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### Disclaimer

This summary contains information in a very condensed form. Its purpose is by no means to replace official airplane manuals or approved training or operational documentation. It is solely a private compilation of information and hints earned in different training, refresher and instruction situations, and flight duties. Please note that no distinction is made here between information that is mandatory and therefore shall be adhered to, and other information which is of a more facultative nature and thus by no means compulsory. Originally written to cover the EMB-145LR, it has been augmented with the EMB-135BJ Legacy variants and different operating procedures, and finally completed to cover all ERJ 145 family members, be it the EMB-135/140/145(XR) and the EMB-135BJ Legacies 600/650. However, it can neither be guaranteed that all differences have been taken care of nor that the text is up to date. Note that the Embraer Legacies 450/500 (EMB-545/550) are not covered as they do not belong to the ERJ 145 family. The document may be distributed without permission by the author, as long as it is not altered. In order to enable continuous improvement, I kindly ask any reader to provide me identified errors as well as improvement opportunities. Updates of this document are available on [www.flite.ch](http://www.flite.ch).

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# 1. TECHNICAL

## 2-00 LIMITATIONS

Operation		Area of operation	60°S .. 80°N					
		Extended overwater ops	<b>120min</b>					
Masses	[kg, NM]	<u>135LR</u>	<u>140LR</u>	<u>145LR</u>	<u>145XR</u>	<u>600</u>	<u>650</u>	
	MTOM	20'000	21'100	22'000	24'100	22'500	24'300	
	MLM	18'500	18'700	19'300	20'000	18'500	20'000	
	MZFM	16'000	17'100	17'900	18'500	16'000	16'400	
	Pax	37	44	48-50	48-50	13-16	13-16	
	Range	1'750	1'650	1'550	2'000	3'400	3'900	
	Cargo capacity			1'200kg		454kg		
			≤ 400kg per section		≤ 390kg/m <sup>2</sup>		tighten if ≥ 125kg/m <sup>2</sup>	
Speeds	Min SPD OEI <b>incl. icing</b>	$V_2$	(T/O safety SPD)					
	Final T/O segment, clean	$V_{FS}$	(SE best ROC)					
	Final APP, LDG config	$V_{APP}$						
	Min SPD 50ft over threshold	$V_{REF}$	= <b>1.3v<sub>S0</sub></b>	= $V_{APPCLB}$				
	<b>OEI G/A, F9, gear up</b>	$V_{APPCLB}$	= $V_{REF}$					
	Gear retraction	$V_{LOR}$	200KIAS					
	Gear extension	$V_{LOE}$	250KIAS		= $V_{LE}$			
			max 3000ft in icing conditions					
	Flaps extension	$V_{FE\ 9/18/22/45}$	<b>250/200/200/145KIAS</b>					
		$V_{FE\ 45}$	<b>160KIAS (650)</b>					
		$ALT_{FE}$	max <b>20'000ft</b>					
	Manoeuvring speed	$V_A$	<b>200KIAS</b>					
	(full aileron and rudder deflection protected)							
	Best angle of climb	$V_X$	≈ $V_{FS}$	(clean)				
	Best rate of climb	$V_Y$	≈ $V_{FS} + 50$	(clean)				
	Clean speed	$V_{Pclean}$	<b>180 / 200 (ice) KIAS</b>					
	(30° bank protected;	$V_{Pg}$	<b>160KIAS</b>					
	flap manoeuvring speeds)	$V_{P22}, V_{P45}$	<b>140KIAS</b>					
			(150 w/F22 after ice)					
	<b>Turbulent air speed</b>	$V_{RA}$	<b>200KIAS ≤ 10'000ft</b>					
		<b>250KIAS &gt; 10'000ft,</b>						
		then M <b>0.63</b> if lower						
Max operating speed	$V_{MO}$	<b>250KIAS &lt; 8'000ft</b>						
		<b>300KIAS (650)</b>						
		<b>320KIAS &gt; 10'000ft</b>						
	$M_{MO}$	0.78 (145)						
		<b>0.80 (135BJ)</b>						
A/S after T/O / during								
climb without <b>retrimming</b>	max	<b>160KIAS</b>						
Direct vision window remove	max	<b>140KIAS</b>						
Hydroplaning speed	T/O	113kts						
(typical)	LDG	97kts						
Taxi speed	recomm.	30kts dry straight						
		10kts dry turns						
		10kts wet/cont strght						
		5kts wet/cont turns						
Min control speed	$V_{MCA/L/G}$	112 / 105 / 101KIAS						

ALT	Max ALT YD disengaged Max airport ALT	FL <b>370</b> (145), FL <b>410</b> (135BJ) FL350 (> M 0.70) <b>8'500ft</b>	
Temperature		Temp <b>above FL250</b> is limited to <b>-45°C TAT</b> FL410: Min <b>-65°C SAT</b> Qualified maintenance inspection after <b>LDG below -40°C</b> No temp limitation for anti-icing system automatic operation	
WND	<b>XWND</b>       <b>TWND</b>  HWND   Parking	<b>30kts</b> <b>25kts</b> <b>20kts</b> 15/11kts <b>10kts</b> "Critical engine": On luv side (for XWND LDG) <b>10kts</b> <b>5kts</b> <b>60kts</b> <b>23kts</b> <b>25kts</b> If WND ≥ 65kts	<b>dry / wet RWY</b> recommended <b>compacted snow</b> or for <b>CAT II</b> <b>standing water / slush</b> CAT III (AEO/OEI) <b>ice (not melting)</b> for steep APP (max. <b>5.5°</b> ) <b>CAT II</b> <b>CAT III</b> Shelter in hangar
RWY		Paved; Slope	<b>-2% .. +2%</b>
Airframe contamination		T/O: No frozen contamination on wing upper surface; underwing max 3mm frost layer	
Structural	Pitch limitation Load factor	max ANU Flaps 0 Any flaps	<b>20°</b> up to 3000ft/MAA -1.0 .. +2.51g 0.0 .. +2.0g

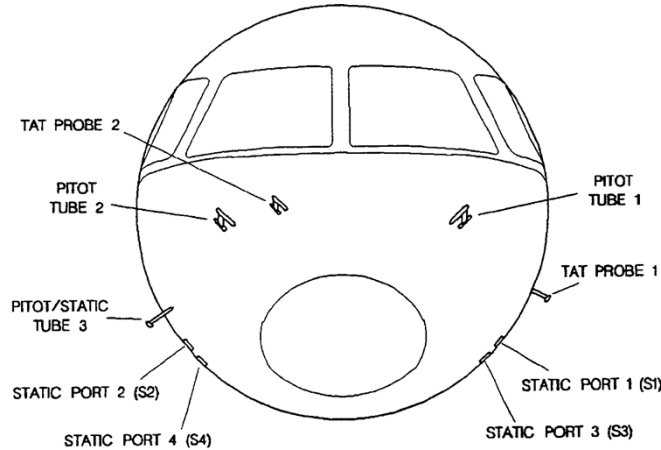
## 2-01 AIRPLANE DESCRIPTION

Dimensions	<u>135</u>	<u>140</u>	<u>145</u>	<u>145XR</u>	<u>135BJ</u>
Wingspan	20.04m	20.04 m	20.04m	21.00m	21.17m
Length	26.33 m	28.45m	29.87m	29.87m	26.33m
Height	6.76m	6.76m	6.76m	6.76m	6.76m
Turning width	18.54m	20.02m	21.21m	21.21m	18.54m
Turning radius	14.94m	16.05m	17.01m	17.01m	14.94m

(nose covers wing tips)

### Probes

Pitot/static 3: For **ISIS** and **cabin** pressurization CPAM



### Antennas

ELT RH ceiling panel of lavatory. Antenna: On top of fuselage (auxiliary antenna on side of ELT when used as portable unit)  
TCAS Directional antenna on top, omnidirectional at bottom

### Cockpit

Circuit breaker panel, overhead panel, glareshield panel, main instrument panel, consoles, control pedestal  
2 cockpit windows, can be opened from inside and outside

### Doors

Indications on MFD T/O page (and EICAS in case of MC/MW)  
2 overwing exits, can be opened from inside and outside (MC)  
Baggage door cannot be opened from inside  
135BJ No service door, only one overwing exit (RH)  
Aft baggage compartment accessible via swing door (MC in cockpit)

### Hatches

Fwd		Cockpit underfloor access hatch door
	<b>LH</b>	<b>Battery</b> compartment
	<b>RH</b>	<b>Hydraulic</b> compartment
Aft	LH	Rear electronic compartment door (rudder servo, cables)

## 2-02 EQUIPMENT AND FURNISHINGS

Water	20l potable water Heated drains Cold WX: Drain water to prevent freezing
Toilet	135BJ: 6l "blue water"

**2-03 EMERGENCY EQUIPMENT**

Operator specific.

## 2-04 CREW AWARENESS

<b>EICAS</b>		<p><b>DAUs</b> provide each 2 channels; select channel B via DAU button on reversionary panel on center pedestal</p> <p>DAU deliver messages to IC-1 and IC-2 and to the RMU</p> <p><b>DAU-1</b> Front part of A/C systems, ENG 1</p> <p><b>DAU-2</b> Rear part of A/C systems, ENG 2</p> <p>PFD "CAS MSG" #messages disagree between IC-1/2</p> <p>Inhibition logic T/O When crossing <math>v_1-15</math>kts until RA &gt; 400ft or CAS &lt; 60kts or after 1min LDG 200ft RA until on GND for <math>\geq 3</math>sec or after 1min</p> <p>Backup display on RMU if SG fail. Selections on the RMU can be done as before, but 20sec after last selection backup EICAS is displayed again TEST button on display controller with WOW and A/S &lt; 50kts: EICAS invalid display</p>																																	
<b>Stall protection</b>	<p>Components SPC, AOA sensor, stick shaker, stick pusher</p> <p>Inputs 2 channels, from IRS, ADC, flaps, spoilers, LDG gear, ice detection, W/S detection, RA</p> <p>SPS Light is on after power-up, remains on after unsuccessful test</p> <p>Stick shaker May be activated at <math>1.0 \dots 1.13 v_s</math></p> <p>Stick pusher Is activated at or below <math>1.0 v_s</math></p>	<p>Inhibited if: Quick <b>disconnect switch</b> pushed or cutout switch pushed, below 200ft RA, RA failure, until 10sec after T/O, below 0.5g, above 200KIAS, SPS advanced</p> <p>Activation needs agreement of both stall protection computers</p>																																	
	<b>SPS advanced</b>	AOA disagree, flaps/spoilers disagree, SPC/ADC/IRS fail																																	
<b>EGPWS</b>		<p>Includes windshear detection and escape guidance function</p> <p>Updrafts <b>MC</b>, yellow WINDSHEAR on PFD, 1x "Caution windshear"</p> <p>Downdrafts <b>MW</b>, red WINDSHEAR on PFD, 3x "Windshear"</p> <p>Escape guidance mode by pressing <b>G/A buttons</b> (&lt; 1500ft)</p> <p><b>Windshear mode does not stop at ASEL ALT</b></p> <p>Inputs IRS, ADC, SPS, RA1</p> <p>Outputs Both IC600 (2 PFD, EICAS for WINDSHEAR INOP), AWU</p> <p>'E': Terrain DB. Red: 30sec. Yellow: 60sec.</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 15%;">Mode I</td> <td style="width: 60%;">Excessive descent rate</td> <td style="width: 25%;">"sink rate", "pull up"</td> </tr> <tr> <td>Mode II</td> <td>Excessive terrain closure</td> <td>"terrain", "pull up"</td> </tr> <tr> <td></td> <td>IIa Flaps not in LDG configuration</td> <td></td> </tr> <tr> <td></td> <td>IIb Flaps in LDG configuration</td> <td></td> </tr> <tr> <td>Mode III</td> <td>Baro ALT loss after T/O</td> <td>"don't sink"</td> </tr> <tr> <td>Mode IV</td> <td>Min terrain clearance</td> <td>"too low"</td> </tr> <tr> <td></td> <td>IVa/b/c</td> <td>"terrain", "gear", "flap"</td> </tr> <tr> <td>Mode V</td> <td>Excessive G/S deviation (1.3 dots)</td> <td>"glideslope"</td> </tr> <tr> <td>Mode VI</td> <td>VIa <math>10^\circ/30ft \dots 55^\circ/\geq 2450ft</math></td> <td>"Bank angle"</td> </tr> <tr> <td></td> <td>VIb DH</td> <td>"minimum"</td> </tr> <tr> <td></td> <td>VIc APP</td> <td>"500", "200", "100"</td> </tr> </table> <p>Enhanced Based on a terrain database</p> <p>No warnings when landing 2NM short of the RWY</p> <p>Inhibit terrain awareness alerting and display (TERRAIN SYS OVRD) within <b>15NM</b> of T/O, APP or LDG when</p> <ul style="list-style-type: none"> <li>- no instrument APP procedure,</li> <li>- longest RWY &lt; 1067m / 3500ft, or</li> <li>- A/P not in data base</li> </ul>	Mode I	Excessive descent rate	"sink rate", "pull up"	Mode II	Excessive terrain closure	"terrain", "pull up"		IIa Flaps not in LDG configuration			IIb Flaps in LDG configuration		Mode III	Baro ALT loss after T/O	"don't sink"	Mode IV	Min terrain clearance	"too low"		IVa/b/c	"terrain", "gear", "flap"	Mode V	Excessive G/S deviation (1.3 dots)	"glideslope"	Mode VI	VIa $10^\circ/30ft \dots 55^\circ/\geq 2450ft$	"Bank angle"		VIb DH	"minimum"		VIc APP	"500", "200", "100"
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Terrain awareness:

<b>Solid</b> yellow	60sec to impact
<b>Solid</b> red	30sec to impact
Red dots	2000ft above A/C
Yellow dots	1000..2000ft above A/C
Medium yellow dots	500ft below to 1000ft above A/C
Medium green dots	500..1000ft below A/C
Light green dots	1000..2000ft below A/C
Black	> 2000ft below A/C

**TCAS II**

Has priority over instructions from ATC  
 Normal range -27..+27, above/below: ±70  
 Climb: Above; Cruise: Normal; Descent: Below  
 2NM, removed if range above 20NM  
**Inform ATC**, do NOT perform an escape manoeuvre  
**Preventive** ("Monitor V/S") / **corrective** ("Climb, climb now")  
 ATC: "**TCAS RA**"

Inner ring	
<b>TA</b>	Descent 400ft/AGL, climb 600ft/AGL
<b>RA</b>	Descent 1000ft/AGL, climb 1200ft/AGL
RA inh	TCAS automatically pops up in case of TA/RA
RA DESC inh	During abnormal situations (OEI, ...)
TA auto	RMU: Cursor into ATC/TCAS, TST for 7sec
<b>TA only</b>	◇ Other traffic
<b>Test</b>	◆ Proximate traffic (within <b>6.5NM, 1200ft</b> )
	● <b>TA 35..45sec</b> amber "Traffic"
	■ <b>RA 20..30sec</b> red "Monitor" (preventive)
	"..." (corrective)

Rate of intruder is only indicated if > 500FPM

**Weather radar**

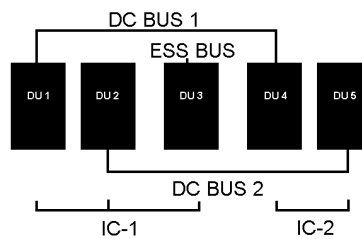
**12"** flat type antenna, tiltable **±15°**  
 Avoid storm cells by 5..10NM (recommended: 25NM), divert to luv side  
**Adjust tilt** regularly (no GND echoes)

Limitations	300ft from refueling operations 15ft from personnel or flammables
Tilt	T/O <b>8°</b> , manual tilt selection <b>5000ft 5°, for each additional 5000ft subtract 1°</b>
Operation	Do not switch on if large metallic objects within scan sector, (re)fueling within 100ft or GND personal too close to 270° sector
Colors	Magenta - red - yellow - green - white (turbulence)
RCT	Rain Echo Attenuation Compensation Cyan where further compensation is not possible
STB	Exit <b>forced STBY mode</b> by pressing <b>4x STB</b> in 3sec
TGT	Display a 'T' (on PFD/MFD) if a red level is within ±7.5°
SECT	Select between ±120° and ±60°

