZFW)	29'315 kg	6'4627 lbs.	
Weight check against max. ZFW	31'752 kg	70'000 lbs.	< MZFW OK
Fuel	2'700 kg	6'000 lbs.	See next page
Take-off weight (TOW)	32'015 kg	70'672 lbs.	
Weight check against max. TOW	37'422 kg	82'500 lbs.	< MTOW OK

Detailed calculation for fueling:

		Weight in kg	Weight in pounds
Distance to destination	340 nm		
Take-off weight (TOW)		32'000 kg	7'0570 lbs.
Flight level to destination	FL290		
ISA deviation	-10 °C		
Headwind component	-22 knots		
Contingency	5%	104 kg (minimum)	230 lbs. (minimum)
Distance to alternate	45 nm		
Flight level to alternate	FL150		
Reserve		750 kg	1'655 lbs.
Taxi		100 kg	220 lbs.
Minimum fuel		2'627 kg	5'791 lbs.
Block fuel		2'700 kg	6'000 lbs.
Center of Gravity (CoG)	22.4% MAC*		

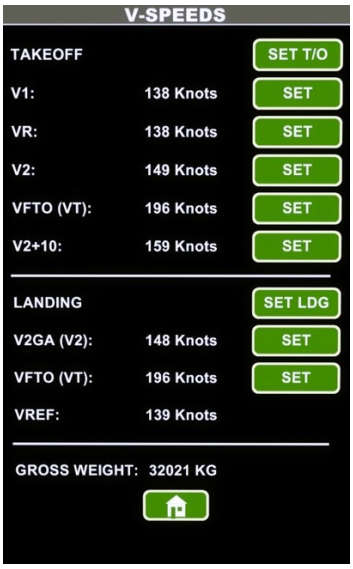
* MAC means Mean Aerodynamic Chord

TAKE-OFF DATA

Based on the above determined take-off weight of 31'715 kg (69'917 lbs.) we will now define the critical speeds for departure. EDDL runway 23L is long enough (9'843 x 148 ft. / 3000 x 45 m) so that there is no restriction and we can use the speeds from the speed card for 70'000 lbs. (31'751 kg) that can be found in the Quick Reference Guide. Or for those lazy RW pilots under us we go directly to DAVE and get our speeds from there. You can even insert them automatically, inputting these speeds manually is a real chore.

We will be setting flaps to 8 degrees for the take-off and our departure airport altitude is close to sea level. Outside temperature is less than 10 °C. This concludes in the following speed selection (DAVE sometimes calculates slighty different values due to more accurate weight info):

- V_1 = 138 knots as maximum speed to abort the take-off.
- V_R = 138 knots for safe lift-off speed
- V_2 = 149 knots as safe speed in the case of an engine failure
- V_2 + 10 = 159 knots as speed for the initial climb phase up to 3'000 ft. above aerodrome level (AAL), also used as acceleration altitude



DEPARTURE FROM DUSSELDORF AIRPORT

AIRCRAFT PREPARATION

After completion of the flight preparation it is time to get started. Just load the flight 'CRJ Tutorial Flight DUS-BSL' in FSX/P3D and make sure to select Ready for Engine Start via the AIRCRAFT STATE menu in DAVE. You are located at apron position V53 at Düsseldorf airport. It is 5:30 Coordinated Universal Time (UTC) or 6:30 local time (LT). Our CRJ900 is prepared per the above described flight planning with the requested fuel and passenger/freight boarding/loading completed.

Next item as pilot flying (PF) is to finalize cockpit preparation and put the aircraft and the crew into a "Request for start-up and push-back" situation.

- Programming of Flight Management Systems (FMS)
- Check of avionic parameters
  - HDG-bug on runway heading
  - Transponder set to 2-3-5-6 and on standby mode
  - Departure route is displayed
  - Approved initial flight level 5'000 ft on SID MODRU 1T
  - Barometric pressure to QNH 1009
  - Approved flight plan is complete and active
- Check on aircraft
  - Fuel according plan
  - Hydraulic pumps on - system under pressure
  - Elevator trim set according weight and centre of gravity actual set to 6.4 trim units
  - All doors closed
  - Auxiliary Power Unit (APU) supplies bleed air and current
  - Parking brake is set
  - Navigation (NAV) lights and Beacon (BCN) light are on
  - Passenger signs "Fasten Seatbelts" and "No Smoking" are on
- Running „Before Start Checklist"

ENGINE START AND PUSHBACK ON APRON POSITION

The start-up of the engines is executed in a semi-automatic procedure and supervised by the Full Authority Digital Engine Control (FADEC) system and the pilots.

- Throttle lever in CUT OFF position
- Press ENG START button – typically the right engine first, thereafter the left one
  - N_2 spooling up to above 20%, check ITT <120°C
  - Throttle lever into IDLE position
  - Kerosene is injected and ignited
  - N_2 climbing further and N_1 to follow
  - ITT must be watched – Limit is shown in EICAS display
- Engine start completed and checked
  - N_1 stable at 20 to 22%
  - Consumption at 250-300 kg/h
  - ITT at 620°C
  - Generators automatically connected and deliver current – Check ELEC page
  - Ventilation and air conditioning active
- Running the „After Start Checklist“
- Pushback facing North-East
- Pushback completed
- Request “Taxi Clearance to runway 23L”

TAXIING TO RUNWAY 23L

Hint: If you have assigned the front wheel steering via a separate axis assignment on your available hardware control, this will allow you to steer the CRJ on ground in a realistic way. In addition, this will allow you to execute the flight controls check in a realistic way during taxi time. If you have not, you need to do the check during standstill which is the preferred SOP anyway..

Before taxiing out you will be setting flaps to position 8° and check the functionality of the controls. This is done by moving all three control axes to their endpoints and check their movements in the EICAS display.