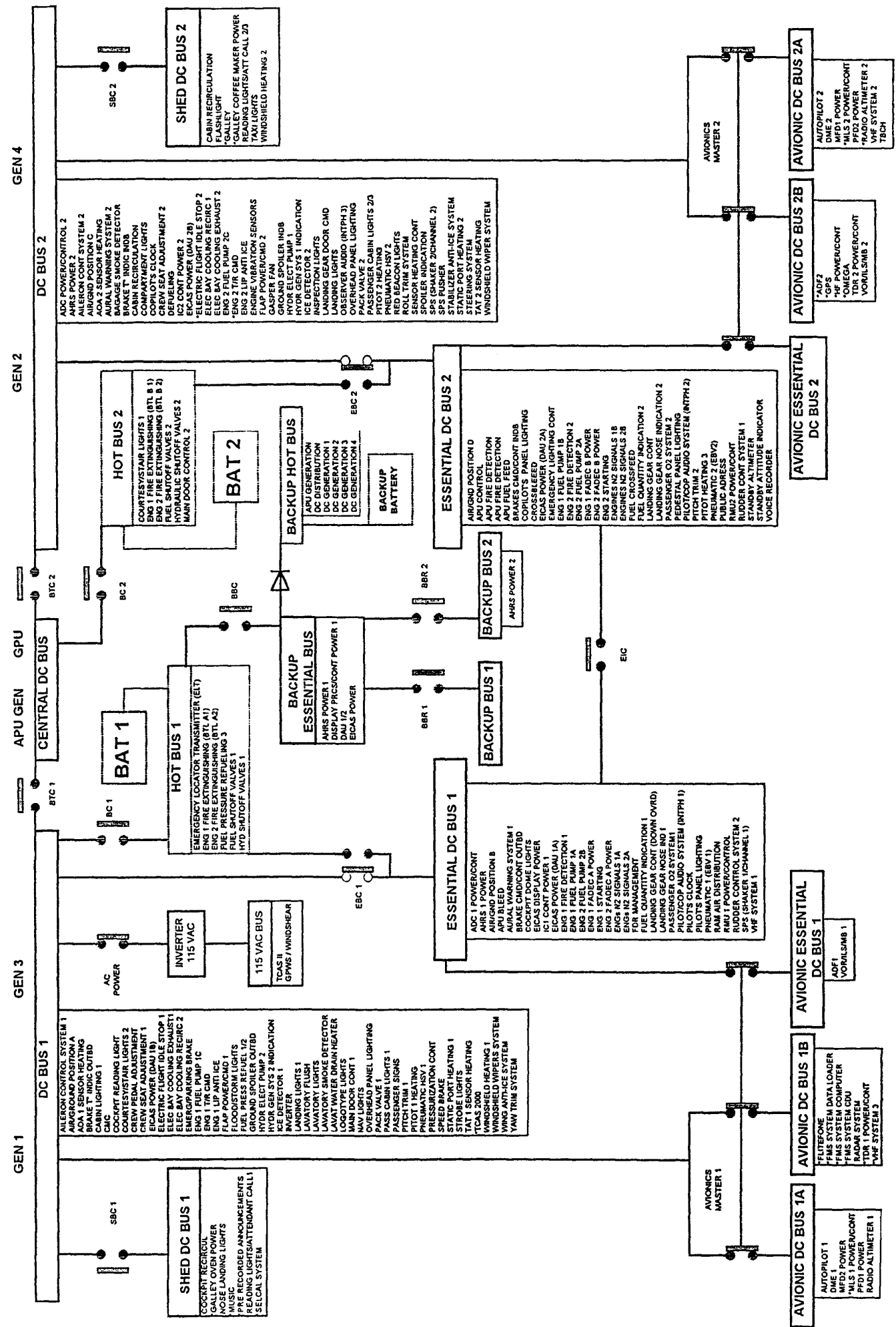
## 2-05 ELECTRICAL

Batteries	<b>BATT 1/2</b>	<p>2 NiCad 24VDC <b>44Ah</b>. Min <b>23.5V</b>. Disconnect if &lt; -10°C  MW if temp above <b>70°C</b> (<b>2</b> temp sensors, only one used for indication, but both for the MW). BATT must be switched off  <b>BATT charging: 1 GEN</b> required  <b>BATT are not charged with GPU</b> online (even not by APU)  BATT can only be <b>loaded if ≥ 19V</b> (if below: <b>exchange</b>)  Connected to <b>hot buses 1/2</b>. Hot bus 1 powers backup buses  <b>Elec EMG</b>: Power supply via BATT 1/2 for <b>40min (ESS PWR)</b></p>
	<b>Backup BATT</b>	<p>1 lead-acid 24VDC <b>5Ah</b>  Stabilized power for hot bus 1 / backup ESS bus; for <b>GCU</b>  Charged if BACKUP button is in</p>
Generators		<p><b>Primary elec source</b> inflight. <b>4 ENG GEN, 1 APU Starter/GEN</b>  Max load <b>400A</b>, except APU GEN above 30'000ft: <b>300A</b>  <b>28VDC</b>. All brushless, except APU GEN</p>
	ENG GEN	<p><b>GEN 1, 3: LH ENG; GEN 2, 4: RH ENG</b>  Online when <b>N2</b> reaches <b>56.4%</b>  <b>GND</b>: Cooled by a fan. Inflight: Via NACA air inlet.  <b>BEARING FAIL</b> advisory: 20h on auxiliary bearings possible</p>
	APU GEN	<p>Starter/generator  Supplies <b>DC BUS 2</b> via central DC bus, can also replace a DC BUS 1 GEN  Online <b>7sec</b> after <b>95%</b> RPM  <b>GND</b>: Air cooled. Inflight: Via NACA air inlet.</p>
	GCU	<p><b>GEN control</b> (voltage regulation, line contactor control, parallel operation, current limiting to 400A [e.g. APU start]), system protection, BIT  To reset GCU: Cycle GEN button</p>
GPU		<p>28VDC (<b>26..29V</b>). Isolated if &gt; 32VDC (only if BATT 1 is installed)  Does <b>not charge BATT</b>  For APU start 1600A required, <b>300A</b> for maintenance/servicing  Has <b>priority over BATT or GEN (cannot be in parallel to any GEN)</b></p>
Buses	<b>EDL</b>	<p>Controls power contactors, fault protection and load shedding  <b>Left and right</b> distribution systems (EDS 1/2)</p>
		<p>≥ 4 GEN: Normal operation, two independent networks left/right  (DC bus 1; central and DC bus 2)  BATT 1: DC bus 1, parallel to GEN 1/3  BATT 2: Via central DC bus to DC bus 2, parallel to GEN 2/4</p>
		<p>≥ 3 GEN: All buses energized, networks connected via BTC  On <b>GND</b> only: 1 GEN+<b>OVRD</b> to power shed buses  Or: GPU to energize all buses</p>
		<p>&lt; 3 GEN: <b>Load shedding</b>. Cabin: EMER PILOT illuminated</p>
		<p>0 GEN: <b>ELEC EMG</b>. Only "inner circle", no DC buses</p>
	Central DC bus	To connect APU GEN or GPU to DC buses via BTCs, and to connect DC buses in case of asymmetrical configuration
	GND service bus	Energized if GPU connected but no BATT/GEN online Interior lights, dome, baggage compartment light
	<b>Shed buses</b>	<p>SHED BUSES AUTO if GPU online  SHED BUS OFF <b>MC</b> → Check <b>GPU</b></p>

<b>AC power</b>		<b>115VAC, 400Hz</b> through a static inverter (LH nose section) powered by <b>DC BUS 1</b> INV does not work on BATT only. MC if < 108.5VAC
	Consumers	<b>TCAS, GPWS, W/S</b> detection
<b>Failures</b>	<b>Electrical EMG</b>	<b>Loss of all GENs, only on (2) BATT.</b> Still powered: <b>ESS DC buses, central DC bus</b> (to start APU), <b>HOT BATT buses, backup EMG bus, backup HOT BATT bus</b> (inner circle) → <b>no DC BUS, no SHED BUS</b> (no DME depending on A/C configuration), <b>no AC power</b> → Max A/S 250kts (nose gear doors could open)
	<b>ESS PWR</b> button	Overrides automatic transfer of the electrical system Connects <b>BATT directly to ESS buses</b>
	<b>ELEC EMERG</b> <b>ABNORM MC</b>	EDS has transferred to ELEC EMG condition without needing to do so. Check ESS PWR switch is off (out), start APU If APU GEN u/s: <b>40min BATT power</b> to land Only " <b>inner circle</b> " of displays available: EICAS, RMUs, ISIS
	<b>ELEC ESS XFR</b> <b>FAIL MW</b>	Loss of all 4 GENs but <b>no automatic transfer to ELEC EMG</b> condition (ESS interconnection contactor did not close) QRH: Press ESS PWR button
	Display units	<b>PFD and EICAS</b> must always be displayed Reversion of PFD to MFD or EICAS possible via rotary knob Each DU: Two fans and two sensors



<b>Miscellaneous</b>	Flashlights	45min	6VDC NiCad. Switch off while in assembly
	ELT	<b>48h</b>	(121.5/243/406MHz) Right ceiling panel of lavatory, antenna on top of A/C. :00...:05 for testing
	ULB	30 days	(37.5kHz)
	EMG cabin lights	15min	
	CVR memory	2h	<b>Power cut at 5g.</b> Erasable on GND only with parking brake on
	FDR memory	25h	Solid state. On if red beacon on or A/C airborne



(subject to variant-specific changes)

## 2-06 LIGHTING

Main Lights	TAXI	2, LH on nose gear, wide and narrow angle (gear must be down and locked)	450W
	WING LDG	2. Wing leading edge, close to fuselage	450W
	NOSE LDG	1, RH on nose gear (gear must be down and locked)	600W
	NAV	3, main and standby lamps each NAV LT STBY switch on PIC side maintenance panel	
	INSP, LOGO ACL	each side (fuselage / under vertical stabilizer) Strobes (3), red beacon (2)	150W
Other Lights	Nose cone, cockpit underfloor compartment, fwd electronic compartment, refueling/defueling panel, baggage compartment, rear electronic compartment, tail cone		
Cockpit	2 dome lights (ESS DC bus 1 - available in ELEC EMG), 3 reading lights, 2 chart holder lights (7 lamps each), 3 floodlight assemblies (below glareshield) 6 dimmers, 9 potentiometers		
Cabin	PAX cabin lights (ceiling, sidewall), PAX warning signs, reading lights (PSU), ATTND call lights, courtesy/stair, lavatory, gallery		
FSTN BELTS/NO SMKG	automatically on if > 14'000ft		
EMG cabin lights	4 dedicated batteries, recharged by essential bus, 6 static INV converting 6VDC → 130VAC, 450Hz. Come on when ESS DC power is lost (15min) <b>MC</b> if not armed <b>F/A</b> may switch them on regardless of cockpit switch		

## 2-07 FIRE PROTECTION

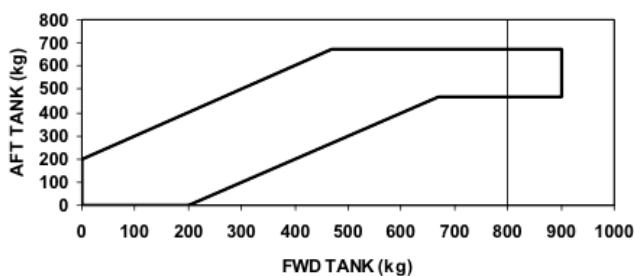
Engines		2 single loop detectors (engine accessory region, pylon region) consisting of <b>16 thermocouples</b> each ENG, ESS DC bus 1/2 These tubes contain gas, its pressure increases with heat Fire extinguisher halon 1301 bottles (tail cone), hot bus 1/2
	Fire handles	<b>Fuel</b> shutoff <b>Hydraulic</b> shutoff <b>Bleed</b> air shutoff <b>ENG air inlet A/I</b> valve shutoff Arm the cartridges → <b>First rotate outboard</b>
	<b>Test</b>	Press at least for <b>2sec</b> . 3 MW, 2 MC, Bagg comp fan goes off (on GND, if pressed > 10sec, APU shuts down) To repeat: Wait ≥ 6sec If pressed ≤ 2sec: BAGG EXTG button may remain illuminated
APU		1 single loop detection, powered by ESS DC bus 2 <b>On GND (only), APU shuts down automatically after 10sec, but no fire extinguisher is automatically activated</b>
	<b>EXTG</b> TST	APU stop, Fuel S/O close, discharge bottle ( <b>not</b> automatically) On GND, APU shuts down if pressed more than 10sec
Lavatory	Smoke detection	Lavatory ceiling: <b>Smoke sensor</b> (indicated on EICAS), powered by DC bus 1 Test via smoke detection panel in fwd galley N/a on 135BJ
	Fire extinguisher	Fire extinguisher tubes tips (in the lavatory waste compartment) melt at <b>77°C</b> (no warning in cockpit), 9 cu inch 120g agent mass (auto discharge into waste compartment). <b>No indication for fire</b> in cockpit
	135BJ	Additional fire extinguisher of this type in galley
Baggage Compartment		2 smoke detectors and temperature sensor to trigger BAGG SMOKE MW Button remains illuminated as long as there is smoke <b>2 bottles:</b> High rate and metering (re-ignition protection min <b>60min</b> ) Powered by ESS DC BUS 1 <b>Fan goes off</b> (also if test switch is pressed)
	135BJ	Close baggage access swing door if smoke in baggage compartment before discharging baggage fire extinguisher bottle

## 2-08 FUEL

Tanks	[kg]	<u>135ER</u>	<u>135LR</u>	<u>135XR</u>	<u>Legacy</u>	<u>Legacy</u>
		<u>145ER</u>	<u>145LR</u>	<u>145XR</u>	<u>600</u>	<u>650</u>
Wing tank		2 x 2087	2 x 2594	2 x 2594	2 x 2587	2 x 2722
Fwd aux tank		-	-	-	2 x 900	2 x 900
Aft aux tank		-	-	-	2 x 670	2 x 670
Ventral tank		-	-	845	-	821
Total		4174	5188	6033	8314	9405

Auxiliary tanks 2 aux tank systems (fwd, aft); = 4 aux tanks  
 Fwd Front section of wing to fuselage fairing  
 Aft Inside rear area of fuselage, aft of baggage compartment (pressurized)

Ventral tank Between main LDG gear (650 only)



System		Engines and APU are fed by the wing tanks only (APU by RH tank)
Indication		<b>7</b> capacity-type sensors per tank
Mechanical		3 measuring points each wing (first read outboard, if no indication read root, then stub. <b>Do not add</b> values)
Ventilation		2 float valves, flame arrestor, NACA air inlet, vent tank
	135BJ	Wing, fwd aux and ventral tank vented by NACA air intake Aft aux tank vented by cabin air pressure
Collector box		Flap valves to <b>keep pump inlets submerged</b> Transfer <b>ejector pump</b> keep fuel in box
Fuel pumps		<b>Wing</b> <b>3</b> ELEC centrifugal pumps <b>per tank</b> ; 1 req (2 for T/O / G/A) Fuel pumps <b>A</b> on respective <b>essential</b> DC bus, pumps <b>B</b> on <b>opposite essential</b> DC bus, pumps <b>C</b> on respective <b>DC</b> bus <b>ELEC EMG</b> : No pumps if <b>C</b> selected <b>Failure</b> of 1 pump Remaining pumps alternate of 2 pumps MC FUEL LO PRESS of 3 pumps ABC steady indication <b>ENG driven fuel pump</b> : Suction feed, only up to 25'000ft Avoid rapid TL movements and unusual A/C pitch
	<b>Auxiliary</b>	Fwd <b>2</b> pumps per tank (1 on stby; A/B selectable) Aft <b>1</b> pump per tank plus <b>cabin air pressure</b> (automatically if > 20'000ft; "P" indication)
	<b>Ventral</b>	<b>2</b> pumps (1 on stby; A/B selectable)
Shut-off valves	ENG	28VDC brushless motor, controlled by fire handle
	APU	Closed by APU master switch, FUEL SHUTOFF or APU EXTG

Operation	Normal	ENG1 from LH wing tank, ENG2/APU from RH wing tank
	135BJ	Auxiliary tanks and ventral tank feed wing tanks
XFEED		Wing imbalance max <b>363kg</b> , FUEL IMBALANCE MC disappears if < 45kg
		Start XFEED when imbalance ~100kg When QRH asks for <b>XBLEED</b> : Consider <b>XFEED</b> <b><u>No T/O, LDG and G/A with XFEED</u></b>
XFER (aux/ventr)		Transfer from auxiliary fuel tanks to wing tanks
		2 independent fuel transfer systems: FUS 1 From lefthand fwd aux tank 1 to righthand wing tank and from lefthand aft aux tank 1 to lefthand wing tank FUS 2 From righthand fwd aux tank 2 to righthand wing tank and from righthand aft aux tank 2 to lefthand wing tank
Operation		Wait 3sec when switching between FUS1/2
		1. Level off fwd and aft aux tanks (feed fwd into wings 1+2) 2. <b>Fwd</b> aux tank into wing <b>2</b> , <b>Aft</b> aux tank into wing <b>1</b> ("clockwise")
Refueling		FUS1/2 on XFER starts if wing ≤ <b>1900kg</b> , stops if ≥ 2400kg
		FUS1/2 off EICAS FUEL XFER CHECK message 7sec after wing ≤ 1850kg Aux <b>ventral</b> tank can be transferred to <b>both wing tanks simultaneously</b> <b><u>No T/O, LDG and G/A with XFER</u></b>
De-Fueling		Pressure <b>35..50psi</b> Drain fuel before refueling or if parked > 2h Procedure: BATT on if A/C not energized; WINGS, amount, connect, go, <b>wait</b> until valves closed, switch <b>OPEN</b> . Switch CLOSED ~ <b>1min / 100kg</b> <b>No APU start</b> during refueling and <b>packs off</b> during refueling
		Pressure ≤ 4psi. Open de-fuel SOV; XFEED LOW1 for left tank If no suction on fuel truck: Fuel pumps on ~ <b>3min / 100kg</b>
Limitations	Density	0.785..0.811kg/l (1000l ≈ 800kg)
	Temperature	Measured in <b>LH tank only</b> <b>-40°C .. +52°C (FUEL TANK LO TEMP)</b> Use <b>TAT</b> if fuel temperature sensor U/S Fuel without icing inhibitor: Fuel leaving FCOC ≥ 5°C
	Freezing point Level	<b>-40°C (JET-A), -47°C (JET-A1, JP8)</b> FUEL 1/2 LOW LEVEL MC: 210..400kg ( <b>30min</b> ), MW if below Unusable: <b>22kg</b> , any pump inoperative: <b>203kg</b> Usable fuel may be reduced by 2x50l if pressure refueled
	Pressure	<b>MC</b> if fuel press < <b>6.5psi</b> before FPMU inlet Two remaining pumps are energized Vent valve opens at 13psig fuel press