The intention to start moving is acknowledged by turning on the TAXI LIGHT. The CRJ starts rolling with just a bit of power to overcome the inertia and can easily be controlled. If light on weight it may be necessary to softly brake to avoid exceeding speed limits. Typically, 7 to 10 kts are used on apron areas and 20 to 30 kts on a free taxiway. This depends very much on weather, taxiway conditions and other traffic. And any instructions from ground control.

Before reaching the holding point of the departure runway the “Taxi Checklist” must be completed and only when everything is normal you signal your readiness by switching the transponder code to ON. Some airports do request to be ON when rolling on the Apron but latest at lining up on departure runway.

TAKE-OFF ON RWY 23L

After having received clearance to "Line up and wait", the last preparations for the take-off need to be made:

- Alert the flight attendants – "Cabin crew prepare for departure"
- Check identical values for HDG-bug and runway direction – should be 232°
- Running "Before Take-off Checklist"

After having received clearance for taking off you switch on the landing lights and by that signals to the tower that the take-off is imminent. First move the throttles forward to achieve about 70% N_1 and check that both engines are very close N_1%. By that you assure that both engines are delivering similar thrust. Only then you guide the throttles beyond CLB-dent into the TOGA-dent and monitor that the target N_1% is matched while ITT temperature limit is not exceeded. Any malfunction leads to immediate take-off abortion by the pilot in charge.

Background information: Taking off in an aircraft is a relative strict process serving safety of flight and noise abatement procedures. You may divide into the take-off run up to V_1, the rotation at V_R and the initial climb at minimum V_2 + 10. All these V-Speeds have been defined during flight preparation as per earlier chapters. See previous chapter of this tutorial.

Rotation at V_R shall not exceed 3 degree/second, so that the tail will not touch the ground (tail strike). Pitch attitude will be set to 15 to 18 ° and the trim may be adjusted to match and the gear will be retracted. By that an optimal rate of climb with a built-in safety margin in case of engine failure and minimal speed can be achieved.

At 1'500 ft. above aerodrome level (AAL) engine power is reduced for noise abatement.

At 3'000 ft. above AAL the acceleration towards the maximum allowed speed of 250 kts will be initiated. This is executed by an aligned process of flaps lift and flaps drag reduction with synchronous reduction of engine power and climb rate to achieve the desired acceleration. You may control the aircraft manually or let the autopilot have the controls.

REGULAR TAKE-OFF SEQUENCE (WITHOUT SPEED LIMIT ON DEPARTURE ROUTE) FOR THIS FLIGHT:

1.	Positive rate of climb	Gear retraction and maintain V_2+10 as minimum.
2.	400 ft.	HDG or NAV to be activated
3.	600 ft.	Activate autopilot with active HDG or NAV mode IAS HOLD mode to be engaged – current speed will be set as target
4.	1'500 ft.	Pull back throttles to CLB dent and keep minimum V_2 + 10
5.	3'000 ft.	Target speed set to 210 kts (maximum speed for flaps 8°)
6.	> 161 kts	Flaps retraction to position 1
7.	> 180 kts	Flaps retraction to position 0
8.	Flaps are 0	Target speed set to 250 kts (maximum speed <FL100)
9.	Climb Check	"After Take-off Checklist" to be completed

CLIMB AND CRUISE

After the busy phase is over and the autopilot follows the horizontal navigation, the route, it is our turn to secure that all marked speed and altitude restrictions will be followed. We also change to standard barometric pressure at the transition Altitude (TA) – in Germany this is at 5'000 ft.

Background information: Different to flying in the US, the European altitude control requires changing at 3'000 to 5'000ft and in mountainous areas higher to meet minimum altitudes above terrain. As of that TL the flight level will be assigned as FL50 equal to 5'000 ft. at standard barometric pressure 1013 mbar (29.92 in HG) and mentioned by the controller.

The CRJ has no automatic vertical navigation control and it is the task of the pilot flying to concur with possible restrictions by setting i.e. the next allowed flight level. Our SID includes the following description and limitations:

MODRU ONE TANGO
On track 232° DY to 3.4 DME DUS/3.6 DME IDNE;
RT, on track 321° to UBORO;
LT, NETEX; LT on track 200° to MODRU.
Climb with 7% (425ft/NM) or more until passing 3000.
GPS/FMS RNAV: [A600+] - DL243[K210-; R] -
UBORO[L] - NETEX[K250-] - MODRU[F210+].

With the following meaning:

- NETEX[K210-] the speed until NETEX is limited to 210 kts, even if you may have exceeded FL100
- MODRU[F210+] means that we should be crossing MODRU at FL210 or higher

Background information: The CRJ has a built-in autopilot modus that can control the climb or descent speed by changing the pitch attitude and by that the rate of climb or descent to match a given target speed. For best performance, thrust lever need to be at least in CLB and the FADEC will set an optimal climb power according a database that relates to altitude and outside temperature. The typically used speed profile is 250/290/0.74 and this profile is the base for our flight calculation. Alternatively, you may choose to fly faster, i.e. catch up with a delay. This would be 250/300/0.77 or even 250/320/0.80. Naturally these are less economical.

The first number in this list of speeds is the speed below FL100, which is unified around the world but maybe lifted by the controller, if current traffic allows.

The second number is the speed for climb and cruise above FL100. With increased flight altitude, there is a limit for aircraft not only from "indicated Airspeed" but also from the Mach number that shall not be exceeded. The mentioned speed profiles keep a safety margin from these structural limits of the aircraft. At about FL270, you reach an interception of IAS =290 and Mach =0.74 and you need to follow the speed control by Mach. The speed selection button has a centre push button to switch between IAS and Mach.

Passing FL100 we switch off the landing lights and could change the IAS HOLD to the desired 290 kts for the following climb to FL290. But since the SID contains a speed restriction of maximum 250 kts until waypoint NETEX, we need to wait until we have that passed. Since our weather is not predicting any special turbulence, we switch off the "Fasten Seat Belt" sign.

Just before we reach FL290 we are matching up with Mach 0.74 and change to Mach speed control.

At 1'000 ft. prior to target FL an alert will draw our attention to monitor the levelling off to horizontal cruise flight. Since this requires less power from the engines, we need to pull out the thrust lever and adjust the N_1

manually so that the speed stays at Mach 0.74. From experience, we know that the expected N_1 is about 81 to 82 % and we adjust to keep a speed of Mach 0.74 consistently.

Cruising is the quietest flight chapter and except for scanning other traffic and ATC handover we just monitor engine parameters and climate control.

ARRIVAL TO BASEL AIRPORT

DESCENT AND ENTRY INTO AIRPORT SPACE

The descent to our destination airport has two distinctive parts. First part is the descent into lower airspace with the reduction of speed down to 250 knots below FL100. Thereafter follows the arrival according to the published Standard Arrival Route (STAR) or according vectors given by the approach controller. We follow the process flying the STAR route which needs to be selected first.

Slight winds from southeast suggest that runway 15 is in use. The approach will be done following the Instrument Landing System (ILS) starting at the Initial Approach Fix (IAF) called ALTIK at 5'000 ft. This is linked to our last waypoint by the STAR called ARPUS8K. Now the route to our landing runway is defined.

Background information: The arrival to the destination airport will be explained by the pilot flying (PF) in great detail during the approach briefing. The Pilot Monitoring (PM) is checking the process. Every step will be indicated and any specialties will be clarified. This may cover speed restriction and minimum altitudes, obstacles and noise abatement requirements. Further the setup of the navigation instruments like VORs (VHF Omnidirectional Range) in both NAV devices and in the ADF (Automatic Direction Finder), if an NDB (Non-Directional Bearing) is available. Final item is the process to execute a missed approach, stating the route which typically ends at a holding at a waypoint, from which a new approach can be executed.

Route preparation:

- ILS Y RWY 15 with IAF ALTIK at minimum 5000 ft.
- 12 DME Arc BLM with frequency 117.45 set in VOR2
- ILS with frequency 111.55, identifier MH set in VOR1 and course 153°
- Threshold elevation 864 ft. entered as LDG ELEV as 860
- MDA/DA of 1070 ft for an ILS cat 1 approach
- Missed Approach straight ahead crossing ADF BS 376 set, followed by a right turn with maximum 220 knots intercepting BLM outbound radial 230°. Thereafter 15 DME Arc BLM to ALTIK hold
- Landing configuration flaps 45° und VRef=136 kts

DESCENT CHECK

Entry into airport space:

- > 10'000 ft. > Setting target speed to 250 kts (maximum speed <FL100) and reducing accordingly
- 10'000 ft > Landing lights on
- 15 min before landing > Passenger signs on
- 7 min before landing > Cabin crew information „Cabin crew prepare for landing "
- 6'000 ft. > Actual barometric pressure set in all altimeters
- Approach Check > Running „Approach Checklist "

Basel airport is in the 3-country triangle of France, Germany and Switzerland with the cities of Mulhouse and Basel and the Jura mountains in the south. Due to this location, the arrival route is quite complex. Adhering to

an altitude minimum of 4'000 ft and a speed of maximum 185 kts, because of tight turns on the entry to the DME (Distance Measurement Equipment) arc and the final 90° turn on ILS localizer (LOC), requires a good control of the aircraft. Therefore, you need to reduce speed to 200 kts and flaps 1° and 185 kts with flaps 8° is necessary. A simpler arrival can be done by using vectors, i.e. outbound VOR/DME GROSTENQUIN GTQ 111.25 MHz set in NAV1 and descending to 4'000 ft. at 10.4 NM before VOR/DME Basel MULHOUSE BLM 117.45 MHz set in NAV2 and once close to BLM switch to standby ILS/DME MH 111.55 MHz on NAV 1.

FINAL APPROACH DIRECTION RWY 15

The maximum required 185 kts at 4'000 ft can be flown with flaps 8° and normally we fly around 180 kts to have a little margin to the maximum speed. We capture the glideslope at 9.5 NM distance and 4'000 ft. We keep 180 kts and select flaps 20°. 6NM before the threshold we drop the gear and reduce speed further. Consequently flaps 30° and 45° are set so that we achieve landing configuration at 1'000 ft above runway elevation and the speed should read V_{Ref} + 5 = 139 kts. Typically, you need about 58% N_1 power. Running the "Before Landing Checklists" and switching off the autopilot when we are cleared to land.

LANDING

During the last 1'000 ft., we are concentrated on keeping the speed and the correct position in reference to the flight director (FD) indication. If the deviation from the ILS LOC/GS happens to be more that 1 dot, the landing must be aborted and the above discussed Missed Approach Procedure (MAP) must be executed. Crosswind influences must be equalized precisely and with strong headwinds the value for Vref needs to be increased by half the headwind. This is done to increase the safety margin.

At 50 ft. above runway – well indicated at the RA display – we pull the thrust lever to idle and reduce the vertical speed with a soft pull on the yoke. Once the main wheels have touched the ground, the spoilers are automatically deployed and the pilot pulls the throttle into reverse position. Drop the nose softly to get the front wheel on ground and only then use wheel brakes for further speed reduction. At 70 kts you cut reversers by setting the throttle lever back to idle position and take the next exit left to your parking position. Crossing the hold line, you configure the aircraft for taxiing to position:

- Landing lights to off, taxi light remains on
- Strobes to off
- Flaps to be retracted
- Transponder set on "Standby"
- Probes heat to off
- Depending on gate or apron position and local prescription we may switch on the APU to assure air conditioning and electric supplies once we switch off the engines
- Turning into position we switch off the taxi lights (danger of blinding ground personnel)

PARKING AND SECURING THE AIRCRAFT

After arrival at the parking position:

- Parking brakes set to on
- Cut the engines
- Fuel pumps switched off
- Seatbelt signs switched off
- NAV lights stay typically on
- Beacon set to off
- Nose wheel steering to off

De-boarding of passengers and recording of flight data

RELEVANT LIDO CHARTS FOR FLIGHT 4U9712 EDDL-LFSB

Effective 02-MAR-2017
23-FEB-2017

Germany **Dusseldorf**

SIDPT

DUS-EDDL

5-70 **SIDs RWY 23L NW (RNAV Overlay)**

LIMA 2T / MEVEL 2T / MODRU 1T / NETEX 5T
RWY 23L (232°)

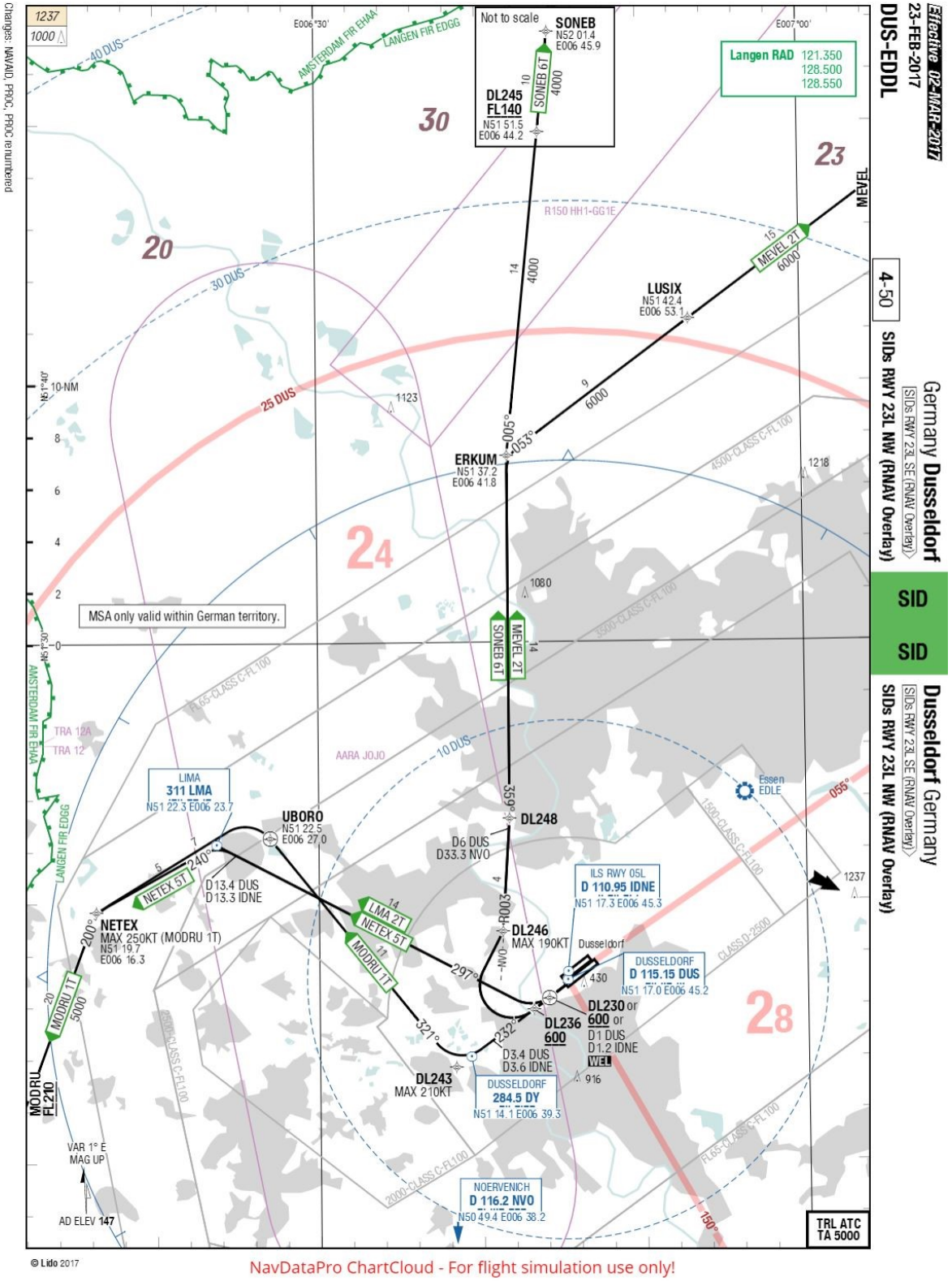
Remain on TWR frequency until passing 2000