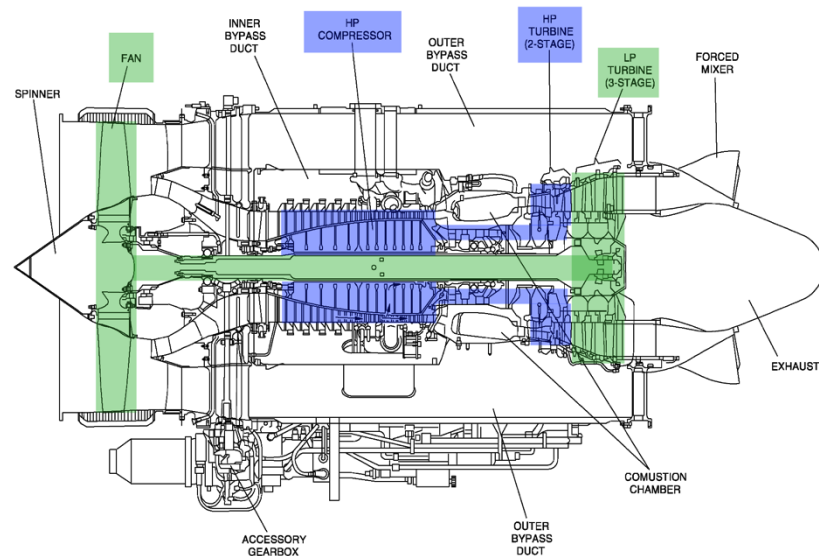
## 2-09 AUXILIARY POWER UNIT

APU		<p>Sunstrand single stage centrifugal compressor, reverse flow annular combustion chamber, single stage radial turbine. Constant SPD gas turbine          Does not contact in parallel to GPU          Fed by RH tank  <b>Do not start while refueling</b>  <b>Packs off while refueling</b>          Leave on if trip time less than <b>30min</b> and <b>GPU not</b> included  <b>Unfiltered</b> fuel flows through <b>bypass valve</b> to fuel pump</p>
	Fuel filter block	
Starter / Generator		<p>28VDC, 400A (<b>300A above 30'000ft</b>)          On <b>DC bus 2</b> via <b>central bus</b>, but will replace any other GEN          Elec load: 100% up to 39'000ft</p>
<b>Start</b>		<p>With <b>GPU</b>, with <b>BATT 2</b>, or with <b>BATT 2 assisted</b> by GENs          Starter power from BATT bus <b>2</b>, <b>BATT bus 1 is disconnected</b>, supplying the avionics. Start with GPU requires <b>1600A</b> (300A for maintenance/servicing). Consider no APU start out of GPU because there is no AMPs indication          APU <b>bleed</b> must be <b>closed</b> prior APU start          Packs on after <b>3min</b></p>
	ESU	<p>Ignition at <b>0%</b> (inflight) / <b>3%</b> (on GND) RPM          FF at 15% RPM          Starter disengagement at 50%/70% (depending on APU model)          Ignition exciter de-energize at <b>70%</b> RPM  <u><b>Online after 95% and 7sec</b></u></p>
Stop		<p>Via <b>STOP</b> button; ESU sends <b>overspeed</b> signal          APU <b>bleed on while stopping</b> APU          Switch <b>off</b> when <math>\leq 5\%</math></p>
	Auto shutdown	<p>GND only: Fire (<b>10sec</b> delay), overtemp, bleed valve opening, low oil press, high oil temp, oil press switch short, loss of EGT          GND/inflight: over-/underspeed, failure to start/accelerate/light, loss of speed data, external short, loss of ESU signal, ESU failure</p>
Limitations	Rotor speed	<p>MW if <math>&gt; 108\%</math> or <math>\leq 95\%</math> (<b>auto shutdown</b>)          (green: 96..104, amber: 0..95/105..110, red if above)</p>
	EGT	<p>Start EGT max <b>884°C</b> (925°C for 10sec above 25'000ft)          Continuous <b>680°C</b> (<b>717°C</b> for 5min)          (732°C for 3sec for APU assisted inlight ENG start)</p>
	APU oil	MC if $< 6$ psi or $> 166^\circ\text{C}$ (APU OIL HI TEMP MC)
	APU fuel	MC if $< 6.5$ psi (APU FUEL LO PRESS MC)
	Start limitations	<p>Min BATT <b>23.5V</b> and <b>-20°C</b>. No APU start when <b>fueling</b>  <b>Max ALT 30'000ft</b> (min -54°C up to FL250, then -30°C)  <b>TWND 34kts</b></p>
	<b>Starter</b>	<p>Max 15sec on          Between 3 attempts: 1min off          Between 2 series of 3 attempts: 30min off</p>
	Pneumatic	<p>APU bleed on after <math>\geq 3</math>min warm-up          Max ALT for bleed air: 37'000ft</p>

## 2-10 POWERPLANT

### Engine

Rolls Royce / Allison AE3007A1E (T406 engine core), 2 x 8169lbs T/O thrust  
 High bypass, 2 spool axial flow turbofan, single stage fan driven by **3** stage **low** pressure turbine, **14** stage axial flow **high** pressure compressor gas generator (with inlet guide vanes and 5 variable-geometry stator stages) driven by 2 stage high pressure turbine. Pneumatically started



Green: Fan (N1)

1-stage low press compressor

3-stage low-press turbine

Blue: Compressor (N2)

14-stage high-press compressor

2-stage high-press turbine

### Variants

	<u>135, 145</u>	<u>145LR, early 600</u>	<u>145XR, late 600</u>	<u>650</u>
Type	AE3007A1A	AE3007A1P	AE3007A1E	AE3007A2
Thrust	3365kg	3705kg	3996kg	4208kg
Modes	ALT-T/O-1 T/O-1	ALT-T/O-1 T/O T/O (RSV) ALT T/O-1 CON CLB CRZ	ALT-T/O-1 T/O E-T/O E T/O (RSV) T/O (RSV) ALT T/O-1 CON (E) CLB CRZ	ALT T/O-1 T/O A2 TO A2 TO (RSV) T/O (RSV) ALT T/O-1 CON (A2) CLB CRZ
Fan blades	24 (A1) / 22 (A2)			

### Fuel System

Routing	FPMU, FCOC, CVG actuators, FF meter and fuel nozzles Tank - Centrifugal pump (increases pressure) - FCOC - Filter assembly (with a bypass if blocked) - High pressure pump (with overpressure relief valve) - Fuel metering valve (constant 70psi, excess is returned to gear pump inlet; operated by dual coil torque motor) - Fuel flow meter - Fuel flow nozzles - Combustion liner
Fuel SOV	will remain in last position if contact to FADEC is lost

Oil System	For cooling (main purpose) and lubrication
Components	Oil tank, lube and scavenge pump, oil filter, ACOC, FCOC, sumps In case of blockage: Oil filter <b>bypass valve</b> opens
Quantity (MFD T/O page)	6..14qts (green range; amber below) in oil tank Min dispatch 8qts Min ENR 6qts
Temperature (EICAS)	<b>40°C .. 126°C</b> (at FCOC) (green range: 21°C .. 126°C) -40°C min temp for start 21°C min temp for T/O thrust
Pressure (EICAS)	34..95psi if N2 < 88% (green range) 50.. <b>95psi</b> if N2 ≥ 88% 96.. <b>155psi</b> for max <b>2min</b> 95psi (red range) if oil temp < 21°C, only idle
Quality	Impending bypass sensor; E1/2 OIL IMP BYP advisory message
Engine Components AGB	Driven by <b>HP</b> spool (N2 shaft) Drives <b>FPMU</b> (centrifugal and gear pumps), <b>PMA</b> , <b>oil pumps</b> , <b>hydraulic pump</b> , <b>generators</b> , <b>pneumatic starter</b> (6)
CVG	To prevent engine stall at low speed conditions Driven by servo fuel pressure from FPMU, controlled by a dual coil torque motor (commanded by FADEC)
<b>PMA</b>	Primary electrical source for engine control Supplies <b>FADEC (&gt; 50% N2)</b> and <b>igniter (&gt; 10% N2)</b> (two coil windings) (else: ESS DC)
Ignition system	2 ignition exciters, 2 high tension igniter leads, 2 igniter plugs FADEC <b>A</b> Bottom igniter FADEC <b>B</b> Top igniter (prefer if wet) OFF No IGN, no FF (for motoring)
ATS	Heavy turbulences: Switch ignition to ON (both IGN come on) Components: Air inlet assembly, impeller turbine, reduction gear set, clutch assembly, output shaft. Controlled by SCV
Thrust reversers	3 locking systems to avoid inadvertent inflight deployment Electrically commanded/controlled, 1, 2: hydraulically powered; 3: electrically powered
FADEC	Dual lane FADEC (A, B), one in hot spare mode (stand-by) Initially powered by ESS DC bus, at 50% N2 by PMA FADEC controls FPMU (FF and CVG) and IGN Indication: A/B (FADEC), IGN A/B (IGN exciter) RESET Reset the fault buffer ALTN Automatically prior ENG start to other FADEC, not the one that attempted last GND start Inflight restart: FADEC in control will command own ignition ON and request other FADEC to command ignition ON too

Start	Sources	First start <b>RH ENG</b> . BAGG door must be closed	
	Sequence	<b>APU bleed, ENG bleed, GND source</b> (hatch near RH ENG) N2 (→ oil pressure) → IGN → FF → N1 → Light up 14% N2 IGN (if AUTO or ON) 31.5% N2 / <b>12sec</b> after IGN <b>FF, after max 10sec ITT↑</b> 54..57% N2 IGN off Stabilized N1 24, ITT 4xx, N2 64	
	Motoring	IGN OFF → No FF, no IGN exciter - dry <b>motoring</b> possible After motoring, to STOP, then START again	
	X-bleed	First start <b>LH ENG</b> . Requires ~ <b>80% N2</b> . Close ENG bleeds (SOPM 2-63)	
	LPU	SOPM 2-65	
	Airstart	Check if ENG is eligible to being restarted (not if <b>N1/N2 zero</b> or <b>no ENG oil</b> - N2 could read zero below 160KIAS) Both IGN come on (FADEC requests other FADEC to ignite)	
	<b>Abort start if</b>	<b>No N1/N2 acceleration</b> to stable idle speed (hung start) N1 rotation is not confirmed or decreases <b>No N2 increase within 5sec</b> after START <b>ITT rises rapidly</b> towards or <u>approaches 800°C</u> (hot start) (new FADEC B8.0 will shut-down automatically) <b>Oil pressure</b> stabilizes below minimum limit Intermittent elec/pneumatic or starter malfunction before starter diseng Abnormal noise, vibration, fire or smoke → <b>ABNORMAL ENGINE START</b> checklist	
	<b>Warm-up</b>	Idle during <u>≥ 4min</u> for cold engines (off for > <b>90min</b> ) <u>≥ 2min</u> for warm engines <b><u>N2 above 83% only if oil temp ≥ 40°C</u></b> , or run for 8min or complete a static run-up to 88% N2, oil pressure ≤ 83psi	
	Spool-up	From idle: Up to 8sec	
	<b>Cool-down</b>	<b><u>1min at idle</u></b> before shutdown	
	Thrust ratings	<b>T/O-1</b>	Max <b>5min</b>
ALT T/O-1		Max 5min. ATTCS armed for T/O-1 if OEI	
GO AROUND		= T/O-1, but different N1, max 5min	
CON		OEI, severe icing, ... FADEC selects T/O-1 if T/O mode button is pressed, TL above THRUST SET, FADEC power up or power interruption, T/O-1 mode T/O data selected, gear down and locked below 15'000ft, disagreement between thrust mode selection on each engine for > 350msec	
Limitations	N1	Max 100%	
	<b>N2</b>	Max <b>102.4%</b>	
	Starter	1min on → 1 min off, after 5 <sup>th</sup> cycle 5min off	
	Motoring	5min on → 5min off,	
	ITT	Measured by 16 open-tip thermocouples in 1 <sup>st</sup> stage (LP) ITT 210°C (no motoring needed) Start ITT max <b>800°C</b>	
	T/O	<b>948°C (5min)</b> (135BJ: <b>970°C</b> )	
	CONT	<b>901°C</b> (135BJ: <b>935°C</b> )	
	Normal ops:	790°C recommended. Accelerate to M 0.65 if higher	
	<b>SE</b>	<b>Max ALT 15'000ft</b>	
	Vibrations	HP indication	Turbine max 1.1IPS
		LP indication	Top outer fan max 1.8IPS < 2.5IPS Monitor ENG > 2.5IPS Reduce thrust
		Fan blade icing	ENG LP VIB; N1 max 60% 3..5sec
		Vibrations on GND in icing conditions: Increase N1 to max. 75% N1	

## 2-11 HYDRAULIC

System	System 1	<b>Gear, steering, door</b> (incl <b>accumulator</b> ); IB spoilers, OB brakes (more critical system, more time req for gear operation, no steering on GND) <b>Priority valve</b> for flight controls (only minimum flow for gear retraction, which will operate through accumulator pressure) <b>if on EMDP only</b> and gear is operated and pressure difference below <b>2400psi</b> (e.g. ENG 1 fail after T/O and gear retraction in a turn) (lower EMDP flow)
	System 2	EMG/park <b>brake accumulator</b> charging; OB spoilers, IB brakes
Components		Reservoir (pressurized by high-pressure HYD system fluid), EDP, EMDP, manifold, shut-off valve, filter
	EDP	<b>3000psi</b> <b>9.2GPM</b> (100% N2)at engine AGB De-selectable; requires maintenance to re-engage
	EMDP (stby)	<b>2900psi</b> <b>1.5GPM</b> intermittently (smaller HYD lines) <b>0.7GPM</b> continuously
	<b>Accumulators</b>	<b>AUTO mode</b> EMDP on if < <b>1600 ±100psi</b> or <b>N2 &lt; 56.4%</b> ; advisory msg Sys 1 EMG/prk brk For <b>6 brake applications</b> , or min 24h parking Sys 2 main door    For <b>4</b> closure operations If blocked (closing line <b>remains pressurized</b> after door closing / solenoid valve failure; <b>BLOCKED</b> inscription illuminates on <b>entrance door panel</b> ), actuate <b>alternative opening valve</b> for <b>2min</b> clockwise
	HYD shut-off	Between reservoir and and EDP Closed by <b>buttons</b> on OVHD panel or by fire <b>handles</b> Used in case of overheat or a leak
Limitations	Temperature Qty indication	Thermal switch in reservoir if > <b>90°C</b> <b>6l</b> reservoir                > <b>1l</b> Green ≤ 1l    Amber, advisory MSG
	Press indication	Amber if                    < <b>1300psi</b> (HYD SYS FAIL MC) or > 3300psi

## 2-12 LANDING GEAR AND BRAKES

System		Hydraulically operated, electrically controlled, mechanically locked <b>Nose gear doors</b> are kept closed by HYD pressure <b>1</b> Doors of main landing gears are mechanically operated LG/LEVER DISAGREE MW after <b>20sec</b> <b>2 WOW</b> switches each main LDG gear, <b>1</b> on nose gear Nose gear switches for thrust reversers and nose steering
Indications	"Gear" if	On EICAS and RMU, ENG backup page 2 - Flaps below 22, RA < <b>1200ft</b> , 1 TL < 45°, 1 TL < 59°; or - F22 or more
Controls	LG WRN CUTOUT DN LOCK REL	To cancel gear warning in case of RA loss Mechanically releases gear handle down lock if the downlock solenoid fails (prevents raising the gear on GND). Wait 10sec, check LG AIR/GND FAIL, do not select gear up
Extension	3 ways to extend	- <b>LG lever</b> LDG gear electronic unit - Elec <b>override</b> NORMAL LGEU has control DOORS Open nose LDG gear doors GEAR/DOORS Extend LDG gear - <b>Freefall</b> lever Depressurizes LDG gear hydr line, releases gear uplocks
Steering		Hydraulically operated, electronically controlled <b>±71°</b> with wheel, <b>±5°</b> with rudder → max <b>±76°</b> deflection <b>Radom</b> is limiting in narrow turns if steering fully deflected Carbon brakes. Automatic gear retraction braking function Wear is mostly related to number of applications rather than the energy applied. Do not pump the brakes
<b>Brakes</b>	BCU	<b>TD protection</b> Permits braking only 3sec after TD or when wheel speed 50kts <b>Anti-skid</b> Triggered if $\Delta$ speed <b>30%</b> . Deactivated below 10kts Only relieves pressure (no increase) → <b>Reduce brake pedal pressure opposite</b> side of turn instead of applying pressure to the desired side <b>Locked wheel</b> Protection above 30kts
	Hydraulics Parking brake (=EMG brake)	System <b>1 for OB</b> brakes, system <b>2 for IB</b> brakes First fully apply pedal brakes, keep it, then set parking brake (to prevent fluid transfer between systems) To release: As well first fully apply pedal brakes Overrides TD protection / anti-skid / locked wheel protection (→ pull slowly, modulate manually) MC if accumulator pressure < 2200psi (max 3700psi)

## 2-13 FLIGHT CONTROLS

Trims		Trimming stops after 3sec actuation Pitch trim: 2 systems/motors. Triggers aural warning if > 3sec
Controls Disconnection		Reset of elevator/aileron disconnection requires maintenance
Elevator	Elevator tabs	Only elevator operates fully mechanically <b>Inner spring tabs</b> , opposite movement at high speeds, neutral at low SPD <b>Outer servo tabs</b> , two-channel HSCU with motors
Ailerons		Hydraulic. <b>Left:</b> Autopilot. <b>Right:</b> Roll trim, artificial feel unit
Rudder		Hydraulic. <b>System 1 shuts off above 135kts (RUDDER OVER BOOST else)</b> Yaw trim not available in mechanical reversion mode <b>Hardover protection:</b> Mechanical reversion if rudder deflected > 5°±1°, pedal force > 59kg, both ENG > 56% N2 (disabled if OEI)
Flaps		Double slotted fowlers, electrically driven by <b>2 motors</b> FLAP LOW SPEED if FECU monitors that only one channel works FLAP FAIL if both failed Velocity sensors to detect flap panel asymmetry
Spoilers	GND spoilers Speed brakes  Panels	Deploy if > <b>25kts</b> & (TL < 30° or N2 < 56%), <b>both panels</b> Deploy if TL < <b>50°</b> , <b>F0</b> or <b>F9</b> , ob panels only (because of ENG) Shall <b>not be used below 1000ft/AGL</b> Leave <b>hand at control while deployed</b> (as a reminder) Inboard 52° deflection Outboard 30° deflection
Gust Lock		Electromechanical <b>Check elevator travel each time after release</b> <b>Wait ≥ 10sec after release</b>

## 2-14 PNEUMATICS, AIR CONDITIONING AND PRESSURIZATION

System	Inputs	Engine 9 <sup>th</sup> and 14 <sup>th</sup> HP compressor stage (N2 > 56.4%), APU or GND bleed air source (GND: 40..45psi) 14 <sup>th</sup> stage HSV: At low power settings with A/I on ENG bleed air has priority over APU bleed air - White stripe in APU bleed Button is pressed (↔ ENG bleeds) - OPEN inscription APU bleed is actually open X-bleed AUTO CBV opens if A/I on or XBLD start selected	
	Outputs	Engine starting, air conditioning (ventilation, temperature, humidity reduction), pressurization, wing/horizontal stabilizer/air intake thermal A/I protection	
	Fans	RECIRC fan	Located at wing root
		GASPER fan	Located between cabin and cargo comp
	Pressurization	From forward to aft pressure bulkhead	
	PACK	Dual heat exchanger. Pneumatic air conditioning kit	
	Valves	High stage valve closes at 45.5 ±2.5psi	
	Press sequence	Thrust set (TL > 75°) → descent 450FPM to 0.2psi below, until A/C ALT is lower or until 15min (so return is possible without having to set the panel) LDG: Cabin stays 300ft below (avoids pressure bumps), then climbs at 500..650FPM A/C rate of descent > 200FPM: Depressurization sequence	
Indications	Temperature	Bleed air temperature downstream of the precooler	
	MC	PACK OVLD	if pack outlet > 55psi or compressor outlet > 243°C
		PACK OVHT	if pack outlet > 93°C or downstream condenser > 95°C
		ELEKBAY OVTEMP	Electronic compartment > 71°C
		MC if ventilation > 71°C	
	"CABIN"	if cabin ALT > <b>10'000ft</b>	
Controls	Temp control	Manual	3 .. 82°C
		Automatic	<b>18 .. 29°C</b> (default 24°C if knob failed)
	Press control	Pneumatic outflow valve (manual) Electropneumatic outflow valve (automatic) CAB ΔP <b>-0.3 .. +8.4psi</b> , overpressure max <b>8.6psi</b> , target <b>8.1psi</b> (145 / 135BJ: slightly higher values) Cabin ALT limiter at 14'000ft (valve closes)	
	Manual press ctrl	12 o'clock position	
	LDG ALT	If no LDG ALT is entered, the system takes 8'000ft	
	Dump	AUTO mode	Press <b>DUMP. Stops at 14'500ft</b>
		MAN mode	Full up (full open)
Limitations	Single bleed / single pack	Max <b>10'000ft for unpressurized flight</b> , unless MEA higher <b>Max ALT with one bleed or pack closed 25'000ft</b> Exception: If bleed 1 u/s and APU bleed used for pack 1 Consider FF↑, use LRC tables in PIH <b>Max ALT for SE or single bleed in icing is 15'000ft</b> If both packs closed, ram air valve opens, providing ventilation	
	Left pack Refueling	Is automatically <b>closed if A/I on below 24'600ft</b> Packs must be off	



## 2-15 ICE AND RAIN PROTECTION

System	Input	Engine 14 <sup>th</sup> HP compressor stage APU bleed is not hot enough to provide flight A/I
	Output Temperature	Horizontal stabilizer fed by left pneumatic system <b>-40°C .. 10°C (SAT)</b>
Operation	Switch on Icing conditions	if <b>visible moisture</b> (VIS < 1 mile) and <b>≤ 10°C</b> FADEC reduces maximum available T/O thrust, and gives minimum thrust setting (+20%) to ensure A/I as long as gear is up → <b>Do not extend gear above 3000ft/AGL in icing (not for 135BJ)</b>
	On GND ENG AIR INLET	Select override knob to <b>ENG</b> Valves open if <ul style="list-style-type: none"> <li>- ICE DETECTION TEST to 1/2, or</li> <li>- ICE DETECTION OVERRIDE to AUTO and ice detected (<b>any</b> of the 2 ice detectors), or</li> <li>- ICE DETECTION OVERRIDE to ALL/ENG</li> </ul>
	WING/STAB	Valves open if <ul style="list-style-type: none"> <li>- ICE DETECTION TEST to 1/2, or</li> <li>- A/C on <b>GND</b>, GSPD ≥ <b>25kts</b> and ICE DETECTION OVERRIDE to AUTO (ice detected; <b>any</b> of the 2 ice detectors) or ALL, or</li> <li>- A/C inflight and ICE DETECTION OVERRIDE to AUTO (ice detected; <b>any</b> of the 2 ice detectors) or ALL</li> </ul> <p><b>Red MW ICE COND-A/I INOP if icing encountered below 25kts</b> (will disappear during T/O roll when ≥ 25kts)</p>
Test		TEST switch simulates icing conditions on the respective ice detector Must be carried out when icing conditions are prevailing/forecasted May be completed <b>on GND (A)</b> or <b>in 2 phases (GND/AIR; B)</b> : <p>A Prevailing icing conditions: Test on GND, before T/O 83% N2, ICE DET OVRD ALL, A/I buttons pressed, ICE DET TST 1 (10", &lt; 15") then 2 (10", &lt; 15"), check OPEN inscriptions / ICE DET 1/2 FAIL / BLD 1/2 LOW TEMP / ICE CONDITION, idle, OVRD ENG</p> <p>B No prevailing icing conditions, not anticipated for T/O / CLB; once a day: Test in two phases</p> <ul style="list-style-type: none"> <li>- GND before ENG start: Air cond packs open, APU/ENG bleeds close, A/I buttons pressed, ICE DET OVRD AUTO, ICE DET TST 1 (10", &lt; 15") then 2 (10", &lt; 15"), check ICE DET 1/2 FAIL / BLD 1/2 LOW TEMP / ICE CONDITION</li> <li>- CLB: ENG bleeds open, 2000..23000ft, TAT &lt; 10°C, before entering icing conditions, ICE DET OVRD ALL (20"), check OPEN inscr., NO ICE-A/ICE ON</li> </ul>
SPS/ICE Speeds		Advisory message; higher stall and approach speeds SPS will activate at reduced AOA for F9/18/22 Can't be reset inflight (on GND: Stall protection test)
Windshield		2 circuits, 1 normal, 1 OVTMP, 1 spare sensor each MC at 55°C
De-icing		SOPM 2-75, AOM 1-02-79 (229) <b>Trim</b> settings: Full down during de-icing (acc CL)

## 2-16 OXYGEN

System	<b>Crew OXY</b>	Cylinder	Composite, high PRESS. RH side of A/C Delivers 300l/min if cylinder PRESS 200..1850psi
		3 Masks	NORM OXY/air mixture (above 33'000ft: Pure OXY) <b>100%</b> (center position) EMERG Overpress; to clear the mask from smoke
		Observer	No vent-valve system, "blinker", on/off valve, test/shutoff slide
		MIC	Push BOOM/MASK button on DAP Consider MIC cold if mask to EMERG
		Smk goggle	Right of observer seat
	<b>PAX OXY</b>	145	36 chemical oxygen generators for passengers 60 continuous-flow masks For <b>12min</b> Masks drop if <b>ESS buses</b> energized, PAX OXY <b>AUTO</b> , > <b>14'000ft</b> Masks are not suited in case of smoke as chemically generated OXY is mixed with ambient air (only for decompression; use a wet towel) 2 tools near ATTND stations to open manually
135BJ		1 or 2 oxygen cylinders for passengers	
	<b>Portable OXY</b>	Cylinders	<b>5 cylinders 120l. Min press 1'500psi. 2 outlets:</b> <b>HI: 4 l/min 30min</b> for 1st aid use <b>LO: 2 l/min 60min</b> for walk around
		PBE	<b>2 PBEs (15min/20min)</b> in cabin, <b>1</b> in cockpit
Warnings	<b>"CABIN"</b>	if cabin ALT > <b>14'000ft</b> FSTN BELTS and NO SMKG come on	
Limitations	Crew OXY	Minimum pressure for dispatch <b>1100/1500psi</b> for 2/3 pilots at 21°C (normal: <b>1850psi</b> ) OXY LO PRESS <b>MC</b> if oxygen pressure < <b>400psi (12min for pilots+observer)</b> Disc bursts if > 2700psi at 21°C	
	PAX OXY (135BJ)	Min dispatch PRESS 1730psi PAX OXY LOW PRESS MC if < 750psi	

## 2-17 FLIGHT INSTRUMENTS

	Inhibit aural	Primus P-1000 MC - Steer Diseng - MC
ADS	A/S indication	ADC 1 (from static ports 1 and 4) and ADC 2 (ports 2 and 3) Static ports 1 and 3 on LH A/C side, 2 and 4 on RH side Red .. $v_s$ .. amber .. $1.13v_{s1g}$ .. white .. $1.23v_{s1g}$ Switches to M if $> 0.45M$ Trend vector Situation in <b>10sec</b> Speed bugs Removed at $v_2 + 42kts / 230KIAS$ Comparison Amber IAS if difference 5KIAS → Use lower indication, or PLIs in pitch mode
	ALT indication	Trend vector Situation in <b>6sec</b> Comparison Amber ALT if difference 200ft (RVSM req.) RA low ALT band below 550ft
	PFD	<b>FMS</b> information <b>Magenta</b> <b>VHF NAV</b> <b>Green</b> On-side pointers Blue Opposite side pointers White CDI opposite Yellow
	<b>PLIs</b>	Shown if $\leq 10^\circ$ between pitch and stick shaker activation
	Limitations	PFD ALT indication $\Delta$ max 50ft PFD ALT to ISIS ALT $\Delta$ max 90ft HDG tolerance $6^\circ$ ( $12^\circ$ if bank $> 6^\circ$ )
RA	Range	2 systems. 2 antennas each: Lower center and lower rear fuselage Connected to EFIS/IC-600, TCAS, GPWS, AWU, SPS 0.. <b>2500ft</b>
	DH	Brown awareness tape on ALT indicator if below 550ft 5..999ft
	Tests	Boxed in white if at or below 100ft above DH Amber if at or below DH Button on display controller First level test Press for $< 6sec$ (WoW, $< 50kts$ ) Second level test Hold $\sim 35sec$ until all green Inflight test Displays $100 \pm 10ft$
IC-600s	Test	RA 920, RA TST
	AWU	2 channels, channel B activated automatically if A failed 4 levels: Emergency, abnormal, advisory, information
	NAV	Consider calculation time for CRS homing after new NAV freq <b>No DME in ELEC EMER</b>
	IRS	3 ring laser gyros and 3 accelerometers
	Align	Insertion of position (via FMS) is required Flashing ALIGN: Wrong LAT/LON entered A/C must remain stationary during alignment, no power interruptions Max LAT for alignment <b><math>78.25^\circ</math></b> N and S Remaining align time NAV, POS SENSORS, STATUS
	ATT	Quick Attitude/HDG restart (like a free gyro)
	TEST	Only in ALIGN/NAV. Below 20kts, ALIGN. After 24sec original state
ISIS		On ESS DC bus 2 Air data from <b>pitot/static 3</b> MAG HDG and slip from <b>IRS 1</b>

Reversionary	<b>SG REV</b>	To select offside ADC, ARS or SG (symbol generator) Changes as well ADC and IRS, and A/P changes CPL
Clock		On ESS DC bus 1 (clock 1) / DC bus 2 (clock 2) ET: Shows elapsed time Enter flight nr in lefthand clock (connected to CMC/CVR/FDR)
FDR		On ESS DC bus 1. Stores <b>25h</b> of data With tri-axial accelerometer De-energized if longitudinal acceleration > 5g On if red beacon is on or aircraft is airborne

## 2-18 NAVIGATION AND COMMUNICATION

<b>FMS Universal</b>	<i>Nearest A/P</i>	<i>NAV DTO LIST [PLN LANG]</i> <i>XTK</i> <i>Extended centerline</i>	<i>Will be canceled after each WPT</i> <i>Via PVOR</i>
<b>FMS Honeywell</b>		Honeywell CD-810 / NZ2000	
	Tasks	Manage NAV sensors, high accuracy in NAV performance, position and guidance calculation	
	Functions	Navigation, flight planning, data base, lateral and vertical navigation, performance, NAV display on EFIS	
	Components	2 CDU (keyboard, CRT display, annunciators), 2 NAV computers (forward electronic compartment; for position computation and flight planning), 2 FMS configuration modules (forward electronic compartment), data loader (PIC side), FMS joystick	
	Databases	Navigation, custom, aircraft, maintenance	
	Dual FMS	4 modes (FMS Maintenance page): - Dual mode: Autotransferring active FPL, performance, pilot defined WPT, stored FPL, offside radio commands - Initiated XFER: Active FPL and performance on command - Independent mode: Autotransferring offside radio commands - Single mode: No data XFER	
	<b>Priorities</b>	for sources for position determination: GPS, DME/DME, VOR/DME, IRS	
	Messages	Alerting ("MSG" also on PFD) / Advisory (only on FMS panel) Message is displayed on scratch pad Clear with CLR ( <b>cannot</b> be recalled)	
MFD	Buttons	NAV-APT (NavAid / Airport), DATA (WPT identifier), JSTK, SKP (skip), RCL (recall, set designator at A/C position), ENT	
	Displays	Long range source, WPT data, wind vector, drift bug, WPT, lateral deviation, navaids, airport, designator bearing, range	
	Colours	Vertical navigation	Cyan
		<b>Lateral</b> navigation	<b>Green</b>
		From	Yellow
		To	Magenta
		Prompts, titles	White
		Flight plan names	Orange
		Atmospheric data	Cyan
	Initialization	Fast down alignment <b>1min</b> . NAV, ALIGN, insert POS, NAV DME must be out of hold	
	<b>1h on GND or error &gt; 2NM</b>	Do a fast alignment (do not move A/C, (un)loading is ok). If A/C is moved during alignment (takes 5..10min), IRS restarts 30sec after motion stopped. If ATT is selected inadvertently, make a new alignment	
	FMS pages	NAV Tune: NAV-Tune. Auto Tune: Displayed in magenta NAV Ident: Default page. Active NDB (NAV DB). Possible to change on ground only POS Init: 3 methods to initialize: Load last POS; define and load reference WPT; <b>load GPS POS</b> . Maintenance: FMS mode, list of failed sensors / history, TRUE or MAG mode Data Load: Up-/download. NDB: Update every 28 days	