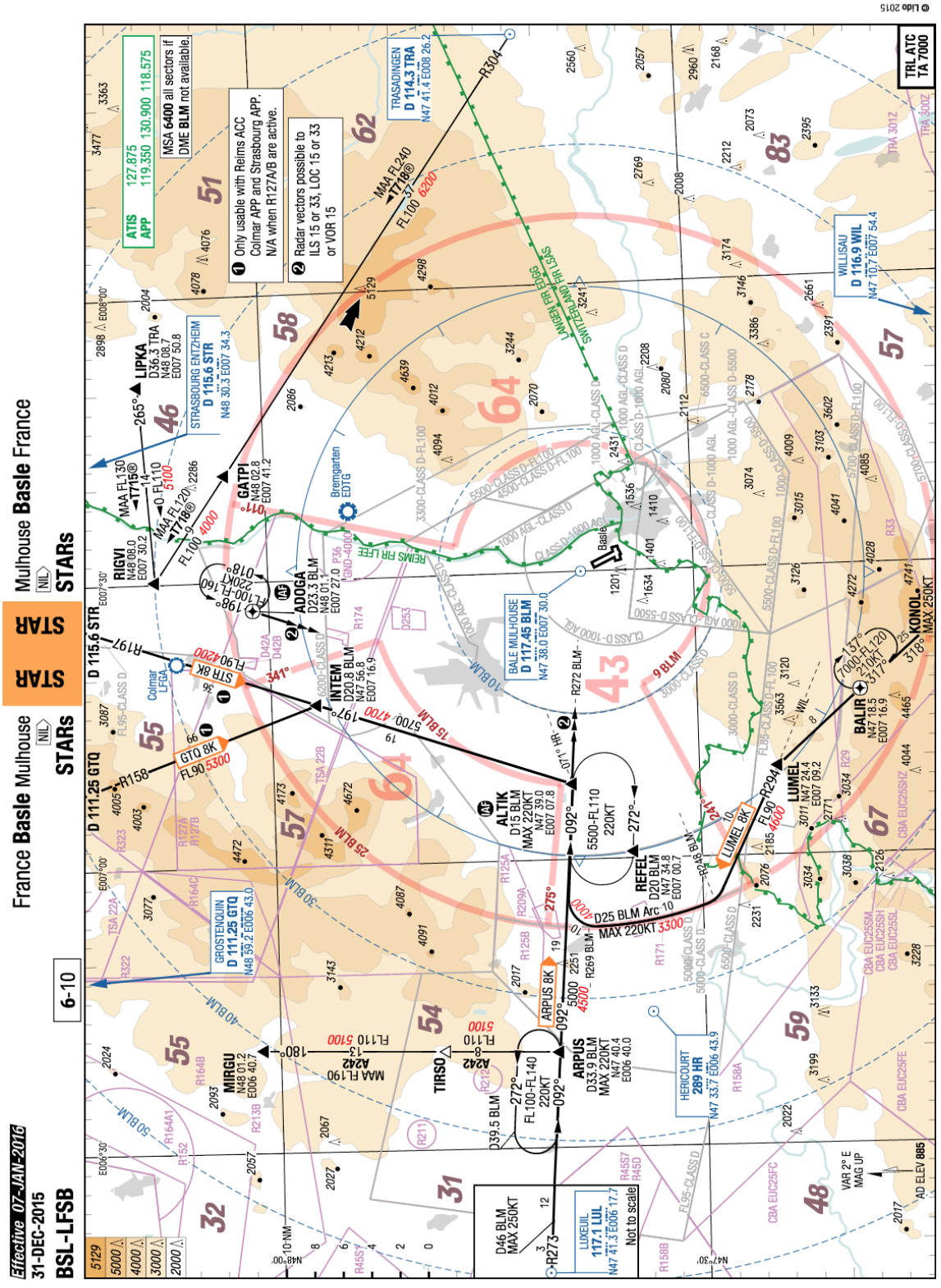
	GS	120	150	180	210	240	270
7.0%	ft/MIN	900	1100	1300	1500	1800	2000

DESIGNATOR	ROUTING	ALTITUDES
	Runway 23L	
LIMA 2T **LMA 2T** 7.0% to 3000 **128.500** ①	at D1 **DUS** / D1.2 **IDNE** or MNM **600**, whichever is later, **RT** intercept QDM 297 **LMA** to **LMA** **FMS** DL236 [R] - LMA	DL236 MNM **600** initial climb **5000**
MEVEL 2T **128.500** ②	at D1 **DUS** / D1.2 **IDNE** or MNM **600**, whichever is later, **RT** intercept R003 **NVO** (MAX 190KT until established) - at D6 **DUS** (D33.3 **NVO) LT** 359° to ERKUM - **RT** 053° via LUSIX to MEVEL **FMS** DL230 or MNM 600 WEL [R] - DL246 [K190-] - DL248 [L] - ERKUM [R] - LUSIX - MEVEL	initial climb **5000**
MODRU 1T 7.0% to 3000 **128.500** ①③	QDM 232 **DY** - at D3.4 **DUS** / D3.6 **IDNE RT** 321° (MAX 210KT until established) - at UBORO **LT** to NETEX (MAX 250KT until established) - **LT** 200° to MODRU **FMS** [A600+] - DL243 [K210- ;R] - UBORO [L]- NETEX [K250-] - MODRU	MODRU MNM **FL210** MODRU MNM **FL210** initial climb **5000**
NETEX 5T 7.0% to 3000 **128.500** ①	at D1.0 **DUS** / D1.2 **IDNE** or MNM **600**, whichever is later, **RT** intercept QDM 297 **LMA** - at D13.4 **DUS** / D13.3 **IDNE LT** intercept QDR 240 **LMA** to NETEX **FMS** DL236 [R] - LMA [L] - NETEX	DL236 MNM **600** initial climb **5000**

① Climb gradient due to airspace structure. If unable to comply, advise DLV on start-up request.
② After passing D6 DUS (D33.3 NVO) BRNAV equipment required
③ After passing D3.4 DUS / D3.6 IDNE BRNAV equipment required

Changes: PROC, PROC renumbered, Note




France Basle Mulhouse STARs
Mulhouse Basle France STARs
STAR
STAR
6-10
Effective 07-JAN-2016
31-DEC-2015
BSL-LFSB
ATIS 127.875
APP 119.350 130.900 118.575
MSA 6400 all sectors if DME BLM not available.
Only usable with Reims ACC Colmar APP and Strasbourg APP. N/A when R127A/B are active.
Radar vectors possible to ILS 15 or 33, LOC 15 or 33 or VOR 15
TRL ATC TA 7000
LIPKA D36.3 TRA
STRASBOURG ENTZHEIM D 115.6 STR
GATPI
RIGVI
ADOGA
INTEM
D 115.6 STR
D 111.25 GTQ
GROSTENQUIN D 111.25 GTQ
MIRGU
TIRSO
ARPUS
ARPUS 8K
ALTIK
REFEL
LUMEL
LUMEL 8K
BALIR
KONOL
WILLISAU D 116.9 WIL
TRASADINGEN D 114.3 TRA
BALE MULHOUSE D 117.45 BLM
HERICOURT 289 HR
LUXEUIL 117.1 LUL
D25 BLM Arc 10
MAX 220KT
Not to scale
AD ELEV 885
VAR 2° E MAG UP
Changes: WPT RIGVI, HLDG
© Ludo 2015
NavDataPro ChartCloud - For flight simulation use only!