Sub	PERF	<p>Performance calculations: 3 modes: Current GS/FF (with default G/S), pilot SPD/FF (pilot entered), <b>full performance</b> (based on pilots' selection and learned values). Certain pages are only available in last mode</p> <p>Fuel reserve: NBAA considering DEST to ALTN but minimum 200NM and 30min at 5000ft</p> <p>What-if and stored flight plan (to estimate fuel for next flight) functions</p> <p>Fuel management and single engine</p> <p>FF: PERF - NEXT - FUEL MGT - NEXT</p> <p>FMS is <b>not linked to FF meters</b></p> <p><b>LDG mass:</b> PERF - PERF DATA - NEXT</p>
	NAV	<p>FMS considers A/C inflight if G/S above 50kts or above 80kts IAS of WOW</p> <p>Following entries cannot be made: Temporary WPT, SID, Alternate FPL with DEST, another stored flight plan</p> <p>ATIS: NAV - DATALINK - ACARS - RETURN - ATS MENU - ARRIVAL/DEPART - REQUEST</p> <p>NAV - NEXT - CROSS PTS - PT <b>ABEAM</b></p>
	PROG	<p>DIST/ETE/FUEL to DEST or WPT</p> <p>Page 3: Offset can be entered (L/R...)</p> <p><b>Navigation DB</b> (VOR frequencies) on PROG page</p> <p>T/O time: PROG - NEXT - FLT SUM</p> <p>Autotune: PROG - DEL - TUNE</p>
	GPS STATUS	<p>RAIM            Receiver autonomous integrity monitoring</p> <p>                  Predictive RAIM (yes/no at point/time)</p> <p>                  "/ETD" on FPL, NAV - POS SENSORS - NEXT - GPS STATUS - PRED RAIM</p> <p>FOM            Figure of Merit</p> <p>H/VDOP        Horizontal/vertical dilution of precision</p>
	Patterns	<p>Hold <b>H</b>, Flyover <b>F</b>, Procedure Turn <b>P</b></p> <p>Holdings over a fix: To remove, DEL, then LSK</p> <p>Turn left <b>L</b>, turn right <b>R</b></p> <p>1min over fix: Exit Hold prompt appears</p>
	GND Operation	<p>Check NDB date</p>
	POS INIT	<p>Reference WPT: Ramp WPT or A/P WPT within 3NM is chosen. Otherwise enter Reference WPT. Positions are not transferred, so</p> <p><b>both FMS have to be initialized</b></p>
	PERF	<p>Initialize fuel reserve data, transition ALT and CRZ ALT, WND, Temp, speed restrictions, weights</p> <p>Climb          270 / 0.65</p> <p>Cruise         290 / 0.76</p> <p>Descent        290 / 0.76 / 3.0°</p>
	FPL	<p>Activate DEP RWY, SID, Transition</p> <p>Within 200NM of DEST: Arrival prompt appears. Within 25NM of DEST: Alternate prompt appears</p> <p>Before: Enter via NAV page</p> <p>Check <b>no discontinuity</b>, connect to <b>ALTN</b></p>
	After LDG	<p>Flight summary page appears</p> <p>Can be cleared when prompt appears after 30sec</p>

ENR Operation	Information about airports: NAV, DATA BASE
Patterns	Press DIR / or NAV - NEXT - PATTERNS
SLOP PROG	3/3 - OFFSET
Holdings	Insert latest 5NM before fix Delete hold: DEL, LSK
APP	During APP, MISSED APRCH prompt appears; will display MAP on MFD
Sensor fail	IRS will be used as a reference (degraded mode) De-select sensors: POS SENSORS page (DEL, LSK)
Pt insertion	LAT/LON, P/B/D or P/B/P/B (place bearing distance) Postfix "T" for true bearings <b>x NM prior</b> to a point Pt // x [First WPT "."] AWY name "." last WPT
Diversion	On FPL, change DEST
Horizontal	Restricted bank on direct-to turns towards points that are not on the flight plan, but $\geq 30^\circ$ off
Vertical	FLx y NM before PtPt // y / x
<b>NDBs</b>	<b>xxNB</b> ADF standby frequency: First stby, then actual freq
Edit	- PREV, then PREV/NEXT/CLR/DEL
Del scratch	- DEL
<b>Default val</b>	Press <b>DEL</b> and the desired LSK
Tune	<b>Always tune COM from same FMS</b>
Auto tune	NAV, TUNE, DEL, LSK (NAV 1/2)
Space key	Press twice '/' (CD-820 would have a space key)
Parallax	Type PX.
<b>Ext centerl</b>	DIR, Pt, DIR, Intercept LSK, Pt, IB CRS, HDG SEL LSK, YES Overlay APP: Both NAV SRC to FMS, RMU to NAV page NAV - DATALINK - ACARS - PRE FLT - INITIALIZE (DEP, DEST) Flight times: NAV - DATALINK - ACARS - NEXT - FLT TIMES
<b>ACARS</b>	

## HGS

Data entry	DC bus 1. Fail-passive. BIT - built-in tests. Own built-in IRS. Threshold ELEV APP chart: <b>RWY ELEV</b> RWY LEN 10-9 chart: <b>Beyond threshold</b>
Symbols	Refer to HGS manual appendix A
PRI	Use <b>PRI</b> mode <b>except AIII for CAT III APP or IMC to monitor a CAT II APP (no APCH WARN)</b>
AIII	FGS guidance source, except LVTO submode (when ILS freq is tuned) HGS guidance source. ILS must be captured, within limits for 5sec, diff magn track and detected CRS $< 15^\circ$ , RA $> 500\text{ft}$ RWY data is displayed for 5sec after AIII mode is selected or whenever values are changed
NO AIII	APCH WARN if below <b>500ft</b>
G/S	<b>-2.50° .. -3.00°</b> for AIII APP
APP	Speed bug changes to <b>v<sub>APP</sub></b> when - RA $< 1300\text{ft}$ , gear down, A/C in air, FD: T/O mode - no WSHR / G/A ("SPD" symbol changes to "VAP") <b>300ft RA RWY</b> symbol appears. 95ft AGL AIII flare command symbol Below 70ft G/S deviation raw data no longer displayed Below 60ft No RWY edges displayed any more 45..55ft AGL <b>Flare</b> maneuver 35ft <b>IDLE</b> message Rollout RWY remaining from touchdown until $< 20\text{kts}$

<b>DAP</b>	ID/VOICE ST MUTE <b>EMER</b>	ID for identification, VOICE (unlatched) to reduce the morse code signal Sidetone, to prevent undesirable feedback of speaker into microphone To control sensitivity or to temporarily mute the marker audio LSP is connected to COM1 / NAV1 RSP is connected to COM2 / NAV2 OBS is disconnected No intercom
<b>ICU</b>	BACKUP INPH	If normal mode failed. Both CABIN and CAB EMER illuminate
<b>MIC Switch</b>	on yoke	PTT - HOT - OFF
<b>RMU</b>		On ESS DC bus 1/2 NAV page source is always <b>NAV 1</b> Can store 12 COM and 6 NAV frequencies Dashes when the radio system fails to respond to commands Test: Cursor into subsystem, then press and hold TST
<b>TBCH</b>	<b>EMRG</b>	On DC bus 2 Alternative mean of tuning COM <b>2</b> and NAV <b>2</b> if RMU 2 failed to take control: RMU2 commands are ignored, AUX indication on RMU 2 NAV AUDIO to identify NAV



## 2-19 AUTOPILOT

System		Primus P-1000, autopilot and flight guidance 3-axes autoflight system and automatic pitch trim Incorporated in <b>IC-1. Fail-passive FD</b>
	Subsystems	Hold thumb overhead DISC button when ordering to engage 2 FD, 1 autopilot (incl. YD), comparison monitor module (located in IC-600, can disengage the autopilot)
	Inputs	Only IC-600 1 has an (enabled) autopilot ATT, HDG, air data, RA, NAV, pilot inputs
Limitations		Min engagement height ( <b>MEH</b> ) <b>1000ft</b> Min use height ( <b>MUH</b> ) <b>160ft, 80ft if CAT II</b> <b>300ft</b> for non-precision <b>Off</b> for <b>SE GA</b> , rudder manual reversion, yaw damper engagement with rudder in manual reversion, aileron manual reversion APP mode selection during LLZ capture only when IB G/A in basic modes allowed if wings LVL
Modes	Basic modes	<b>Roll and pitch</b> Entered when changing CPL, changing NAV source on VOR/LOC/ILS, pitch wheel or TURN knobs on autopilot controller, TOGA buttons, invalid sensor signals, changing SG or an armed mode is captured
	ALT mode	Maintains barometric ALT at the time of selection Entered after ASEL capturing (25ft, < 5FPS)
	IAS mode	IAS below <b>25'000ft</b> , Mach number if above SPD bug is synchronized when engaged Does not cancel GS captured mode
	V/S mode	Descent: Brakes rate if approaching red line speed (as well valid for FLC in descent)
	GS mode	canceled if GS signal is invalid for > 5sec
	FLC mode	Climb speed      FL100 and below <b>240KIAS</b> FL120..FL170 <b>270KIAS</b> <b>FL170</b> and above <b>M 0.56</b> Descend rate      FL370..FL120 <b>-2000FPM</b> FL100 and below <b>-1000 FPM</b> Max acceleration 0.1G, overspeed protected Difference to IAS mode in climb: <b>FLC won't descend</b> to catch up speed equals ROL-TO. Will level wings
	G/A	Transitions to SPD hold if < 1.23v <sub>s</sub> or 20sec after G/A and > 170KIAS
	Non-prec APP	VOR                    APR mode (more accurate) LLZ                    NAV mode NDB                    HDG mode
	Roll mode	Once LLZ established, bank is limited to 8°..10° Engaged from HDG mode via TCS or TURN knob on center pedestal Canceled if bank < 6°
	<b>Half bank</b>	<b>14°</b> instead of <b>27°</b> . <b>Only</b> available in <b>HDG</b> mode Automatically when climbing through <b>25'000ft</b> and cancelled when descending through <b>24'750ft</b>
YD		Disengages when red button is pressed
A/P Failure	A/P, YD FAIL MC	Pull IC-1 CB (3↑, 3→) BACKUP BATT off

<b>TCS</b>	to manoeuvre the airplane without disengaging the autopilot	
	When TCS is released:	
	- primary servos re-engage	
	- new pitch attitude and vertical modes are synced (except in APR mode)	
	- lateral control is returned to the previously selected mode	
<b>G/A buttons</b>	On GND, < 80kts, or < 400ft	Put FD into T/O submode (14° ANU)
	During a windshear	Put FD into W/S mode, switch A/P off
	Otherwise	Put FD into G/A mode

## 2. OPERATIONAL

### FLIGHT PLANNING

#### Planning on GND

**VIS** (not RVR) required at **ETA ±1h**; plus **ceiling for non-prec**  
METAR with NOSIG: VIS is valid for 2h, but RVR is **not**  
If both VIS+RVR is given with a NOSIG, then  
- RVR overrules VIS for current situation  
- VIS however is valid for 2h  
(trend appended to a METAR/SPECI overrules the TAF for that period)  
Snowtam: 2h prior A/D opening; MOTNE: With METAR  
Only consider mean X/WND (w/o gusts)

WND

VIS APP / Circling

**CAT I and NPA**

**600ft MDH, VIS 2400m (Cat C A/C)**  
CRVR := f(VIS) acc **conversion table:**  
HIALS/RWY lights x 1.5 (day) / x 2 (night)  
other lights x 1.5 (night)  
no lights / day x 1  
(VIS: Prefix "V"; equal to RVR if no prefix)

Low VIS T/O

**(not for T/O, CAT II/III, circling)**  
if RVR < **400m** (MIN **125m**, 90m visually [slant range])  
RVR < 150m: High intensity runway centre line lights spaced 15m or less apart and high intensity edge lights spaced 60m or less apart; 90 m visual segment that is available from the flight crew compartment at the start of the take-off run; required RVR value is achieved for all of the relevant RVR reportings  
Start T/O roll at threshold (caution: displaced threshold)

**LVP** in force

T/O ALTN

Use **monitored APP**  
If not possible to return, considering OEI  
**Max 60min OEI CRZ SPD (270kts max CONT)**

No T/O

**Closed DEST**

**ALTN**

if moderate or heavy freezing rain  
2<sup>nd</sup> ALTN required; calculate with the higher ALTN fuel  
Must be open for lower APP category:  
**CAT II/III → CAT I → Non-prec → Incr 200ft / 1000m RVR**

**No DEST ALTN**

required if **two separate RWYs**,  
CEIL ≥ 2000ft / circling height + 500ft, whichever is higher at  
ETA ±1h and flight time ≤ **6h**  
Add 15min holding at 1500ft for 2<sup>nd</sup> APP

**Max dist** to adequate A/D: 2h @ 333kts (OEI CRZ SPD)

#### Inflight

Req Wx at **ETA (no ±1h margin)**  
**Ceiling/VV not required** (only **VIS**). ALTN must be open  
(no lower APP category req as during planning on GND)  
APP may be started irrespective of RVR when there is a reasonable chance for a success  
APP may be started, but **continue beyond OM / 1000ft only if latest RVR ≥ RM chart**  
CAT I: Required RVR is **550m/125m/75m**. **CAT II: 300m/150m**  
If RVR drops after having passed OM: Look and see  
A/P ILS, DH 300ft / RVR/VIS ≥ 800m May be flown raw data  
ILS, DH 200ft / RVR ≥ 700m FD compulsory  
ILS, DH 200ft / RVR ≥ 550m/300m AP, RSP flies, LSP lands

A/P

**MDA** Must not be undershoot; **add 50ft**

Contact

**DA** Altitude at which the decision to land / G/A has to be taken  
if at least **3 consecutive lights** in sight (one of which with a central row)

Airports	<b>Fire fighting</b>	For DEP/DEST	4
		For ALTN	3
	Class B	Self-briefing airport	
	Class C	SAAA airport	
RWY	Factored LDG distance (for planning)	<b>DEST</b>	unfactored x <b>1.67</b> for dry RWY unfactored x <b>1.92</b> for wet RWY
		<b>ALTN</b>	unfactored x <b>1.67</b> for both dry and wet RWY
	Inflight	Use unfactored LDG distances (dry) / QRH tables/factor (wet)	
	WED	Slush	0.85
		Wet snow (loose)	0.40
		Dry snow (loose)	0.20
		T/O	Max <b>8</b> mm WED
	LDG	Max <b>20</b> mm WED	
	Wet	<b>Wet if <math>\geq 50\%</math> shiny and water coverage <math>&lt; 3</math>mm</b>	
	Grooved RWY	May be considered <b>dry</b>	
Contaminated	$\geq 3$ mm (but $< 13$ mm); Plan at least with <b>wet</b> No ALT-T/O. IGN on		
	<b>BA</b>	<b>BA unreliable</b> does not imply a poor BA	
Balanced T/O		T/O dist to 35ft (w/ENG failure at $v_1$ ) = ASD (dry RWY) (by adjusting $v_1$ within $v_{MCG} \dots v_R$ to obtain max TOM)	
		- Wet RWY: $v_1$ is reduced to compensate for longer ASD; screen height reduced from 35ft to 15ft, usage of reversers is allowed for ASD - Reduced acc (deposits, uphill, density ALT, OAT, ... $\rightarrow$ increase $v_1$ ) and reduced stopping capability (e.g. slippery, downhill, ... $\rightarrow$ reduced $v_1$ , 15ft margin only) No $v_1$ correction if RWY is covered with roll-resisting deposits - Contaminated RWY: $v_R/v_2$ are increased for better climb	
	<b>Unbalanced T/O</b>	Only if <b>not RWY limited</b> (2..2.5km)	
T/O Segment	Ground roll	$v_1 - v_R - v_{LOF}$	
	1st segment clb	Gear in transit, 35ft at $v_2$	
	2nd segment clb	Up to acceleration ALT (400ft)	
	3rd/acceleration	Flaps up	
	4th/final segm clb	$v_{FS}$ or $1.25v_S$ , max cont power, up to 1500ft	
Climb Gradient		Indicated on APP chart only if $> 2.5\%$ ; then brief OEI MAP	
<b>Dispatch</b>	MEL	Minimum Equipment List, for A/C systems, on GND as long as A/C is not operating under own power If a system is not listed, then it has to be ok After off-blocks <b>QRH</b> applicable, not MEL any more	
	CDL	Configuration Deviation List, outside parts of A/C No time frame given for rectification	
	HIL	Maintenance has to transfer tech log entries to HIL (or pilot with assistance of maintenance, if pilot is trained)	

<b>RVSM</b>		<p>FL290 to FL410 (both inclusive)  Operator, crew and aircraft must be approved  Check blue documents booklet and ATC FPLN (10/equip 'W')  <b>MEL:</b> 2 independent primary ALT, 1 A/P w/ALT hold (<math>\pm 65\text{ft}</math>),  1 ASEL (alerting deviations <math>&gt; 300\text{ft}</math>), 1 XPDR w/ALT enc  <math>\Delta</math>ALT GND max <b>75ft</b> (in between and compared to known ALT)  Inflight max <b>200ft</b>  <b>XCHK</b> and log on OFP prior entering and <b>every 60min</b>  ALT changes: Do not over-/undershoot by more than <b>150ft</b>,  Reduce to max 1500FPM the last 1000ft  <b>"Affirm/negative RVSM" / "Unable RVSM due eq / turb" /</b>  <b>"Ready to resume RVSM"</b></p> <p>Non-RVSM <b>odd</b> FL290 FL330 FL370  Non-RVSM <b>even</b> FL310 FL350</p>
Jeppesen Charts	MSA MOCA ("T")  MORA ("a")  JeppView PLN	<p>Clearance by 1000ft within <b>25NM</b>  Min obstruction clearance ALT. Radio NAV signal coverage only within  22NM from the VOR (<math>\Leftrightarrow</math> MEA)  Min off-route ALT (grid/route). Obstacle clearance le/ri 10NM by 1000ft  (<math>&lt; 7000\text{ft/MSL}</math>) or 2000ft respectively  24.WOOD1B HELEN HELE1A.27</p>
SWC		<p>WND speeds <math>\geq 120</math> kts: ALT of WND is being indicated  80kts isotachs (from LVL / to LVL)</p>
<b>OFF</b>	Fuel	<p>Trip fuel 3.5kg / NM air  3.2kg / NM air for longer flights  Rule of thumb # kg / 20 = # minutes  1<sup>st</sup> hour <b>1500kg</b> trip  2<sup>nd</sup> hours and ff <b>1200kg</b>  Contingency fuel 5%, or 3% with fuel ALTN  Diversion fuel Dest ALTN fuel + company fuel + final res  = fuel from MAP to dest ALTN + final res  Final reserve 15min holding at 1500ft  Calculate <b>+20%</b> for 180KIAS instead of <math>v_{\text{Hold}}</math>  Target: Arrive w/<b>2000kg fuel</b> onboard  <b>Fuel checks</b> at least once an hour</p>
	Icing conditions	<p>Climb fuel Increase by <b>10%</b> (ISA or below)  Increase by <b>20%</b> (above ISA)  Holding fuel Increase by <b>20%</b> (ISA)</p>
	CRZ LVL	<p>Optimum 1.4 x trip NM  Fastest Around <b>FL258</b>; where <math>v_{\text{MO}}</math> meets <math>M_{\text{MO}}</math>  Lower LVL Add <b>3%</b> to trip fuel for <b>each 1000ft</b></p>
<b>Loadsheet</b>	<b>Min fuel</b>	<p>18'500 - 16'000 = 2500  <b>Burnoff + 2500 with full house</b>  Taxi/APU <b>70kg</b>  Trip fuel DEST with burn-off correction  a) ZFM + ramp fuel - taxi/APU  b) MTOM/RTOM  c) MLM/RLM + trip fuel  Underload Lowest of a/b/c - actual TOM</p>
Dangerous Goods		<p>Articles/substances capable of posing significant risks to health, safety,  environment, property  "No Carry Operator" if no approval</p>

EASA Regulation (EU) 965/2012 on air operations,  
CAT.GEN.MPA.180; customs regulations, OFCOM

Originals of:



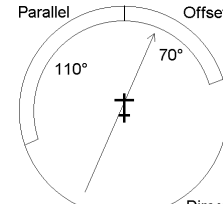
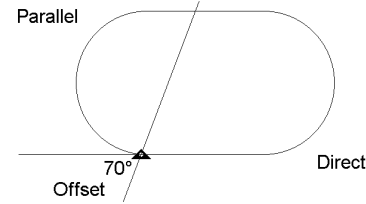
- Aircraft flight manual (AFM)
- Certificate of registration
- Certificate of airworthiness
- Noise certificate
- Air operator certificate (AOC)
- Operations specifications
- Aircraft radio station operating licence
- Third party liability insurance certificate
- Journey log
- Technical log
- ATS flight plan, charts
- Procedures and visual signals information for interceptions  
(ICAO Annex 2)
- Information concerning search and rescue (AIP)
- Operations manual (relevant parts)
- MEL
- OFPNOTAMs, briefing documentation, MET
- Passenger/cargo manifests
- M&B

## NORMAL PROCEDURES

Manuals	AFM AOM SOPM	Certified document, must be strictly applied Additional details of applicable procedures Proposed sequence of actions with appropriate CRM in order to best cope with the situation
Priorities	FGS	<b>Stall warning</b> → <b>EGPWS</b> → <b>TCAS</b> Always follow FD, except TCAS RA, EGPWS hard warnings, or when in doubt about correctness
CRM	MCDU Closed loop A/P Call-outs	<b>Below FL100, PF orders all MCDU entries.</b> PM enters, PF confirms Simplified: PF executes and calls out, PM: "Checked" Extended: PF orders, PM executes silently, PF checks silently Below 1500ft/AGL Always one hand at yoke "On/Off" or Change of system status "Engage/Disengage" "Select" Including mode change "Set" Change of a value, but same mode "NAV1 ... active, CRS ..., preset ..." "Insert" FMS; PM: "Inserted" - PF: "Checked" "Select FL ..." PM: " <b>FL ... armed</b> " "Gear" / "Flaps" Only silent check "LLZ / G/S alive" But no capture call-out Deviations Call out "guidance", "speed" (+10/-5), "sink" (-900FPM), "pitch", "thrust", "LLZ" - PF: "Checked" Guarded switches Always need confirmation ALT "CLD FL/ALT ..., STD/QNH, passing FL/ALT ...", "CHKD, ±...ft, STBY ±...ft" "FL100" Handover "Ready for handover?", "Ready" Call out actual modes, "Checked" "Your controls", "My controls" " <b>NAV source to FMS</b> " on (new) PF DCP, <b>CPL AP, "AP on your side"</b> Re-engage and call out modes, "Checked" " <b>NAV source to NAV</b> " on PM DCP <b>TCAS</b> page on PF side, <b>FUEL</b> page on PM side Cabin T - ime available E - mergency type S - ignals to be used T - ransmit additional instructions
Areas of Responsibility	LSP RSP PF PM	Glareshield panel incl. middle part, control pedestal Overhead panel, RH RMU, RH CDU Spoilers Gear, Flaps
Lights	NAVIGATION LOGO RED BEACON TAXI (nose) STROBE LDG INSP	Whenever A/C is energized Sunset to sunrise and during low VIS operations When engine(s) running or when A/C is moved On GND when moving (together with <b>parking brake</b> ) When on active RWYs During T/O / LDG, after <b>clearance</b> received, < FL100 / in congested areas For visual wing surfaces inspection

Shoulder Harness	May be removed between TOC and TOD Lock in case of turbulence, expected crash, pilot incapacitation					
ENG Start-Up	BATT min 24V					
LPU	Low press unit	AOM 1-02-81 1 01	(273)			
XBLEED	Cross start	AOM 1-02-81 3 01	(275)			
	Bleeds closed (non-operating ENG) and open (other ENG) N2 > 80%					
T/O	LSP	Hand on TL until $v_1$				
	<b>Low VIS</b>	Use <b><u>T/O-1</u></b> Start T/O on <b>green line</b> (taxi forward if displaced threshold)				
	Profiles	$v_2+15$ , when outbound HDG established consider $v_{FS}$ . Acc ALT: 210kts NADP-1 / ICAO A: $v_2+10$ until 800ft (NADP-1) / 1500ft (ICAO A), then CLB thrust, maintain $v_2+10$ until 3000ft, then $v_{FS}$ NADP-2 / ICAO B: $v_2+10$ until 800ft (NADP-2) / 1000ft (ICAO B), then CLB thrust, $v_{FS}$ until 3000ft				
Climb	Do not use V/S mode for climb (much shorter time until stall after engine failure than with <b>pitch mode</b> ) Good climb performance at <b>4°..5° ANU</b> When CAB $\Delta P$ reaches 7.8psi, select max 1500FPM					
	Approaching	<b>Max 1000FPM</b> 1000ft before cleared ALT/LVL				
	Endurance	<b>240KIAS</b> to FL100, <b>270KIAS</b> to FL174, then M <b>0.56 (FLC)</b> (high TWND ENR or climb fast through turbulences)				
	High speed	240KIAS to FL100, <b>290KIAS</b> to FL216, then M <b>0.65</b>				
	Climb gradient	e.g. 383FPM: Multiply by [GS]				
	Intermediate LVL	Max <b>240KIAS</b> $\leq$ FL100, <b>300KIAS</b> $>$ FL100 Maintain CLB thrust mode				
	Cruising LVL Select	<b>CRZ mode</b> when speed exceeds M <b>0.70</b>				
Pitch - Thrust	ISA, 18t, CG 25%	T/O	F9	$v_{F0}$	14°	T/O thrust
		LVL	clean	180KIAS	5°	59%
		LVL	clean	210KIAS	4°	62%
		LVL	clean	240KIAS	4°	70%
		LVL	30° bank	210KIAS	4°	64%
		LVL	45° bank	210KIAS	5°	68%
		LVL	F9	160KIAS	5°	59%
		LVL	F9	180KIAS	3°	61%
		LVL	F22, gear down	160KIAS	3°	71%
		LVL	F45, gear down	140KIAS	3°	80%
		3° G/S	F9, gear down	180KIAS	1°	64%
		3° G/S	F22, gear down	160KIAS	0°	57%
		3° G/S	F22, gear down	140KIAS	3°	52%
		3° G/S	F45, gear down	140KIAS	0°	67%
	<i>OEI</i>	LVL	<i>clean</i>	<i>180KIAS</i>	<i>5°</i>	<i>75%</i>
		LVL	<i>F9</i>	<i>160KIAS</i>	<i>5°</i>	<i>76%</i>
		3° G/S	<i>F22, gear down</i>	<i>160KIAS</i>	<i>0°</i>	<i>73%</i>
		3° G/S	<i>F22, gear down</i>	<i>140KIAS</i>	<i>3°</i>	<i>70%</i>



XWND	T/O LDG WCA	SOPM 3-15-05 4 Positive rudder, small control wheel inputs SOPM 3-40 7f 4 Methods (sideslip, crab, de-crab, crab and sideslip) [kts]
		 
		for 120KIAS. At 150KIAS, decrease corrections by 30%, at 90KIAS, increase corrections by 30% multiply by 2
	m/s → kts	
Timed Turns		Bank = $\frac{TAS}{10} + 7$ for a rate-one turn. 10sec for 30° (TAS = 1/2 FLT LVL + KIAS = 6 x Mach Number)
Turn Radius		$\frac{GS}{100} = \text{Turn radius [NM]}$
Descent Planning	Normal Eco <b>WND</b>  A/I Procedure	<p><b>3NM each 1000ft + 10NM</b> margin (or: FL x 3) 4NM each 1000ft, 3000FPM, until FL110, idle TOD <b>2NM</b> earlier <b>per 10kts</b> TWND TOD 2NM later per 10kts HWND FADEC ensures min 55% N1 → Shallower descent Until FL130 <b>Maintain 310KIAS</b> The lower the ALT, the more thrust necessary to maintain constant M, the less thrust necessary to maintain constant IAS</p> <p>At <b>FL130</b> <b>FLC</b>, thrust↑ to maintain <b>V/S of 5xGS</b> At FL100 250KIAS At FL80 240KIAS At 4000ft 200KIAS LLZ intercept 180KIAS</p> <p><b>5% N1 ≈ 1000FPM</b> Glide angle 1:18 Angle of descend x Mach number x 1000 = Desc rate [FPM] 10 x Mach number = #NM per minute</p> <p>Recommended Within last 2000ft ASEL max rate 1500FPM Within TMA V/S ≤ 1000FPM within last 1000ft, V/S ≤ 1500FPM within last 1500ft</p>
	Corrections Idle descent Mach	
	Rates	
Holdings	Standard RT	  <p>(end of OBS needle) (Offset = Teardrop, 30° for 1min)</p> <p>Outbound leg 1min if ≤ 14'000ft/MSL, 1½min if above</p>
Course Intercepts		90°/45° intercept if <b>QDM more than 20°</b> 30° intercept otherwise
FD		Always follow, except for TCAS RA, EGPWS hard warnings, or if in doubt VIS APP: FD OFF

ILS	LLZ signal	± 35° to 10NM ± 10° to 18NM Full deflection 2.5° (VOR: 10°)
	G/S	1000ft after threshold 3° → 50ft/ARTE
	DME	Carefully check DME identification with chart
<b>CAT II</b>		<b>AEO only.</b> Requires 2 ILS set to frequency, F22, RA set to MIN Both DU on RSP side must be working RSP flies down to MIN, "CTC / LDG" → H/O; G/A otherwise Use <b>F22 ice speeds</b>
	Malfunctions	Any malfunction requiring crew action > 1'000ft/AFE G/A if not completed prior 1'000ft/AFE < 1'000ft/AFE G/A 500..1'000ft/AFE Downgrade (new MIN)
<b>CAT III</b>		<b>OEI possible.</b> PF: LSP, PM: RSP Use <b>F22 ice speeds</b> Arm AIII No troubleshooting / system downgrading below 1000ft/AGL APPR warning before T/D: G/A
	Setup 500ft	PF: "AIII armed", PM: "Checked" PM: "500", PF: "AIII checked" PM: "Flare/Idle"
<b>RNP APP</b>		LNAV, LNAV/VNAV, LP, LPV (SW6.1+) RNP is a type of PBN AOM 1-02-80 9ff
	Required eq	1 FMS, 1 GPS, 1 DME*, 1 VOR/LOC*, 1 ADF*, 4 DU, 1 FD, 1 MCDU (* for conventional NAV backup) LP/LPV: SBAS required
	Procedure	Check NAV DB validity Perform predictive <b>RAIM</b> Check <b>TEMP</b> limitation for LNAV/VNAV APP (or compensate TEMP) FMS PROG 1/3 FMS NAV mode GPS, LRN MIN 3 FMS ACTIVE FPLN APP WPT, CRS DIST, ALT constraints, final APP angle <b>2NM before FAF</b> Check <b>APP</b> annunciation
Non-Precision APP General		Use <b>FMS overlay</b>
	<b>RNAV</b>	GPS only: <b>No overlay</b> required
	Required <b>VIS</b>	<b>DH x 6</b> = VIS [m] required to see RWY
	Required <b>V/S</b>	<b>5 x G/S</b> = V/S [FPM] for 3° descent, max 1500FPM
	VDP	<b>DH / 300ft</b> = Dist [NM] for 3° descent
	Timed VDP	<b>DH / 10</b> = time [sec] from VDP to RWY Deduct from given time from FAF to RWY
Circuits	400ft	SPD 180, CLB Thrust, F0
	1500ft	Start turn, After T/O CL
	Begin downwind	F9, APP Briefing (T/G / Full Stop), Config
	ABM THR	TC, Gear down, F22, SPD 160
	45sec	Start turn, descent, SPD 140 (or: <b>3 x ALT / 100</b> = time [sec])
	T/G	Instructor: F9, Pitch Trim 8, "Go"
Steep APP		GS of <b>4.5° or more</b> (135BJ: <b>max. 5.5°</b> ) Max TWND 5kts

<b>Stabilized APP</b>		SPD (-0/+20), flight path, sink rate (max 1000FPM exc. steep APP), thrust stabilized
	In VMC	500ft/AFE
	In IMC	1000ft/AFE
	Exceeding $v_{REF}$	10% increase in $v_{REF}$ : 20% increase in LDG distance
<b>High SPD APP</b>		Mind: Not stabilized at 500ft (F45)
	Final	<b>F9, 240KIAS</b>
	1500ft	TL idle, gear down (mind "GEAR" warning at 1200ft)
	200KIAS	F22
	145KIAS	F45, set 62% N1
RTF Phraseology	Readback	Readback QNH and RWY
	Acknowledge	"[Roger], C/S" "Wilco" only to confirm a reporting instruction
	HDG	All headings should be expressed in single digits
	SPD	All speeds should be expressed in single digits
	ALT	Specify ".. FEET" and "FLIGHT LEVEL ..." 10'000ft can be expressed as "one zero thousand feet" FL can be expressed in hundreds
	Request	"Request FL360" (not: "any chance" / "is available")
	Yes	Affirm
	No	Negative
	Clearance	"C/S, information hotel, stand E43, request clearance to..."
	Cleared	The word "cleared" shall only be used in connection with an ATC clearance at the gate, a T/O, an APP or a LDG clearance, but not for crossing or L/U "RWY 28 cleared for T/O"
	Conditional	"BEHIND landing traffic, line-up RWY 28 and wait BEHIND"
	H/O	Only repeat the frequency, not the station for the hand-over