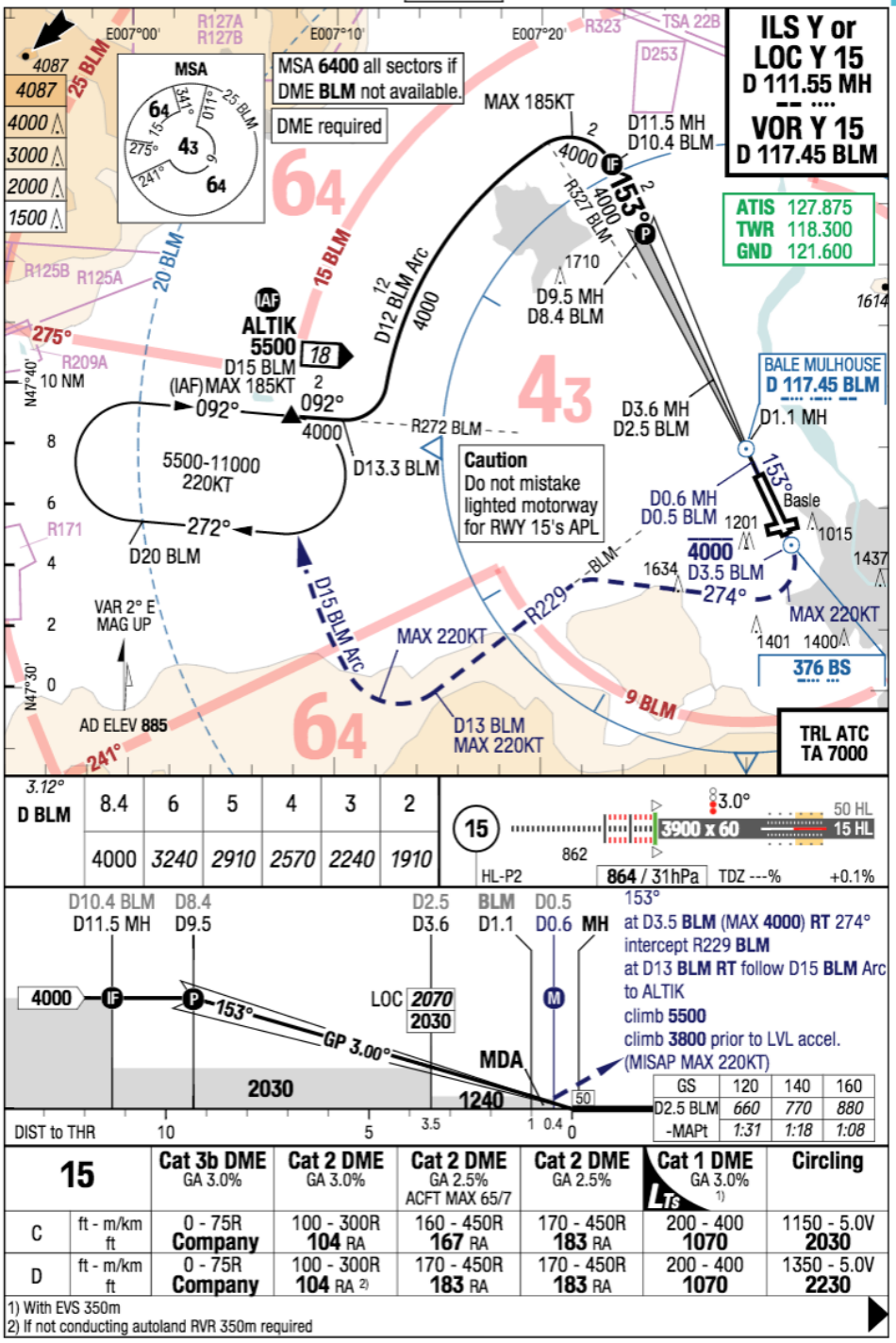
France **Basle** Mulhouse

IAC

06-OCT-2016

BSL-LFSB

7-20 **ILS Y or LOC Y 15 / VOR Y 15**



3.12° D BLM	8.4	6	5	4	3	2
	4000	3240	2910	2570	2240	1910

15 — 3.0° — 50 HL — 3900 x 60 — 15 HL — 862

HL-P2 — **864** / 31hPa — TDZ ---% — +0.1%

GS	120	140	160
D2.5 BLM	660	770	880
-MAPt	1:31	1:18	1:08

15		Cat 3b DME GA 3.0%	Cat 2 DME GA 3.0%	Cat 2 DME GA 2.5% ACFT MAX 65/7	Cat 2 DME GA 2.5%	Cat 1 DME GA 3.0% 1)	Circling
C	ft - m/km ft	0 - 75R **Company**	100 - 300R **104** RA	160 - 450R **167** RA	170 - 450R **183** RA	200 - 400 **1070**	1150 - 5.0V **2030**
D	ft - m/km ft	0 - 75R **Company**	100 - 300R **104** RA 2)	170 - 450R **183** RA	170 - 450R **183** RA	200 - 400 **1070**	1350 - 5.0V **2230**

1) With EVS 350m
2) If not conducting autoland RVR 350m required

Changes: Reprint

APPENDIX 3: ROUTE SUGGESTIONS

During preparation of the tutorial we considered several different routes flown by the CRJ in real life. The intention was to find a scenic route which is not too short (more stress when climb and descend follow nearly instantly on to each other) and not too long (overall time it takes to work through the tutorial).