## ABNORMAL PROCEDURES

<b>Always</b>		<b>Check CBs first</b> , reset if at all after 3min cooling period <b>Never reset CBs</b> of fuel pumps / quantity indication systems
	MW	Requires immediate crew action
	MC	Requires immediate crew awareness
<b>Worksplrit</b>	PM	Acquisition: "MC/MW, ..."
	PF	"Cancel warning/caution" Fly, navigate, ATC <b>"Check thrust, check performance"</b> "BHI", PM: "BHI completed" "Abnormal CL" Analyse, "Worksplrit: I fly, my ATC, your CL. <b>Check CBs.</b> " (e.g. request "delaying actions")
	< 400ft/AGL	<b>"Check thrust, check performance"</b> (gear, flaps, spoilers) (only MC/MW cancel and flight controls disconnect if stuck/trim runaway)
	≥ 400ft/AGL	<b>BHI, Worksplrit (no BHI &lt; 400ft/AGL or after 4NM final)</b> (non-major EICAS MSG are inhibited v <sub>1</sub> -15 .. 400ft) ACL/ECL only if above 1500ft/AGL, if on APP: G/A if below, except blocked controls / trim runaway
	Wording	PM: " <b>TL confirm</b> ", PF: "L/R TL confirmed" etc. (hand on respective control to have it confirmed, don't make suggestion) ECL: Read, then action: " <b>Pumps off, off</b> " <b>Status reports</b> after checklist work
<b>QRH</b>	Smoke	Baggage smoke, lavatory smoke; <b>smoke evacuation, smoke/fire/fumes</b> (non-annunciated)
	Non-annunciated	No EICAS annunciation: (all items are as well listed in the TOCs of the system-specific chapters) aileron runaway, APU overtemperature, ditching, dual engine failure, emergency descent, emergency evacuation, engine fire / severe damage or separation, engine oil low pressure, forced landing, fuel leak, inadvertent spoiler open, jammed aileron, jammed elevator, jammed rudder, pitch trim inoperative, pitch trim runaway, rapid cabin depressurization, roll trim runaway, smoke evacuation, smoke/fire/fumes; abnormal engine start, abnormal landing gear extension, ADS-B out fail or degraded, aileron artificial feel inoperative, approach warning, asymmetric rudder operation, cabin depressurization, cabin rate abnormal fluctuations, CAS message miscomparison, CDU data bus fail FMS annunciation, cracked windshield, display failure, emergency/parking brake handle disagree, engine abnormal vibration, engine airstart, engine control failure, engine failure/shutdown, engine high oil pressure, engine high oil temperature, engine low oil level, engine oil low pressure, engine overtemperature, engine tailpipe fire, erroneous stall protection actuation, gear lever cannot move up after takeoff, gust lock failure, IC bus failure, IC failure, impaired or cracked windshield, IRS/MSU failure annunciation, loss of engine indications, loss of pressurization indication, main door blocked, NAV/flight instruments failure, one engine inoperative approach and landing, overweight landing, oxygen leakage, partial or gear up landing, pressurization automatic system failure, radio altimeter fail, rudder artificial feel inoperative, rudder runaway, single engine bleed operation in icing conditions, steering system inoperative, stiffened elevator, structural damage, transponder fail, uncommanded aileron disconnection, uncommanded elevator disconnection, uncommanded swerving on ground, unreliable airspeed, volcanic ash, yaw trim runaway

Message Index	Warning - Caution - Advisory
	1 Air conditioning, pneumatics & pressurization
	2 Autopilot, flight instruments & navigation
	3 Auxiliary power unit
	4 Doors
	5 Electrical & lighting
	6 Engine
	7 Fire protection
	8 Flight controls
	9 Fuel
	10 Hydraulics
	11 Ice & rain protection
	12 Landing gear & brakes
	13 Oxygen
	14 Warning system
Performance	Wind, pitch trim, flap speeds, unreliable airspeed, T/O / APP / reference / holding speeds, drift-down tables, LDG distances
Appendix	Emergency evacuation

### Pilot Incapacitation

SOPM 3-05-10 11f

= Failure to respond to a **second request**, or e.g. impairment by gastrointestinal illness or laser strikes. Is always an **emergency**

1. Fly
  2. Restrain (assisted by cabin crew)
  3. ATC: "Mayday x 3, pilot incapacitation"
  4. Cabin crew to assist in CL reading
  5. APP briefing (verbal), consider two-loop briefing with ATC
- With increasing stress level, hearing/attentiveness is impaired  
→ Start a normal dialogue, touch other pilot

### T/O Abortion

SOPM 3-15-05 1ff

#### Beyond 80kts

High energy, only abort with **ENG failure, fire, unflyable condition** (flap retraction, spoilers extension) or **pilot incapacitation**

Do not vacate RWY, except on high speed TWY

Try to turn A/C into WND. Set parking brake

PM: Watch spoilers, "**TWR, ... aborted T/O**

**RWY ... request fire brigade"**

CMD: "**Cabin crew and PAX, keep your seats"**

"GO minded"

Short RWY, low VIS

Cabin call

**Always abort T/O**

### Engine Failure

SOPM 3-15-10

1. **Maintain wings LVL with ailerons,**

2. **add rudder gently until ailerons neutral,**

3. **trim** (remember 3sec trim cutout), use **ISIS**

**Add 10% N1**, pitch remains same

**F22 for OEI LDG**

Always **start APU**, always start **XFEED**

**Neutralize trim before LDG**

PF Handles TL

PM Handles Start/Stop selectors

After  $v_1$

Pilots tend to pull yoke. Make sure that elevator remains down

At 14° ANU

Pitch down to **10° ANU**

**Dual ENG out**

~**1200FPM** ↓. Check HYD page if pumps on

Use F22/F45 for G/S adjustments. **APU start limit: FL300**

**ENG fail on final**

< 4NM: *Consider* continuation and **retract to F22**, add 10kts SPD increment

In general: **G/A**

CL

After bird strike, vibrations, bang/noise, **N1 or N2 zero, ...:**

**"ENG Severe Damage CL". BHI only for fire, severe damage, separation**

<b>COMM Failure</b>	VMC IMC		Squawk 7600, maintain VMC, land asap Squawk 7600, maintain assigned SPD/LVL for <b>7min</b> , then resume FLP
<b>LDG Gear Malfunctions</b>			During gear cycle: Consider leaving gear↓ if down and locked; no retract
<b>Pitch Trim Runaway</b>			Declare EMG, request ALT band and traffic separation Avoid over-use of trim, press DISC button (overheating) Use reduced flap setting for LDG, land w/o flare Try not to change configuration
<b>Both hydraulic Systems inoperative</b>			Use <b>half bank</b> , use asymmetric thrust, use <b>rudder</b> Final APP: Copilot is "verbal autothrottle" Braking: Use parking brake smoothly; do not taxi to stand (request push-back)
<b>TCAS</b>	TA	PF	Look out; hands on yoke
<i>SOPM 3-05-10 3ff</i>		PM	All external lights on, FSTN BELTS on
	RA	PF	<b>A/P off</b> , set thrust. Call out position of intruder If in a turn: <b>Wings LVL</b>
		PM	" <b>TCAS RA</b> " to ATC, when "Clear of conflict": " <b>resuming cleared FL/ALT ...</b> " File report
<b>Unreliable Airspeed</b>		PF	<b>Disengage A/P</b> , switch off FD, do <b>not use SPD brakes</b> Refer to Pitch-Thrust values. Consider GPS GND SPD and ALT Annoying <b>high SPD aural warning</b> (instead of pulling AWU CBs): Consider pulling ADC CB and use ADC reversion
<i>SOPM 3-25 17, QRH NAP-36</i>			
<b>Turbulences</b>			Pitch and roll A/P modes (disengage actual modes) During climb: Maintain thrust, climb faster
<i>SOPM 2-80 1, 3-25 5f</i>			
<b>Windshear Recovery / EGPWS</b>			Any "G/S" or "W/S" callout: " <b>Windshear</b> " (any pilot), <b>G/A</b> <b>A/P off, TL max, G/A button</b> , PF: " <b>Max</b> ", wings LVL, pitch up <b>20° or PLI</b> (remain between FD [stable] and PLI [nervous]) <b>Do not change config</b> (only once terrain cleared and <b>above 1500ft/AGL</b> or after WDSHEAR label disappears) (reasons: Safer with LDG gear down when <b>touching GND</b> ; flaps retraction could lead to a <b>stall</b> ) <b>PM monitors V/S</b> and calls out if A/C is descending In W/S mode: <b>No ASEL ALT</b> will be captured
<i>SOPM 2-83 1, 3-15-05 10f, 3-40 11f</i>		<b>MC</b>	"Positive" W/S. Pilot's decision to continue or to G/A
		<b>MW</b>	"Negative" W/S; downdrafts
<b>Upset Recovery</b>	PF		" <b>Upset</b> "
<i>SOPM 3-25 18f</i>	First		<b>Unload the wings</b> (for aileron effectiveness) (even with AND)
	ANU		First adjust <b>pitch</b> , then <b>wings LVL</b>
			If pitch is too high: Bank to 45..60° until pitch is lower
	AND		First <b>wings LVL, throttle idle, adjust pitch</b>
	High SPD buffeting		Thrust idle. <b>Do not use speed brakes</b>
	Dutch Roll		Use YD. Use <b>ailerons. Do not use rudders</b>
<b>Stall Recovery</b>		PF	" <b>Stall</b> ". <b>Nose down, wings LVL, TL max</b>
<i>SOPM 3-25 20</i>			No trimming below top of white speed arc (1.23v <sub>S</sub> )
	Approaching v <sub>MCA</sub>		Reduce thrust, lower nose, increase thrust

<b>Driftdown</b> <i>SOPM 3-25 6ff</i>	after ENG failure	$v_{FS} \approx v_{DD}$ . NAV reception is not guaranteed <b>ALT hold, max cont thrust, at <math>v_{DD}</math> engage SPD</b>
<b>EMG Descent</b> <i>SOPM 3-25 13ff</i>	after rapid depr	<b>BHI. Fly 5..10NM parallel (turn 30° off to leave AWY)</b> Inform ATC, ASEL to FL100 / MEA. Initiate descent with TCS Squawk 7700, turn on exterior lights "Attention crew, EMG descent" ALT callouts every 10'000ft 4000ft before target FL: Add thrust to decrease rate At target FL: Retract gear ( $v_{LOR}$ 200KIAS) "Attention crew, we have reached safe ALT"
	PACK fail	Immediately EMG descent
	Press problems	Immediately stop climb
	Decompression	- Slow > 1min Whistling sound, may feel ear problems - Rapid Explosive noise, fog, flying objects, - Explosive < 1sec dizziness, pain
	TUC	FL300 <b>1min</b> FL350 <b>30sec</b> FL400 <b>15sec</b>
<b>Overweight LDG</b> <i>SOPM 3-40 17f</i>		ROD max 300FPM
<b>Ditching</b> <i>SOPM 3-40 21ff</i>		Refer to QRH (non-annunciated). Squawk 7700, cabin signs on, ELT on PACKs / BLEEDs out, max available flaps, gear up, reduce onboard fuel Land parallel to waves
<b>Fire / Smoke</b> <i>SOPM 3-10 18f</i>	On GND On final <b>Smoke</b> in cabin	In case of any fire, even if extinguished: <b>EMG EVACUATION</b> Continue, land, EMG EVACUATION <b>Always put on mask</b> (even if not visible in cockpit)
<b>EMG Evacuation</b> <i>SOPM 3-10 20ff</i>	Rapid deboarding	Switch off ENG first "Crew at station" / "EMG evacuation" not via ICU but via <b>PA</b> Using stairways. SOPM 3-05-01 7

## EXPANDED CHECKLIST

<b>INTERNAL SAFETY INSPECTION</b>		<i>Every crew's FFD on a particular A/C</i> <i>Performed by RSP according CL</i>	
	CBs	Also behind seats	
	Electrical	All ON/AUTO except GPU, BATTs, ESS PWR, AVIONICS	
	A/C	RECIRC/GASPER in, PACKs/BLEEDs out (closed)	
	EMG/PKG brake	Push pedals while applying/releasing to avoid fluid transfer	
	<b>ALTN gear ext</b>	NORMAL	
 <b>POWER UP</b>		 <i>Every crew's FFD on a particular A/C or after SHUTDOWN</i> <i>Performed by RSP according CL</i>	
	Electrical	BATTs AUTO, "Aural unit ok" Min temp -20°C. Replace BATT if < <b>19V</b> BATT Voltage for APU start: <b>23.5V</b> If recharging, BATT 1 off before APU start, AUTO after 3min Min recharging time 30min	
	GPU	<b>26..29V</b>	
	Fire detection	2x pushed out. TEST for ≥ <b>2sec</b> : <b>3 MW, 2 MC</b> , BAGG COMP <b>FAN OFF</b> (to repeat: wait ≥ 6sec)	
	APU	Do not start APU before 30sec after energizing airplane (IRS) Do not start APU while refueling <b>Fuel pump 2. Wait 3sec on ON. TC (3min for APU bleed)</b> <b>SHED BUS OVRD</b> (for galley power)	
	Avionics master	Release BACKUP BATT momentarily, check ISIS → <b>IRS</b> : To NAV asap	
 <b>BEFORE START</b>		 <i>Performed by LSP/RSP according areas of responsibility</i>	
	OVHD	EMER LT	ON, then ARM
		PB LT	TEST
		FIRE panel	2x pushed out
		APU FUEL SHUTOFF	Pushed out
		POWERPLANT	Store T/O data (local temperature)
		FLIGHT CONTROLS	4x pushed in
		HYDRAULIC	SHUTOFFs pushed out Pumps AUTO, then OFF Check 2900±200psi and fluid level (do not test if on BATT only)
		PASS SIGNS	FSTN BELTS on after refueling
		ICE PROTECTION	All in/AUTO, except W/S as req (defog)
		A/C	As req, APU BLEED on if available
	Oxy masks	Oxygen mask, regulators, mic (MASK/BOOM), <b>1100/1500psi</b> (crew of 2/3), 1150psi (pax)	
	Glareshield	WX RADAR	TEST (WX on MFD), then STBY
	A/P	Release gust lock, AP, check AP/YD, DISC, set gust lock Modes: <b>ROL - TO</b> , CPL to PF	
	Clock	LSP	Enter flight number, enter date according GMT
	Instruments	Flag free, set ASEL (cleared ALT - 100ft / MSA), x-check ALT, set NAV / CRS / HDG bug (ISIS: Airplane must not be moved 90sec after power-up)	
	MFD	Select <b>WX, NAV, APT</b>	
		SYS	ENG <b>OIL LEVEL</b> Check
		PF	<b>TCAS</b> page
		PM	<b>FUEL</b> page
	RMU	TCAS	Press TEST for <b>5..7sec</b>
		XPDR	Insert call sign



Control pedestal When **IRS aligned** Release gust lock, SPS TEST (ICE/SPS ADVANCED msg)  
 Trims Check 3sec protection  
 TBCH Normal, copying RMU 2  
 Pressurization DEST A/P ELEV, DUMP/AUTO out, manual full down  
 FMS Check NAV DB expiry date  
 Load GPS POS. PF sets route  
**PERF INIT**: CRZ WINDS, ISA DEC,  
 INIT CRZ ALT = AT ALT  
**M&B**: BOM, block fuel, cargo 0, #PAX

PF **PROG** page

PM **FPL** page

RSP **"Before start CL complete down to the line"**

SPD bugs V1 VR V2 AP Bug  
 $V_1$   $V_R$   $V_2$   $V_{AP}$   $v_2+20$  (max)  
 ( $V_{REF45}+5$ )

Briefing LSP Any failure before  $v_1$ , you call it out or point at it.  
 I decide whether to break, TL to idle, reverse.  
 When we stop, you inform the **ATC**. I decide on **evacuation**.  
 Beyond **80kts**: High speed T/O abortion only for  
**ENG failure, fire, pilot incapacitation or unflyable** condition  
 PF After  $v_1$ , we fly SID, **accelerate** at ..., (A/P elevation + 3000ft; climb to  
 MSA), power reductions, WX, terrain/MSA, noise abatement, low VIS,  
 inoperative airplane components, RWY in use / condition, return ALTN  
 A/P, NOTAM, ops procedures

RSP **Pumps, red beacon, safety pins on board**  
**"Before start CL complete"**

LSP **"Starting ENG 2 (1)", RUN for 2sec**

LSP **TC START** Check **10sec N2**↑, **12sec FF**, oil pressure

RSP **TC FF** Check (5 - ) **10sec ITT**↑

LSP **"Normal start", "Set F9, Flight Ctrl Chk, after start CL"**

## AFTER START

RSP **SHED BUS** AUTO

**APU** OFF

**FADEC** RESET/ALTN **650**: Confirm ALTN

Check N1 target remains within  $\pm 0.2\%$

HYDRAULIC **ELEC HYD PUMPS** AUTO

ICE DET OVRD **ENG** (icing conditions only)

A/C ALT T/O **ENG bleed** ~~APU bleed~~ X-bleed AUTO

(E) T/O-1 **ENG bleed** ~~APU bleed~~ X-bleed OPEN

(E) T/O-1, ice **ENG bleed** ~~APU bleed~~ X-bleed AUTO

RSP **"After start CL completed"**

LSP **"Left side clear"**

RSP **"Right side clear"**

LSP Ailerons into wind. **TAXI** LT on, check brakes, check FD

Single engine taxi: Use ENG1 (higher TLA available with gust lock set;  
 steering is on HYD SYS 1)

Ice detection test: 83% N2, OVERRIDE to ALL, TEST to 1, then 2 (min 10sec/  
 max 15sec), check 4 inscriptions, BLD LOW TEMP MC