We didn't want all our ideas go to waste and hence include the routes as suggestions for further flights after going through the tutorials.

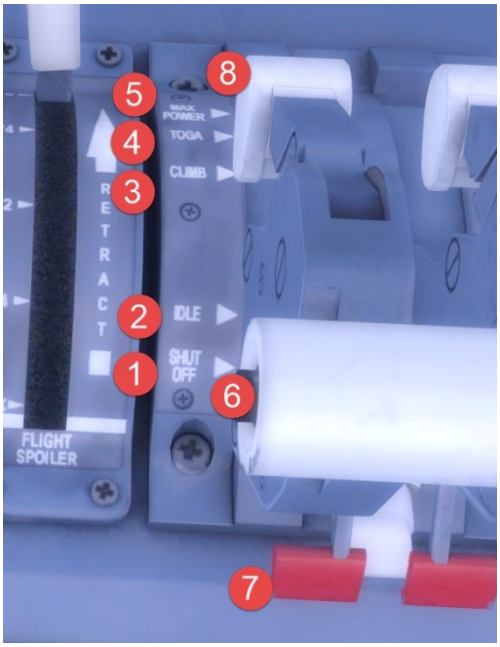
Departure	**Arrival**	**Airline / Flight No**	**CRJ Type**
Hamburg (HAM / EDDH) 09:50	Copenhagen (CPH / EKCH) 10:40	Scandinavian SK646	CRJ900
Copenhagen (CPH / EKCH) 08:10	Gothenburg (GOT / ESGG) 08:55	Scandinavian SK434	CRJ900
Munster-Osnabruck (FMO / EDDG) 06:35	Frankfurt (FRA / EDDF) 07:25	Lufthansa LH063	CRJ900
Dusseldorf (DUS / EDDL) 07:10	Basel-Mulhouse (BSL / LFSB) 08:20	Lufthansa / Germanwings 4U9712	CRJ900
Munich (MUC / EDDM) 10:45	Marseille (MRS / LFML) 12:20	Lufthansa LH4362 (meanwhile flown with ERJ-195	CRJ900
Copenhagen (CPH / EKCH) 18:05	Aberdeen (ABZ / EGPD) 18:50	Scandinavian SK1521	CRJ900
Copenhagen (CPH / EKCH) 15:00	Berlin Tegel (TXL / EDDT) 15:55	Scandinavian SK0679	CRJ900
Copenhagen (CPH / EKCH) 14:05	Bergen (BGO / ENBR) 15:25	Scandinavian SK2868	CRJ900
San Francisco (SFO / KSFO) 12:50	Jackson Hole (JAC / KJAC) 15:57	United Airlines UA5490	CRJ700
Seattle (SEA / KSEA) 20:15	Santa Barbara (SBA / KSBA) 22:42	Alaska Airlines AS3444	CRJ700

APPENDIX 4: SPEED CONTROL AND AUTO THROTTLE

During the testing phase, it was obvious many people had issues with the way speed is controlled in the CRJ and how to activate the Auto Throttle. To start with the latter, there is none. Don't let the SPEED button on the glare shield fool you. We'll explain the functionality later.

THROTTLES

On the throttle, you will see several markings



1. SHUT OFF (FUEL SHUT-OFF)
   To move the throttle from IDLE to SHUT OFF, lift the red lever and retard the throttle. The Idle / Shutoff Release latches (7) are there to prevent you from shutting down the engines in flight.
2. IDLE (TRUST SETTING)
   The range between IDLE and CLIMB is the throttle range you will normally use.
3. CLIMB (THRUST SETTING)
   The Climb thrust setting is the highest possible continuous thrust setting allowed (though ITT limitations do still apply).
4. TOGA (TAKE-OFF AND GO-AROUND THRUST SETTING)
   The TOGA setting is used for most take-offs and for go-arounds. TOGA can only be used for 10 minutes continuously.
5. MAX POWER
   The MAX POWER setting is only used when maximum power output is needed.

The Take-Off / Go-Around Switches (6) will activate the take-off / go-around mode of the flight director. The Thrust Reverse Levers (8) are pulled up (with throttle in idle) to deploy the thrust reversers. At minimum thrust reverse range there is little or no reverse thrust but all forward trust is removed, at higher settings actual reverse thrust is generated.