<b>BEFORE T/O</b>		RSP	Advise <b>cabin crew, lights on, check brake temp, MFD 2xTCAS page, EICAS, TCAS/XPDR TA/RA, gust lock, T/O config</b>
		LSP	During line-up: " <b>Before T/O CL</b> " STROBE LT on, RADAR on (4xSTAB), center HDG bug LDG LT on (with T/O clearance)
		MFD	WX and TERRAIN
<b>T/O</b>			<b>40% N1, brakes release, thrust set</b>
		PF	" <b>Check thrust</b> " - PM: "Thrust checked"
		PM	" <b>80kts</b> " - PF: " <b>Checked</b> "
		PM	" <b>v<sub>1</sub>, rotate, positive rate</b> "
		PF	" <b>Gear up</b> ", <b>trim down to 14° ANU</b> before 160 KIAS use <b>TCS</b> if SPD < v <sub>2</sub> +10 Fly <b>v<sub>2</sub>+20</b> (noise abatement)
	<i>Any failure</i>	LSP	" <b>Reject</b> " / " <b>Go</b> "
	<i>Abortion</i>	LSP	<i>Idle, reversers</i>
		RSP	"60kts", to ATC: " <i>Stopping</i> " [, " <i>Fire</i> "]
		LSP	<i>Decide on further proceeding, inform cabin</i> <i>"Attention crew, wait for instructions"</i>
<b>AFTER T/O</b>	<b>400ft</b>	PF	"Select <b>NAV</b> "
	<b>1000ft</b>	PF	"Engage <b>autopilot</b> "
	<b>1500ft</b>	PF	"Select <b>CLB thrust</b> "
		PM	Check packs
	<b>3000ft</b>	PF	" <b>CLB sequence</b> "
		PM	v <sub>FS</sub> . At v <sub>F0</sub> ( <b>v<sub>2</sub>+15</b> ): FO, " <b>Flaps 0</b> "
		PF	" <b>After T/O CL</b> "
		PM	Do CL silently; APU as required, " <b>After T/O CL completed</b> "
	Trans ALT	PM	" <b>Transition ALT</b> ". ALT set and x-check
	FL100 PM		External lights, cabin signs
<i>ENG Failure after v<sub>1</sub></i> <i>(loss of thrust)</i>		Any	" <b>ENG ... failure</b> "
		PF	" <b>Check thrust</b> " - PM: "Thrust checked"
		PF	Climb at v <sub>2</sub> ( <b>10° ANU</b> ) (use <b>TCS</b> ) Yaw trim until system automatically stops after 3sec (¾dot)
	<b>400ft</b>	PF	" <b>Select HDG, bank, SPD v<sub>2</sub></b> " (full bank protection if ≥ v <sub>2</sub> +10) In case of fire: "Check recall items"
	<b>1000ft</b>	PF	" <b>Select ALT hold, engage autopilot</b> "
	v <sub>F0</sub> (v <sub>2</sub> +15)	PF	" <b>FO</b> " - PM: " <b>FO, v<sub>FS</sub></b> " (SE best ROC clean)
		PF	" <b>Select SPD v<sub>FS</sub>, continuous thrust, bank off,</b> <b>recall items, applicable abnormal CL, after T/O CL</b> "
<b>Climb</b>		PF	Max 240kts / 300kts (above FL100) Reduce ROC (≤ 1500FPM) if cabin Δp reaches 8.1psi
<b>Cruise</b>		PF	CRZ thrust when reaching 300kts / M0.7

**DESCENT**

PF FLC mode. Maintain 310kts with TL. FL110: Idle  
PM Windshield heating on

Briefing

PF **NAV setting, charts, SPD bugs, FMS, fuel**  
(inoperative airplane components, WX, fuel/delays, RWY condition, low VIS, terrain/MSA, descent profile, MAP, taxi in)

SPD bugs

$$\boxed{V1} \quad \boxed{VR} = \boxed{V2} \quad \boxed{AP} = \boxed{Bug}$$

$V_{FS}$                        $V_{REF}$                        $V_{APPCLB}$                        $V_{APP}$                        $V_{APP}$   
( $\approx V_{DD}$ )

$$V_{APP} = V_{REF} + \frac{1}{2}HWND + Gust\Delta$$

SPD increment:	F45	5 .. 15kts
	F22	5 .. 20kts
	Ice/OEI	0 .. 15kts (HWND ≤ 10kts incl)

$$OEI: F22, V_{REF} = V_{REF45} + 10$$

PM Set LDG data, pressurization  
PF **"Descent CL"**

FL100 PM **"10'000"** - PF: "10'000 checked"  
PM External lights on, cabin signs on  
"Attention crew, prepare for LDG"

**APPROACH**

Trans LVL PM **"Transition LVL"**. ALT set and x-check  
PF **"Approach CL"**

Precision APP

RA Set **RA DH to 0** (CAT I) / **DH (CAT II/III)**  
Intercept HDG **APR mode, "F9", 210KIAS**  
PM "LLZ alive", "G/S alive"  
**1dot G/S** PF **"LDG gear down, F22"**  
FAP **"Set G/A HDG and ALT"**  
**"F45, before landing CL"** (latest at 500ft/AGL)  
TL **64% N1**  
1000ft PM "1000" - PF: "Checked"  
**CAT II/III: Check "CAT II" / "AIII" engaged**  
500ft PF "500" - PF: "Checked"  
OM "OM check", ALT / MIN / G/A ALT, "OM check completed"  
**100ft/MIN** PM "Approaching minimums", "Minimums"  
PF "Landing / G/A"

Non-Precision APP

Set **RA DH to 0**  
PM "CDI alive" - PF: "Checked"  
**0.3NM** PF "LDG gear down, F22"  
Select **V/S 0, disarm ASEL** (see below)  
FAF PM "FAF"  
PF **"Set G/A ALT and HDG "** for CDFA (else: ASEL to MDA; SOPM 3-35-10 7f)  
V/S **-700FPM** (max 1500FPM),  
(MDA = VDP = MAPt)  
PM Call-out ALT at every NM  
PF "Landing / G/A"  
ASEL to G/A ALT as soon as visual

Circling APP	Final		LDG <b>gear down, F22</b> (as well for OEI)
	MIN	PF	"Select <b>HDG</b> and <b>ALT hold</b> " Break off: <b>45°</b> for <b>30sec</b> (protected area: 4.2NM; do not break off before)
	Abm LDG thresh		TC, <b>20sec</b>
	Base	PF	" <b>F45</b> , before LDG CL"
	G/A		Initial climbing turn towards landing RWY and overhead A/D Intercept published MAP for <b>APP</b> RWY
Steep APP			<b>Fully configured</b> before capturing glide
	<b>After F45</b>		Push <b>steep APP button</b> , " <b>Steep APP green</b> " (inhibits EGPWS warnings) <b>V<sub>APP</sub> = V<sub>REF</sub></b> A/P off latest at 200ft/AGL (or earlier)
	LCY		Land within first 300m (lamps), G/A otherwise
G/A		PF	" <b>G/A, F9</b> " (if above v <sub>REF</sub> ), <b>G/A button</b> , TL MAX, <b>10° ANU</b>
		PM	" <b>Positive rate</b> ", check thrust (silently)
		PF	" <b>Gear up</b> "
		PM	<b>Select SPD v<sub>FS</sub></b> and advice ATC
		PF	" <b>NAV SRC FMS, select NAV</b> " / "Select HDG"
		<b>v<sub>FS</sub>-5</b>	
	OEI G/A CAT II		<i>Fly v<sub>2</sub> (= v<sub>REF</sub>) / v<sub>APPCLB</sub> to <b>G/A ALT</b></i> <i>Prefer A/P off (late G/A rotation with A/P on)</i>
BEFORE LDG	OEI LDG		<i>Anticipate yaw with rudder</i> <i>Autopilot and XFEED must be off</i> <i>ENG failure on final: Retract to F22, re-brief speeds</i>
	A/P off		Silent item; press TCS to cancel warning
	Flare		Increase pitch by 2°..3° Do not apply brakes prior nose gear touchdown F22: If RWY wet, do not flare, positive T/D, brake early
	<b>60kts</b>		Min reversers
	<b>30kts</b>		Close reversers
AFTER LDG	Vacating		<b>WX radar STBY</b>
		LSP	" <b>After landing sequence</b> " LDG and STROBE LIGHTS off
		RSP	<b>APU, WINDSHIELDS, RADAR</b> stby, <b>XPDR</b> ATC, <b>F0, TRIM 7</b> , gust lock
SHUTDOWN			<i>Performed by LSP/RSP according areas of responsibility</i>
		LSP	TAXI LIGHT off
			PRK brake: Check <b>brake temp</b>
			If amber: Chocks, release PRK brake soon
			ENG BLEEDs close prior engine stop
			ENG min <b>1min idle</b> before shutdown RED BCN off, FSTN BELTS off APU bleed and packs on while APU shutdown APU master off when <b>below 5%</b>
LEAVING THE AIRPLANE			<i>Performed by LSP/RSP according areas of responsibility</i>
		IRS	Off
		A/C	All out except RECIRC/GASPER

## RECALL ITEMS

<b>Baggage Smoke</b>	135BJ	<i>BAGG ACCESS OPN MC</i> <b>Fire Extg Bagg</b> Button	<i>Not displayed on EICAS</i> Push in
<b>Smoke / Fire / Fumes, Smoke Evacuation</b>	135BJ	Crew oxygen <b>masks</b> Smoke goggles Crew <b>communication</b> <i>Recirculation fan</i>	Don, 100% (center pos) Don Establish, <b>also with ATC</b> <i>Push out</i>
Aileron / Rudder Trim Runaway		Quick <b>DISC button</b> <b>AILERON / RUDDER SHUTOFF</b> 1+2 <i>Control attitude manually with control wheels and rudder</i>	Press and hold 1+2 Push out
135BJ: Airplane Overspeed		<i>Airspeed</i>	<i>Max <math>v_{MO}/M_{MO}</math></i>
<b>Emergency Descent</b>	135BJ	Cabin Crew <b>FSTN Belts</b> Thrust Levers <b>Speed Brakes</b> <b>A/S</b> <b>LDG Gear</b> <b>Descent</b> <i>Transponder</i> <b>ALT</b>	<b>"Attention crew, EMG descent"</b> On <b>Idle</b> Open, check MAX 250KIAS ( $v_{LOE}$ ) Down, check Initiate 7700 <b>MEA of 10'000ft</b> if higher <b>"Attention crew, we've reached safe ALT"</b>
<b>Emergency Evacuation</b>	LSP	Parking <b>Brake</b>	Apply
	RSP	Cabin Crew <b>(3)</b> Top OVHD row  <b>(2)</b> Med OVHD row  <b>(1)</b> Bottom OVHD row <b>(1)</b> Cabin	<b>"Attention crew, wait for instr"</b> Fire Extinguishing <b>Handles</b> Pull <b>APU Fuel Shutoff</b> Valve Push ENG/APU Fire Ext <b>Bottles</b> <b>Disch</b> (if req) Fuel <b>Pumps</b> Pwr 1 and 2 Off Hydr Elec <b>Pumps</b> 1 and 2 Off <b>EMERG LT</b> ON
	LSP	Evacuation	<b>Depressurize</b> <b>"EMG, open seat belt, evac"</b>
Jammed Aileron / Elevator		Aileron / elevator <b>DISC</b> handle	Press and pull
Pitch Trim Runaway		Quick <b>DISC button</b>	Press and hold
Rapid Cabin <b>Depressurization</b>		Crew oxygen <b>masks</b> Crew <b>communication</b>	Don, 100% (center pos) Establish, <b>also with ATC</b>
Abnormal ENG Start	To abort	Associated TL START/STOP selector	<b>IDLE</b> <b>STOP</b>
Erroneous Stall Protection Actuation		Quick DISC button Stall Protection Cutout 1+2 Quick DISC button	Press Push out Release
<b>APU Fire</b>		APU fuel <b>SOV</b> APU <b>MASTER</b>	Push in OFF, (TC)
<b>Battery Overtemperature</b>		Affected <b>battery</b>	<b>OFF</b>

<b>ELEC ESS XFR FAIL MW</b>	<b>ESSENTIAL POWER</b>	<b>Push in</b>
ATTCS Failure	Thrust levers	Max
<b>Dual Engine Failure</b>	Oxygen masks	As required
	Fuel Pump Power Tank 1+2	On
	Fuel Pump Sel 1+2	A or B
	APU	START (max FL300)
	A/S for windmilling	Above 10'000ft    MIN 250KIAS Below 10'000ft    220..250KIAS
<b>ENG Fire, severe Damage, Separation</b> <i>(no BHI for ENG failure)</i> <i>(e.g. after bird strike, vibrations, ...)</i>	Associated TL START/STOP selector Fire ext handle <i>Legacy 600: Fuel Fus Tk XFER</i> <i>Legacy 650: Fuel XFER master knob</i> <i>Fuel XFER OVRD button</i>	<b>IDLE</b> <b>STOP</b> (LSP) <b>Pull</b> (do not rotate) (RSP) <i>OFF</i> <i>OFF</i> <i>Pushed in (off)</i>
Inadvertent Spoiler Open	SPEED BRAKE	CLOSE
Steering System inoperative / uncommanded Swerving on GND	Steering handwheel Steering disengage button <i>Use differential brakes / rudder</i>	Do not use Press
<i>135BJ: Stall Protection inoperative</i>	<i>Affected Stall Protection Cutout</i>	<i>Push out</i>
Stick Pusher Failure	Control column	Toward neutral

### 3. ABBREVIATIONS

A/C	Aircraft
A/S	Airspeed
ACOC	Air Cooled Oil Cooler
ADC	Air Data Computer
ADS	Air Data System
AFE	Above Field Elevation
AFM	Airplane Flight Manual
AGL	Above Ground Level
AND	Attitude Nose Down
ANU	Attitude Nose Up
AOM	Airplane Operations Manual
APP	Approach
APU	Auxiliary Power Unit
AR	Authorization Required
ASD	Accelerate-Stop Distance
ATS	Air Turbine Starter
AWU	Aural Warning Unit
BCU	Brake Control Unit
BHI	By-Heart Item (Memory Item)
BIT	Built-In Test
BTC	Bus Tie Contactor
C/S	Callsign
CAS	Calibrated Airspeed
CB	Circuit Breaker
CDFA	Continuous Descent Final Approach
CMC	Central Maintenance Computer
CPAM	Cabin Pressure Acquisition Module
CRS	Course
CVG	Compressor Variable Geometry
DA	Decision Altitude
DAP	Digital Audio Panel
DAU	Data Acquisition Unit
DB	Database
DMA	Daily Meal Allowance
DU	Display Unit
EDL	Electrical Distribution Logic
EDS	Electrical Distribution System
EGPWS	Enhanced Ground Proximity Warning System
EICAS	Engine Indication and Crew Alerting System
ELT	Emergency Locator Transmitter
ESU	Electronic Sequence Unit
FADEC	Full Authority Digital Engine Control
FCOC	Fuel Cooled Oil Cooler
FD	Flight Director
FDC	Flight Data Computer
FFD	First Flight of the Day
FLC	Flight Level Change
FLP	Filed Flight Plan
FMS	Flight Management System
FPM	Feet Per Minute
FPMU	Fuel Pump and Metering Unit
G/A	Go-Around
GCU	Generator Control Unit

GMT	Greenwich Mean Time
GPU	Ground Power Unit
HGS	Head-up Guidance System
HIL	Hold Item List
ICU	Integrated Communication Unit
ICU	Intercommunication Control Unit
INU	Integrated Navigation Unit
ISIS	Integrated Standby Instrument System
L/U	Line-Up
LH	Lefthand
LPU	Low Pressure Unit
LSP	Left Seat Pilot
LVP	Low Visibility Procedures
LVTO	Low Visibility Take-Off (< 400m)
MC	Master Caution
MCDU	Multifunction Control Display Unit (FMS)
MDA	Minimum Descent Altitude
MFD	Multi Function Display
MIC	Microphone
MW	Master Warning
NAV	Navigation
NPA	Non-Precision Approach
OEI	One Engine Inoperative
OVHD	Overhead
PAX	Passenger
PBE	Protective Breathing Equipment
PBN	Performance Based Navigation
PF	Pilot Flying
PFD	Primary Flight Display
PLI	Pitch Limit Indicator
PM	Pilot Monitoring
PMA	Permanent Magnet Alternator
POB	Persons On Board
PSU	Passenger Service Unit
QRH	Quick Reference Handbook
RA	Radio Altimeter
RA	Resolution Advisory
RAIM	Receiver Autonomous Integrity Monitor
RH	Righthand
RMU	Radio Management Unit
RNP	Required Navigation Performance
RSP	Right Seat Pilot
RTF	Radiotelephony
SCV	Starter Control Valve
SOPM	Standard Operating Procedures Manual
SOV	Shut-Off Valve
SPC	Stall Protection Computer
SPS	Stall Protection System
TA	Traffic Advisory
TBCH	Tuning Backup Control Head
TCAS	Traffic Collision Avoidance System
TCS	Touch Control Steering
TL	Thrust Lever
TOC	Table Of Contents
TUC	Time of Useful Consciousness
UFN	Until Further Notice



ULB	Underwater Locator Beacon
V/S	Vertical Speed
W/S	Windshear
WED	Water Equivalent Depth
WOW	Weight On Wheels
WPT	Waypoint
WX	Weather
XPDR	Transponder