GLARESHIELD SPEED CONTROLS

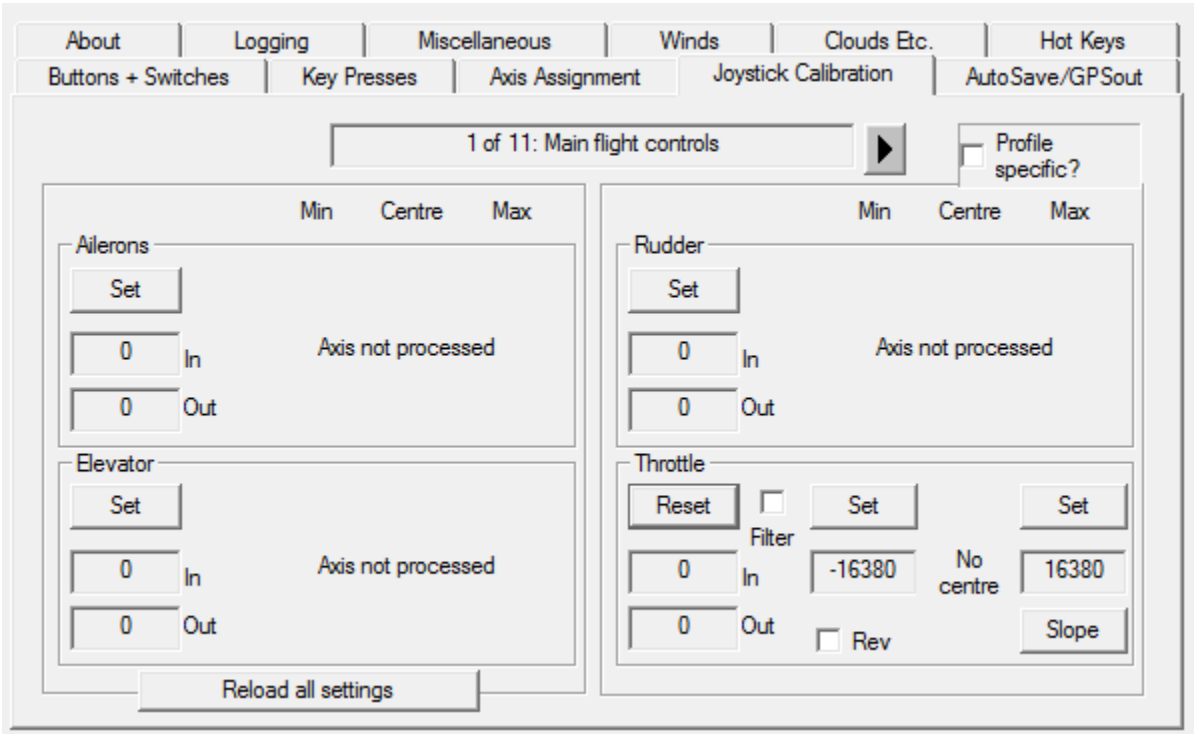
On the glare shield, there is a SPEED button and a SPEED rotary control. This is what confuses many people. The Speed Mode System is only active during climb and descend. It does NOT control the thrust output of the engines but adapts the pitch of the aircraft to maintain the set speed.

1. The SPEED button is pressed to set and select the three modes:
   a. CLB (Climb) / DES (Descend)
      When selected, the current speed is used as the speed to maintain and the CLB or DES mode is selected automatically depending on the Vertical Speed.
      In CLB mode the aircraft will never descend, in DES mode it will never climb.
   b. IAS (Indicated Air Speed)
      When selected the current IAS/MACH is hold, no matter if descent or climb is required.
2. The button on the rotary Speed control toggles between IAS and MACH.
3. The rotary control is used to change the set speed after a mode is selected.

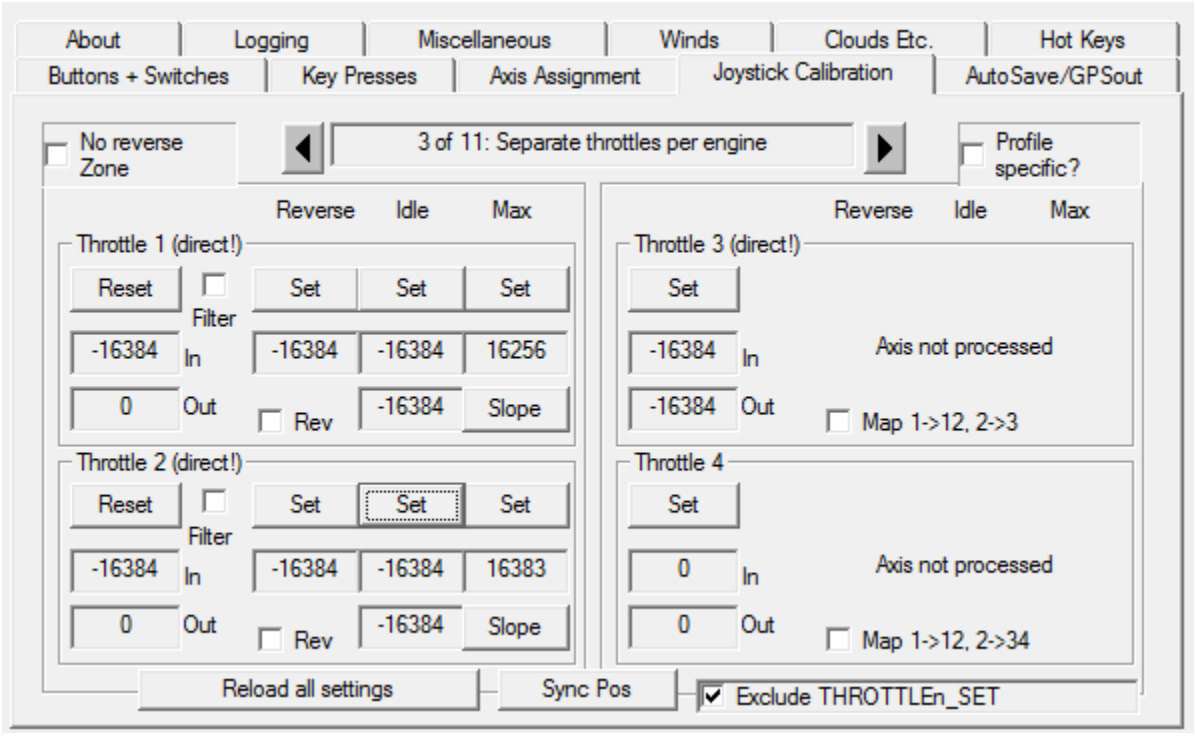
APPENDIX 5: FSUIPC THROTTLE CALIBRATION

Please note that FSUIPC I NOT needed for the Aerosoft/Digital Aviation CRJ and we do NOT advise the use of it for the throttle channel. If you would like to use it follow this guide.

If you don't use FSUIPC at all or just a single throttle axis, like shown in the screenshot below, select "Default" from the throttle range dropdown menu:



If you use FSUIPC with separate throttle axes and have it set so it returns are value between 0 and 16383 (no reverser range), select "FSUIPC without Reverser Range" from throttle range dropdown menu:



If you use FSUIPC with separate throttle axes and have it set so it returns are value between -4096 and 16383 (with reverser range), select "FSUIPC with Reverser Range" from throttle range dropdown menu: