

Airbus Notes

Training Notes for A319/320/321 by Eric Parks

Copyright © 1999 - 2024 Eric Parks

Disclaimer: NOT approved by American Airbus A320 Flight Training Dept.

For study only, use at own risk, last update – 06/11/2024

These notes are intended to be used in conjunction with the Operating Manual and Flight Manual. As always, the OM, FM and American Airbus A320 Training Dept are your final authorities.

For corrections, suggestions or comments email: CaptParks28@yahoo.com

Welcome to the Airbus!
Resistance is futile, you will be assimilated.

American Airlines Airbus A319, A320, A321 Notes

Table of Contents

<i>Table of Contents</i> _____	2
<i>Limits</i> _____	5
<i>Systems</i> _____	8
Ice & Rain Protection (ASM 13) _____	8
Electrical (ASM 7) _____	9
Fire Protection (ASM 8) _____	13
Fuel (ASM 11) _____	15
Air Conditioning, Pneumatics and Pressurization (ASM 3) _____	20
Pressurization (ASM 3,2) _____	23
Hydraulics, Brakes & Landing Gear (ASM 12 & 14) _____	25
Flight Controls (ASM 9) _____	30
Instrument / Nav / Comm (ASM 10) _____	38
ECAM _____	38
Oxygen (ASM 16) _____	62
Powerplant (ASM 17) _____	63
APU (ASM 4) _____	65
FMGS (ASM 5.2) _____	66
<i>Pseudo Waypoints</i> _____	71
<i>Initializing the FMGC</i> _____	72
<i>Phase Triggers (ASM table 5.1)</i> _____	78
<i>Reroutes</i> _____	79
<i>Takeoff</i> _____	85
<i>VI Cuts (AOM 6.5)</i> _____	89
<i>FMS Engine Failure Procedures</i> _____	90
<i>ILS Approaches</i> _____	98
<i>LDA Approaches</i> _____	98
<i>PRM Approaches</i> _____	104
<i>VOR/NDB approaches</i> _____	111
<i>Engine-Out Approaches</i> _____	112
<i>Visual Approaches</i> _____	113
<i>Go Around (AOM 11.1)</i> _____	114

American Airlines Airbus A319, A320, A321 Notes

<i>Landing</i> _____	<i>116</i>
<i>Maneuvers</i> _____	<i>118</i>
<i>A to Z Acronyms and Abbreviations</i> _____	<i>125</i>
<i>Legal Stuff</i> _____	<i>130</i>

Note:

AOM is Aircraft Operating Manual, how to operate the A320

ASM is Aircraft Systems Manual, how the systems on the A320 work

FOM is Flight Operations Manual, policies and procedures to be a great AA pilot

American Airlines Airbus A319, A320, A321 Notes

Authors notes:

These notes are not intended to be a comprehensive look at every aspect of the A319/320/321. I only intend them to cover the basics. They assume an already high level of experience with advanced aircraft systems. I hope they help in studying for initial or recurrent or as a quick reference during line operations. They are written from the viewpoint of an American Airlines Line pilot because that is who I was. As of June 2024 I have retired from 37 years of airline flying and you may see me at some small general aviation airport somewhere in the USA.

I have been privileged to get to fly some great airliners over the years and have enjoyed helping others learn how to master the technology. The phrase "Match and Mash" was coined by me to help pilots understand how to work with the Airbus Autothrust. "Levels of Automation" was also created by me to help pilots new to FMC aircraft understand what part of automation they were working on. It is very gratifying to know that these phrases have become industry standards.

Eric Parks

CaptParks28@yahoo.com

Caution!

The information given here is specifically tailored to American A319/320/321 operations. If you fly for another airline or operator your procedures, numbers and/or limits may be different. Always check with your airline's or operator's documentation before using anything here. Be sure you are always compliant with your company's procedures and limits. As I have retired this information will become more out-of-date as time goes on.

Permission is given to distribute or copy these notes under the following conditions:

- Nothing may be charged for the notes
- No changes may be made without express consent of the author
- Authors copyright must be included

Trust in the LORD with all thine heart; and lean not unto thine own understanding. In all thy ways acknowledge him, and he shall direct thy paths. Proverbs 3:5,6

American Airlines Airbus A319, A320, A321 Notes

Limits

(memory items in ***bold italics***)

Weight Limits (AOM 18.2.3)

<i>(in lbs.)</i>	A319	A320	A321 <i>non-Sharklet</i>	A321-IAE <i>Sharklet</i>	A321 NX A321 NA
Max Ramp:	167,330	170,637	205,911	207,014	207,014
Max Takeoff:	166,448	169,755	205,029	206,132	206,132
Max Landing:	137,788	142,198	171,519	171,519	174,606
Max Zero Fuel:	128,970	134,481	162,701	162,701	166,669

Operational / Wind Limits (AOM 18.2.1, 18.2.4)

Max wind for takeoff and landing (inc. gusts):	50 kts.
Max crosswind for Takeoff or Landing:	35 kts.
Max tailwind for takeoff (all A319 & A320/A321 CFM):	15 kts.
Max tailwind for takeoff (A320/A321 IAE engines):	10 kts.
Max tailwind for landing (Sharklet):	15 kts.
Max tailwind for landing (non-Sharklet):	10 kts.
Max operating altitude:	39,000 ft.
Max landing gear extension altitude:	25,000 ft.
Max operating altitude w/ slats and/or flaps extended:	20,000 ft.
<i>Note: use Wind Limitations chart in QRH or AOM for Crosswind Limits in Contaminated Runway, Low Visibility (below 4000 RVR) or Autoland conditions.</i>	

Speed Limits (AOM 18.2.2)

Max operating speed (V _{MO}):	350 KIAS
Max operating speed (M _{MO}):	.82 M (M_{MO})
Max gear extended (V _{LE}):	280 KIAS / .67M
Max gear extension (V _{LO}):	250 KIAS
Max gear retraction (V _{LO}):	220 KIAS
Max windshield wiper operations speed (V _{WW}):	230 KIAS
Max window open speed (who is going to open it?):	200 KIAS
Max tire speed:	195 kts.
Max taxi speed:	30 kts.
Max taxi speed for 90° turn:	10 kts.

Turbulence Penetration – (AOM 18.2.2)	below 20,000 ft.:	at or above 20,000 ft.:
A319/320	250 KIAS	275 KIAS / .76M
A321	270 KIAS	300 KIAS / .76M

American Airlines Airbus A319, A320, A321 Notes

Max Flaps / Slats (V_{FE}) (AOM 18.2.2):

Model	Position:	1	1+F	2	3	FULL
A319/320	V _{FE} KIAS	230	215	200	185	177
A321	V _{FE} KIAS	235	225	215	195	190
A321NA	V _{FE} KIAS	238	225	215	195	186
A321NX	V _{FE} KIAS	243	225	215	195	186

Note: use V_{FE} Next -10 as limit for flap extension

Note: V_{FE} Next is the Amber equals sign on the airspeed scale

Engine Start Crosswind limit: LEAP-1A 45 kts, CFM-56, IAE: 35 kts.

Engine Takeoff Crosswind limit: LEAP-1A 35 kts (gust included)

Ice & Rain Protection (AOM 18.5)

Engine anti-ice must be on during all ground and flight operations when icing conditions exist (and prior to descent into icing conditions) except during climb and cruise when the temperature is:

Icing conditions exist on ground:

below -40° C SAT

OAT 10° C (50° F) or below

Icing conditions exist in flight:

TAT 10° C (50° F) or below

Fuel (AOM 18.14)

(6.676 lbs. per gal.)	A319/A320	A321
Wing tanks:	27,500 lbs	27,500 lbs.
Center tank:	14,500 lbs.	14,500 lbs.
Additional Center tanks:	N/A	10,500 lbs.
Total useable fuel:	42,000 lbs.	52,500 lbs.

Fuel Management

Center tank fuel must be emptied before wing tanks are emptied (unless center tank fuel is being used as ballast)

Takeoff on center tank fuel is prohibited

A321: If center tank is not full, dispatch with more than 200 lbs. fuel in both ACTs is prohibited, unless directed by MEL. (A)

Air Systems (AOM 18.4.1)

Do NOT use external conditioned air simultaneously with the air packs

Except in A321T, do NOT put animals in cargo compartment

American Airlines Airbus A319, A320, A321 Notes

Autopilot / Autoland (AOM 18.6) Autopilot Minimum Height in ft.:

Min altitude after takeoff (if SRS is indicated)	100 ft. AGL
(Note: internal logic prevents autopilot engagement for 5 seconds after liftoff)	
Enroute (A319, A320):	500 ft. AGL
Enroute (A321):	900 ft. AGL
ILS Approach non-autoland (CAT I / CAT II or III in FMA)	160 / 80 ft. AGL
Non-ILS approach	250 AGL
After Manual Go-Around in SRS	100 ft. AGL
Engine Out Autoland:	CATIII Single
Engine Out Autoland: A320 config FULL ONLY, A319 & A321 config 3 and FULL	

Max Winds for Autoland (including gusts) QRH "Blue Pages" & AOM 18.2.4

Headwind A319	20 knots,	15 single engine
Tailwind A319 Non-Sharklet below 5,750' MSL and Config FULL		10 knots
Tailwind A319, all other configurations		5 knots
Crosswind A319 vis \geq 4000, $\frac{3}{4}$	20 knots,	10 single engine
Crosswind A319 vis $<$ 4000, $\frac{3}{4}$	15 knots,	10 single engine
Headwind A320, A321	30 knots,	A321NX 15 knots
Tailwind A320, A321	10 knots	
Crosswind vis \geq 4000, $\frac{3}{4}$, A320, A321	20 knots,	A321NX 10 knots
Crosswind vis $<$ 4000, $\frac{3}{4}$, A320, A321	15 knots,	A321NX 10 knots

RVSM Altimeter tolerances (AOM 18.2.1)

Ground Check: PFD 1 and 2 within plus/minus 75 ft. of known airport altitude
Max difference between PFD 1 and 2 within 20 ft.

In Flight: Max difference between Capt's. and F/O's PFD for RVSM is **200 ft.**

Miscellaneous

Max brake temp for takeoff, fans OFF (AOM 18.15.2)	300° C
Min engine oil for dispatch (AOM 18.10.5)	13 qts

Crew Oxygen Pressure, if Oxygen Pressure is below 1000 PSI consult chart in AOM 18.3.5.

Climb Speeds (not limits but I just wanted to include them here)

Max Angle of Climb: EXPED pb -or- OP CLB and Green Dot

Max Rate of Climb: OP CLB and A319/A320: 260/.76M, A321 280/.76M

American Airlines Airbus A319, A320, A321 Notes

Systems

Note: pb stands for pushbutton (NOT peanut butter!) and there are lots of 'em!

Ice & Rain Protection (ASM 13)

Wing Anti-ice Wing anti-ice heats the three outer wing slat panels on each wing. Wing A-I is available for single-engine (if Engine Fire pb not pushed) by using pack off and crossbleed open as per. Use Wing Anti-Ice when icing is occurring (build up on windshield wiper nut or wing)

Wing A-I valves close automatically:

- On touchdown
- Leak detected
- Electrical power lost

In normal use select Wing Anti-Ice (AOM 15.8.6):

- On after thrust reduction on take-off
- Off at FAF during approach

Engine Anti-ice (AOM 18.5.1, 15.8.4) –

- In flight or on ground at or below 10°C (50°F) with visible moisture/possible ingestion (AOM 18.5.1, 18.5.2). Not required during flight in climb or cruise **below -40° C SAT** (-40°F SAT). Do not use on ground above 10° C.

Engine A-I ducting is independent of wing A-I. Engine A-I valves will open automatically on loss of electrical power. They close automatically with air pressure not available (engine not running). Engine limits are automatically reset when Engine A-I selected. Engine Ignition will come on automatically when Engine Anti-Ice is selected ON with IAE engine aircraft and CFM non-upgraded FADEC aircraft. On CFM aircraft with new upgraded FADEC's the ignition will only come on when FADEC detects certain parameters being exceeded. Use Engine Anti-ice prior to entering icing conditions.

Probe and Mast Heat / Window Heat / Rain Removal

All heat is turned on at low power on ground after the first engine start. In flight all heat automatically goes to High. Can turn on manually on ground before engine start by pressing pb to ON. Deselect to Auto after second engine start.

Note: when on ground a windshield (or window) heat fault may be given due to heating by the sun. Cool the cockpit (or stow shades) and reset the WHC circuit breaker. Rain repellent is inhibited on the ground with engines shut down.

American Airlines Airbus A319, A320, A321 Notes

Electrical (ASM 7)

All normal electrical power shifts automatically except the External Power which must have the EXT PWR pushbutton selected to supply power to the AC bus tie.

The External Power (EXT PWR) pb will show green AVAIL when power is connected and OK. The pilot must press the pb to manually select external. Once pressed the EXT PWR pb will show blue ON indicating that external is now powering the aircraft. When you wish to switch to ships power first ensure that a power source is available, normally the APU. Then press the EXT PWR pb. It will change from blue ON to green AVAIL as the APU (or engines) begin to supply power. Once the external power has been deselected and the green AVAIL is showing in the pb you may disconnect the external power.

New Airbus pilots will sometimes find it hard to remember that the green AVAIL does NOT mean that EXT PWR is powering the aircraft, only that it is available . Blue ON indicates that external is powering the aircraft.

① *Airbus Gotcha:* Just to make things interesting Airbus has used the same pb's for the APU Start pb as the External Power pb. The MASTER SW APU blue ON is the "APU Master Switch" and just indicates the APU is prepared to start. The blue ON for the APU START pb means the APU is actually starting. The green AVAIL in the APU START pb shows that the APU is available for use and power is OK and the APU will automatically pick up the electrical load unless you are on external (remember, EXT PWR requires a manual power shift). So for the APU START green AVAIL can be showing in the pb when powering the aircraft, the opposite of the EXT PWR pb green AVAIL. The point here is that green AVAIL can mean something different on these two pb's. This is just a reminder as the APU panel is not part of the Electrical panel.

Normal priority for AC BUS power is: (work across ELEC panel from GEN 2)

- 1) On-Side (respective) engine generator
- 2) External Power
- 3) APU generator
- 4) Off-Side (opposite) engine generator
- 5) Emergency Generator (RAT)
- 6) Batteries

The only way to power both AC busses from a single power source is through the AC BUS TIE. The APU and EXT PWR both feed the AC BUS TIE. Both AC busses connect to the AC BUS TIE as needed. APU will automatically power AC unless the EXT PWR or ENG GEN is on. If both IDG's are available then the AC busses will not be connected to the AC BUS TIE. If only one ENG GEN (no APU or EXT PWR) is available the opposite AC bus will connect to it through the AC BUS TIE.

American Airlines Airbus A319, A320, A321 Notes

The Electrical system is divided into two main branches. Both AC and DC are normally separated into two branches with Engine 1 driving IDG (integrated drive generator) 1 and IDG 1 feeding AC BUS 1. AC BUS 1 then feeds DC BUS 1 through TR 1 (transformer rectifier). The same happens on side 2.

As long as each engine IDG is available then the two sides remain electrically isolated. If there is a loss of power on an AC bus then the remaining powered bus will automatically power the unpowered AC bus through the AC BUS TIE. If the APU is then started it will automatically power the bus tie and the failed AC bus. The AC BUS TIE will then be isolated from the normal powered bus. IDG should not be disconnected when engine not turning (operating or windmilling) and the IDG disconnect should not be pressed more than 3 seconds. IDG can only be reconnected on the ground.

In case of TR failure the DC busses can be automatically connected through the DC BAT BUS.

Two batteries are installed. Battery charging is automatic and is controlled by the BCL (Battery Charge Limiter). The BCL connects the battery to its respective DC BAT BUS during battery charging and during APU start. The batteries have an automatic cut-off logic to prevent complete battery run-down when the aircraft is unpowered and on the ground. This will shut off the batteries at about 22.5v capacity to ensure APU start after overnight.

Min Battery voltage is 25.5v. During the Electric Power Up Procedure check (AOM 3.2.1) battery voltage with the BAT switch OFF. To charge batteries turn them on by pressing their respective pb's and connecting external power. A 20 min. charge is required if BAT voltage is not enough. If BAT ONLY start APU must be started within 30 minutes of selecting BAT to AUTO.

Part of the normal procedures for the Origination Flow calls for the check of both batteries to make sure that they are charging properly. Turn off each battery and then turn them back on. Watch on the ECAM ELEC page to see that both batteries have initial current charge rates after 10 seconds of less than 60 amps and decreasing.

If all AC (no RAT) is lost a static inverter is connected from HOT BAT 1 bus to AC ESS bus (not SHED bus). BAT 2 will supply DC ESS (not SHED) in the event of loss of all AC (no RAT emerg. gen.) regardless. Below 50 kts. AC ESS will no longer be supplied by the inverter and will be unpowered. DC BAT will connect below 100 kts., it is not supplied above 100 kts. in loss of all AC.

If both Main AC busses lose power and the airspeed is 100 kts. or more the RAT will automatically deploy. The emergency generator will then power AC ESS BUS and DC ESS BUS. During the 8 seconds it takes the RAT to deploy and supply power the batteries will supply the ESS busses (not their shed busses) and the

American Airlines Airbus A319, A320, A321 Notes

red FAULT light on the EMER ELEC PWR panel will be on during those 8 seconds. The RAT emergency generator is lost at landing gear down (unmodified A320) or less than 125 kts (A319, modified A320, A321) and ND1 and MCDU1 will go out at that time due to loss of AC shed bus. On landing the DC BAT bus is automatically connected to the batteries when airspeed drops below 100 kts. When all AC is lost including the RAT emergency generator BAT 1 will supply AC ESS through the static inverter and BAT 2 will supply DC ESS. When the speed drops below 50 kts. the AC ESS bus is shed and power is lost to remaining CRT's (PFD1, ECAM upper). *Note:* min. RAT speed is 140 kts, RAT will stall out at less than 125 kts on A319, A321 and modified A320. However, the RAT will continue to supply hydraulic pressure even after it is unable to power the emergency generator. The RAT is normally deployed automatically for electrical problems, however pressing the MAN ON red guarded pb on the EMER ELEC PWR panel will manually deploy the RAT and hydraulically power the Emergency Generator. If you need to reset the Emergency Generator after the RAT has been deployed (such as go-around after gear has been deployed) press the RAT MAN ON pb again and this will allow the Emergency Gen to reset and come back online.

AC BUS 1 normally supplies power to AC ESS, TR 1 and DC BUS 1 which eventually feeds DC ESS. If AC BUS 1 fails the pilot may press the AC ESS FEED pb to ALTN (in some aircraft this switches automatically). This will put the AC ESS BUS on it's alternate source, GEN 2 through AC BUS 2. AC Essential Feed will automatically switch on some aircraft as installed. ECAM will direct whether to repower AC ESS or to leave it unpowered. AC BUS 2 will then also supply power to DC ESS BUS from the AC ESS BUS through the ESS TRU when on ALTN.

If TR1 fails the DC BAT BUS and DC BUS 1 will become automatically powered by DC BUS 2 which will automatically connect to the DC BAT BUS.

APU will carry all busses on ground but will not supply main galley shed busses in-flight. In-flight if only one generator is supplying the entire system then part (321: all galley power) of the galley load and passenger in-seat power supply is shed.

GEN 1 Line (7.1.9) – If there is smoke in the avionics compartment the amber SMOKE light will come on in the GEN 1 LINE pushbutton. The procedure will call for the pilot to press the pb. This will open the GEN 1 line contactor and depower AC bus 1. GEN 2 will then automatically pick up AC BUS1 through the AC BUS tie. However, GEN 1 will still be powering two wing fuel pumps, one in each wing inner tank. *Note: this is not the complete smoke procedure, just the beginning that deals with the GEN 1 LINE pb.*

In loss of all AC (RAT only) emergency the APU is allowed 3 min. for start after EMERG GEN connects. The APU will not start in-flight when on BAT only (this is

American Airlines Airbus A319, A320, A321 Notes

due to the DC BAT BUS being disconnected during Electrical Emergency configuration above 100 kts). Lights available in loss of all AC emergency are Capt. instrument lights, F/O dome light (if on DIM or BRT) and compass/ice light.

If any generator is operating at more than 100% rated load the GALY & CAB (or GALLEY) pb will illuminate amber FAULT. You will be directed to select OFF which will then load shed by offloading the main galley, secondary galley and the in-seat power supply. In AUTO (normal blank) pb position the main galley (A319 & A320) or all galleys (A321) and inseat power supplies will automatically load shed if in-flight with one generator operating or on the ground with only one engine generator operating. If APU gen or EXT PWR is supplying power then all galleys are powered.

Commercial pb (A321 only) when pushed will depower all commercial electrical systems (Cabin & Cargo lights, Water & Toilet system, Drain mast ice protection, Galley, Passenger entertainment).

Circuit breakers are color coded. Green are monitored by ECAM. All other colors are not monitored. The ECAM will display C/B TRIPPED ON OVHD PNL (or REAR PNL) if a green monitored breaker is tripped for more than a minute. Yellow breakers are pulled during the procedure for flight on battery power only. Red capped breakers are NEVER pulled in flight. Red caps are installed on the wing tip brakes circuit breakers to prevent loss of flap asymmetry protection. All circuit breakers have a letter (horizontal) and number (vertical) code.

When on the gate with normal APU or EXT PWR (AC established) the GEN 1 & 2 amber FAULT lights will normally be the only amber FAULT lights on in the overhead panel (with packs ON). With packs OFF the GEN 1 & 2 amber FAULT and the PACK 1 & 2 amber FAULT lights will be on.

When shutting down the APU and turning off BATs allow 2 min. after APU Green AVAIL light goes out to allow time for APU flap to close (OM 3.16).

Batteries must always be on when APU is running for fire protection.

Ain't no magic when the electrons stop! Bottom line here, ya gotta have electrical somehow! Make sure you have a GEN, EMER GEN or at least a BAT or your sidestick just became a worthless piece of plastic!

American Airlines Airbus A319, A320, A321 Notes

Fire Protection (ASM 8)

Both engines and the APU each have two identical loops, A & B and a computer-FDU (Fire Detection Unit). A fire warning is given when both loops reach the proper overheat condition. If one loop fails the other loop is able to generate the warning by itself. A fire warning is given if both loops fail within 5 seconds of each other. There is a red disc on the aft fuselage to show thermal discharge for the APU fire bottle. The engines each have two extinguishers, the APU one. Engines have sensing elements in three sections; pylon nacelle, engine core and fan section. APU has sensing element in APU compartment.

APU fire on ground will auto shutdown, blow extinguisher bottle, sound nose wheel well horn and APU FIRE light will illuminate on external interphone panel. APU fire in-flight must be manually shutdown (will not auto shutdown) and extinguished. *Note:* APU will auto shutdown in air for other than fire (go figure).

The forward cargo compartment has two smoke detectors and the aft has four (319,320). The 321 has four forward detectors and six detectors in the aft cargo. In either case two loops. Agreement of two smoke detectors on a loop will give warning. If one smoke detector fails the system remains operational on the remaining detector. There is one extinguisher bottle (*Note:* ETOPS aircraft will have two bottles) for fore and aft compartments with one nozzle forward and two nozzles aft. Halon will last about an hour from one bottle. If cargo SMOKE is warning is given an isolation valve will close and the extraction fan will stop. Cargo smoke gives: CRC, Master Warn light and Cargo SMOKE light.

ENG fire test: (7 items – 4 reds) (AOM 3f.1.3)

ENG 1 Test – press and hold

- ENG FIRE pb illuminated (red)
- SQUIB and DISCH lights illuminated (2)
- MASTER WARN illuminated (2) (red)
- CRC aural chime
- ENG 1 FIRE warning on E/WD (red)
- ENGINE page on SD
- FIRE light ENG 1 (on ENG panel) illuminated (red)

Repeat for ENG 2

APU fire test: (BAT only 2 items – 1 red, AC 6 items – 3 red)

APU FIRE Test – press and hold (APU will not shutdown during test if running)

American Airlines Airbus A319, A320, A321 Notes

- APU FIRE pb illuminated (red) *
- SQUIB and DISCH light illuminated *
- MASTER WARN lights illuminated (2) (red)
- CRC aural chime
- APU FIRE warning on E/WD (red)
- APU page on SD

* BAT only (when doing Electrical Power Up procedure on Battery only, no External power)

ENG FIRE pb pressed performs: (work down panel with 2,1,2,1,2 sequence – two on FIRE, one on HYD, two on FUEL, one on ELEC, two on AIR COND)

FIRE -	Silences CRC, Arms squibs	(2)
HYD -	Closes hydraulic fire valve	(1)
FUEL -	Closes low pressure fuel valve and turns off FADEC	(2)
ELEC -	Deactivates the IDG	(1)
AIR COND-	Closes engine bleed & pack flow valves	(2)

APU FIRE pb pressed performs: (work down panel with 3, 0, 2,1,2 sequence)-

FIRE -	Silences CRC, Shuts down APU, Arms squib	(3)
HYD -		(0)
FUEL -	Closes low pressure fuel valve & APU fuel pump off	(2)
ELEC -	Deactivates APU GEN	(1)
AIR COND-	Closes APU bleed & Crossbleed valves	(2)

Cargo Smoke Detector test - press & release button for test. You should get:

- DISCH amber lights illuminate.
- SMOKE red lights illuminate (2X)
- MASTER WARN light illuminate
- CRC aural
- CARGO SMOKE on E/WD

This test will run twice after you select it once to test both channels. *Note:* DISCH amber lights only on first test.

If the CARGO SMOKE bottle is fired the indications you can expect are:

Red SMOKE light remains on (smoke & bottle discharge are trapped)

Both amber DISCH lights will come on and remain on (only one bottle)

American Airlines Airbus A319, A320, A321 Notes

Fuel (ASM 11) Note: Fuel now listed in pounds useable

A321NX only: FWD Additional Center Tank 5175 lbs						
Surge (Vent) tank	Outer wing tank 1550 lbs. (N/A 321)	Inner wing tank 12,200 lbs.	Center tank 14,500 lbs.	Inner wing tank 12,200 lbs.	Outer wing tank 1550 lbs. (N/A 321)	Surge (Vent) tank

A321 only: Aft ACT 1 5175
Aft ACT 2 5175

A319/320:

Total Left Wing Fuel 13,750	Total Center Fuel 14,500 lbs.	Total Right Wing Fuel 13,750
--------------------------------	----------------------------------	---------------------------------

A321:

A321NX only: FWD Additional Center Tank 5175 lbs		
Total Left Wing Fuel 13,711	Total Center Tank Fuel 14,191 lbs.	Total Right Wing Fuel 13,711

A321 only: 2 Aft Additional Center Tanks 10,350 lbs

Total Fuel – A319/320: 42,000* lbs., A321: 52,500* lbs., A321NX: 57,147*

*approximate values at standard fuel densities

Note: some A319 aircraft have slightly different fuel totals. Their total fuel comes to 41,814. Some A321 aircraft have slightly different fuel totals. Their total fuel comes to 51,371

American Airlines Airbus A319, A320, A321 Notes

Fuel Philosophy: Fuel in center last, Center fuel emptied first

Takeoff on center tank prohibited (AOM 18.14.3)

Fuel may not be added to ACT unless center tank is full (A321) except by MEL.

The center tank pumps run at a higher override pressure (A319, A320) so the center tank fuel will be burned before the wing tank fuel will be even though center and wing pumps are both providing fuel pressure to the manifold at the same time.

If both pumps in same tank fail, only the inner wing tanks can suction feed.

Center tank fuel would be unusable if both pumps in Center Tank fail.

APU fuel is drawn from the left fuel manifold. The APU normally uses the tank pump pressure but has its own fuel pump that it will use if no other fuel pump pressure is available.

Losing one center pump requires opening crossfeed valve (one ECAM chime)

Losing one inner tank pump just requires turning off the pump switch (no chime)

Losing two center tank pumps will make any remaining center fuel unusable (no suction feed).

Losing two inner tank pumps will put that wing on gravity (suction) feed. There is a chart to determine safe altitudes for gravity feeding in the QRH .

Normally fuel is run in Auto mode. This will run the wing tanks continuously and the center tank on a schedule. The Auto mode schedule for the center tank is to run the center tank pumps any time there is fuel in the center tank except when the slats are extended. Exceptions to the Auto schedule:

- After engine start the center tanks will run for at least two minutes for a “test run” even if the slats have already been extended. If slats are not extended pumps will continue to run as normal until they are extended. The pumps will restart again after takeoff when the slats are retracted.
- After the center tanks run dry the pumps will continue to run for 5 more mins.
- If IDG return fuel fills the outer wing tank the extra fuel will spill over into the inner wing tank. If the inner wing tank fills completely up then the center tank pump on that side will be automatically turned off to allow wing tank fuel to be burned until 1,100 lbs. has been used. Then the center tank pump will turn on again. This prevents surge tank spillage.

American Airlines Airbus A319, A320, A321 Notes

The fuel in the outer wing tanks will gravity feed through two transfer valve openings when inner wing tank fuel level reaches 1,650 lbs. When either wing inner tank reaches the 1,650 lbs. level a signal is sent to latch open all the transfer valves in both outer wing tanks. This is a total of 4 valves, 2 in each outer wing tank. The transfer valves will remain open for the rest of the flight and will close on the next refuel operation. If fuel is “sloshed” during climb or descent it is possible for the transfer valves to be opened early due to a LO LEVEL alert.

An ECAM caution is given if during Auto mode the center tank has more than 550 lbs. of fuel while the left or right wing tank has less than 11,000 lbs. of fuel per wing. This would indicate that the normal Auto schedule was not being followed.

The Crossfeed pb is normally extinguished when the valve is closed. It will show white ON when selected on and green OPEN when *fully* open. The Crossfeed valve itself is powered by two electric motors. Opening the Crossfeed valve enables one engine to be fed by both sides and/or the center or both engines to be fed by one side and/or the center.

There are two full levels for the inner wing tanks, a fueling full and an operational full. The fueling full is less than the operational full and that allows the extra IDG fuel room to collect in normal circumstances without triggering the center tank pump turn-off for IDG return fuel.

Note: In Auto the center tank pumps run all the time if center tank fuel is present so with all fuel pumps on if you are on the gate with APU running (slats up) you will be using center tank fuel. If operating in Manual mode the crew must ensure that the center tank pumps are off when the wing tanks are completely full or when the center tank is empty.

Note: Unusable fuel is shown with a half amber box around the fuel quantity on ECAM. If the fuel quantity is in a degraded mode the ECAM fuel quantity will have amber dashes through the last two digits. Refuel is shown on upper ECAM memo when refueling door is open.

A321 differences:

The A321 Center Tank does not have the same electric pumps as the A319/320 but uses jet pumps instead. Further, the jet pumps are “powered” by fuel pressure from the fuel pumps in the main wing tanks and the jet pumps transfer fuel from the Center tank to the respective wing tank. The A321 wing tanks do not have an outer and inner tank and there are no transfer valves to latch open. All the wing fuel is in one wing tank and total wing fuel remains the same as the A319/320. Please understand that the pumps in the wing must be running in order to power the center tank jet pumps and transfer fuel.

American Airlines Airbus A319, A320, A321 Notes

The center tanks pump pb's have been replaced on the A321 with transfer valve pb's. Essentially these CTR TK L (R) XFR pb's handle the same function as the center tank pb's on the A319 and A320. In Auto mode they will control the valves that allow the jet pumps to operate once the wing fuel has been burned down 550 lbs. Once the wing fuel tank is again full the transfer will stop until the tank is burned down 550 lbs. again. This will continue until all center fuel has been used. If the FUEL MODE SEL pb is in MAN then the center tank transfer valves will open and must be turned off to avoid overfilling the wing tanks. If in MAN they should also be turned OFF once all center tank fuel is gone.

Note: Some A319 Sharklet aircraft use Center Tank Transfer Valves, not pumps. This is similar to the A321. In these aircraft the fuel is transferred from the Center tank to the Wing Inner tank using jet pumps. All fuel is fed to the engines from the Wing Inner tanks.

Note: A321 IDG return fuel is added to the wing tank as there is no outer tank.

Note: There is no ECAM OUTR TK FUEL XFRD memo on the A321 as there is no outer or inner wing tank (all fuel in one wing tank). However, there is a memo "FOB below 3T" and while rather cryptic I have been able to translate this as Fuel On Board below three Tons (possibly Tonnes?). So you still have a sort of low fuel message at around 6,000 lbs.

The A321 has two Additional Center Tanks that will automatically feed to the Center tank when the Center tank burns down to a certain level defined as when the high tank level sensor is dry for 10 mins. The Additional Center Tanks do not have pumps but use cabin air pressure to feed the center tank through transfer valves. The ACT 2 (aft tank) will transfer fuel first followed by the ACT1. All fuel transfer is done automatically in the normal mode of operation. The automatic fuel transfer from ACT to Center Tank is noted on the ECAM as a green triangle between the ACT fuel indicators.

An additional pb has been added to the FUEL panel to control the ACT fuel transfer. Yes, you guessed it, the normal mode is AUTO (are we seeing a pattern here?). In AUTO mode the ACT pb allows automatic control of the fuel transfer after slat retraction when in-flight. Fuel transfer will begin from the ACT 2 when the center tank is no longer full. Transfer will continue until either the center tank is full or both ACT's are empty. After ACT transfer starts if the center tank becomes full transfer will stop until the center tank burns down sufficiently and the transfer process will automatically restart.

Aft ACT 1 (forward)
Aft ACT 2 (aft)

American Airlines Airbus A319, A320, A321 Notes

An amber FAULT light will illuminate in the ACT pb if the center tank has less than 6,614 lbs. of fuel and one ACT has more than 550 lbs. of fuel which would indicate that the AUTO schedule was not being followed. If the ACT pb is selected to FWD then all ACT fuel will be manually transferred forward to the center tank using the ACT transfer pump, which is a backup pump that can pump from either ACT. This backup ACT XFR pump runs at a low volume and may not be able to transfer all fuel at higher altitudes (FL270 and above) or supply as fast as the engines are burning. The Non-Normal procedures will specify how to complete transfer of fuel in case of ACT transfer FAULT.

It is normal to have fuel being transferred from the ACT's to the Center tank and from the Center tank to the Wing tanks at the same time. On the A321 there's a whole lotta transferring goin' on. Please note that in order to feed an engine from the opposite wing you must still open the fuel crossfeed valve. In normal AUTO operation the fuel procedures are the same and fuel transfer operation is transparent to the pilot.

A321 NX aircraft can have up to 3 ACT tanks as compared to the usual 2 ACT tanks in other A321 aircraft. If equipped with 3 ACT tanks there will be 1 Forward tank and 2 Aft tanks. In this case the FWD ACT tank will transfer first, then the AFT 2 and then AFT 1.

Note: For the A321 all fuel is burned from the Wing tanks. Fuel must be transferred to a Wing tank for it to be available for use by the engines. There is no ECAM CTR TANK FEEDG memo as the A321 never feeds from the Center Tank.

Note: For A321: if center tank is not full then do not takeoff with fuel in an ACT unless MEL directs otherwise (AOM 18.14.3)

Note: For the A321 on the SD FUEL display the left ACT is #1 (forward) and the right ACT is #2 (aft). Gee, why not just display them as fore and aft?

American Airlines Airbus A319, A320, A321 Notes

Air Conditioning, Pneumatics and Pressurization (ASM 3)

The Airbus uses two packs for air conditioning/pressurization which are supplied through two pack flow control valves. Air pressure can be supplied from either/both engine(s), the load compressor on the APU and external high pressure air. In normal operation with both engines supplying pneumatics the system is split into two by the crossbleed valve being closed.

The pneumatic system supplies high pressure air for:

- Air conditioning
- Pressurization
- Engine starting
- Wing anti-icing
- Hydraulic reservoir pressurization
- Aft cargo heat
- Water tank pressurization

High pressure air can be supplied by:

- Engine bleed
- APU load compressor
- High pressure ground connection

Controlled by BMC (Bleed Monitoring Computer)

Engine Bleeds close automatically when BMC's detect:

- A APU bleed valve open
- S Engine Start
- O Over temperature
- L Leak
- O Over pressure

The valve will also automatically close pneumatically when:

- Low pressure
- Reverse flow

And is electrically closed when:

- ENG BLEED selected off
- ENG FIRE pb selected

The APU bleed will close for leaks

American Airlines Airbus A319, A320, A321 Notes

The APU is ready for bleed when reaching 95% for two seconds or 99.5%. The AVAIL light will show in the APU start pb and green APU AVAIL will show on EWD display when APU is available for use.

The crossbleed valve can be operated in automatic or manual mode. There are two electric motors for the valve, one for each mode. In automatic mode the crossbleed valve opens automatically when using APU bleed air. During normal operation the crossbleed is closed to isolate the two engine bleeds.

The crossbleed is manually set OPEN during the engine crossbleed start procedure.

The leak detection system uses a single loop for the pylons and APU to detect hot air temps associated with duct leaks. Dual loops are used for the wings. If both of the dual loops detect a leak a warning is given, unless there is a fault on one, then only one loop is required to give a warning.

If a leak is detected:

- The engine bleed air valve (APU bleed air valve) on that side is closed
- Associated ENG (APU) BLEED FAULT light comes on
- Crossbleed valve closes (except during engine start)
- Left wing leak only – APU bleed air valve closes (except during ENG start)

Packs

Pack Flow Control Valve is air powered and electrically controlled. It will automatically close using a spring with no air pressure. It will also close automatically electrically for pack overheat (on ground only), engine starting or the Fire or Ditching PB selected.

① *Airbus Gotcha:* Do not use external conditioned air when using packs (OM 1.7.2). Unfortunately, there is no cockpit indication of external air connected! You can turn off the cabin fans pb and if air continues to blow from the vents then external air is connected.

Pay attention here, many new Airbus pilots fail to understand the way the Zone Temp system works. If you are familiar with the 737-400 this is very similar. Both packs are feeding all three zones. Whichever zone is commanding the coldest temperature will drive BOTH packs to that temp. Hot air is then added to any other zone that is commanding a higher temp. This hot air is called trim air and is how the zone temp system controls temperatures in three zones with only two packs.

There are three air conditioning zones: Cockpit, FWD Cabin and AFT Cabin.

American Airlines Airbus A319, A320, A321 Notes

The zones are controlled by having the packs deliver all air at the lowest temp requested by any of the three zones. Then hot air is added through the trim air valves to the other two zones as needed to meet temp requirements. A/C zone temp selectors have a range of: Cold 18°C/64°F, 12 o'clock 24°C/76°F, Hot 30°C/86°F

The AC pack can bypass bleed air around the air cycle machine (ACM) if the ACM fails and run the bleed air through the primary heat exchanger directly. This allows the pack to operate as a simple heat exchanger with reduced pack flow.

Pack flow will revert to HI during single pack operation or APU bleed source regardless of selector position.

The Zone controller can override pilot selected pack flow (HI, NORM and LOW) as needed to meet demands. It can also command higher APU speed or engine idle as needed.

One Zone controller with two channels. Failure of the primary channel will result in fixed temperature at 76° F with no optimization. Failure of the secondary as well will result in a fixed temp of 68° F pack 1 and 50° F pack 2.

One Pack controller per pack. Two channels per controller. If primary fails the secondary pack air flow will be fixed at the pre-failure setting. No further optimization is available. Further failure of the secondary will result in a fixed pack outlet temp of 59° F.

Pack controllers also regulate the cooling air flow through the ACM. During takeoff and touchdown the controllers close the ram air inlet flaps to prevent ingesting debris.

Note: The Airbus 319/320/321 can be dispatched with one pack INOP. The MEL may require a limit on max altitude depending on the MEL applied.

When sitting on the gate with AC established (APU or EXT PWR ON) the PACK 1 & 2 amber FAULT lights will be on when the packs are not supplied (no APU bleed or external high pressure air).

RAM air

RAM air is available for cabin ventilation in the event of loss of pressurization or smoke removal. When the RAM AIR pb is selected the RAM air inlet opens.

When pressurization differential is less than 1 psi. the outflow valve will open to 50% to allow exhaust. If above 1 psi. then the outflow will remain normal.

American Airlines Airbus A319, A320, A321 Notes

Pressurization (ASM 3,2)

There are two identical independent pressurization systems. Control is normally fully automatic. Control is swapped automatically between systems after each landing or a control failure. The system has one control panel, two controllers, one outflow valve and two safety valves. The outflow valve has three DC motors: Primary, Backup and Manual. Controllers can operate in automatic, semi-automatic and manual modes.

Automatic: Controller automatically takes the destination field elevation from the aircraft database. The entire pressurization schedule is optimized by the system.

Semi-automatic: If the database is not available for some reason the pilot can select the landing elevation from the LDG ELEV knob by pulling the selector out of the AUTO detent and turning to the needed value.

Manual: Normally, the controllers take turns controlling by swapping after each leg. If the active controller fails the backup automatically takes over. If both automatic systems fail the pilot may control manually by pressing the CABIN PRESS MODE SEL to MAN. The primary and backup outflow valve motors are depowered and the manual motor is activated. Now the pilot can select vertical speed on the cabin using the MAN V/S CTL switch.

Abort mode: If the aircraft returns (stops climbing) after takeoff the system will reset to departure field elevation.

Ditching pb: The Ditching pb will close all exterior openings below the flotation line. This pb is also used during deicing to prevent deicing fluid from entering the aircraft.

① *Airbus Gotcha:* on ground with Ditching pb ON and all doors closed & external low pressure connected a pressurization differential will build.

Note: If the pilot suspects that pressurization is not performing normally but has not yet failed press the MODE SEL pb to MAN for 10 secs. then return to AUTO. This will cause the systems to swap.

Depressurization: When cabin exceeds about 11,000' the cabin may illuminate and Exit and all cabin signs illuminate automatically. Masks will automatically drop at 14,000' cabin altitude.

Note: During a takeoff that requires maximum thrust the APU Bleed is selected ON to provide air conditioning and pressurization during takeoff. This reduces the load on the engines and allows more thrust for takeoff by automatically turning off the engine bleeds. The APU Bleed will provide air for pressurization and air conditioning during takeoff. After takeoff the APU Bleed is selected OFF and the

American Airlines Airbus A319, A320, A321 Notes

engine bleeds will be turned back on automatically. In this case the plane is pressurized and air conditioned during takeoff. If APU Bleed is not available the packs will be turned off manually and then selected back on after thrust reduction (first pack) and flaps up (second pack). In this case the plane is depressurized and does not have air conditioning during takeoff. See AOM Supplementary Procedures for full procedure description.

Ventilation

The avionics are cooled through a system that uses two openings and two electric fans. Conditioned air is also available for backup if needed. Yes, a computer controls the whole thing (sigh). The intake is on the lower left side below the cockpit. A blower fan draws air in and the extract fan on the right side exhausts the air out from a port below the cockpit on the lower right side.

Open configuration: Only for ground operations, both the inlet and outlet vents are open and both fans operate. *Note:* during heavy rain operations on ground select EXTRACT pb to OVRD with both packs operating. This will prevent rain from entering the avionics bay. Return to normal auto operation once airborne (see OM 3.2.5 for parameters).

Closed configuration: In-flight mode and very cold ground operations. Both vents are closed, however both fans run to circulate air past skin heat exchangers that are cooled by low outside skin temperatures. Some air exhausted through cargo underfloor. Also known as the infamous Skin Cooling Config.

Intermediate configuration: Only for use in-flight when warm, same as closed except reduced opening to allow some additional exhaust of cooling air.

Abnormal configuration: Fault is detected in either the BLOWER or EXTRACT fan. Blower fan is off but Extract remains ON. Similar to closed except air conditioned air is added to the circulated air. ECAM will direct configuration.

Smoke configuration: If smoke is detected in avionics both the BLOWER and EXTRACT fan will have amber FAULT lights on and the GEN 1 LINE pb (on EMER ELEC PWR panel) has amber SMOKE illuminated. Selecting BOTH fans to OVRD will cause the blower to stop but the extract to continue operating. Conditioned air is added to attempt to cool and clear the smoke, then exhausted overboard.

American Airlines Airbus A319, A320, A321 Notes

Hydraulics, Brakes & Landing Gear (ASM 12 & 14)

There are three hydraulic systems: Green, Blue and Yellow. All three systems are independent of each other and do not transfer fluid at any time. Each system has its own accumulator. Priority valves ensure proper pressure to critical users when system pressure is low. Normal pressure is 3000 psi and 2500 psi with RAT.

Green system – 1 pump: engine driven. Two power sources: engine 1 pump & PTU

Blue system – 2 pumps: 1 electric and the emergency RAT. Two sources of power: electric pump & RAT pump.

Yellow system – 3 pumps: 1 engine, 1 electric & 1 hand pump. 4 sources of power: engine 2 pump, electric pump, hand pump and PTU.

Green is the “heavy” system with landing gear, flaps/slats, nosewheel steering and Normal Brakes. (nosewheel steering is on Yellow for enhanced aircraft)

Blue is basically for redundancy with the only unique items on it being L & R spoiler 3 and the Emergency Generator which are “backup” items themselves.

Yellow provides the ground service items of parking brake and cargo door and also helps power the flaps. Also, nosewheel steering for enhanced aircraft.

The RAT and Yellow electric pumps do not normally run during flight. The Yellow electric pump will automatically come on when a cargo door is operated. Other Yellow system functions are inhibited when automatically activated by a cargo door. A hand pump is provided on the Yellow system to provide the ability to open cargo doors with no electric power on the aircraft. Blue electric operates all the time in-flight and on the ground when at least one engine is operating.

The RAT hydraulic pump is for emergency use only and will only deploy manually for hydraulic problems. For electrical problems it will deploy automatically above 100 kts. with loss of all AC. *Note:* Min RAT speed is 140 kts. with A319/321 and modified A320 RATs stalling at less than 125 kts. This speed limit is for electrical power and the RAT will continue to supply hydraulic power to much slower speeds.

The PTU (Power Transfer Unit) is able to transfer power but not fluid. It transfers power between the Green and Yellow systems (the two with the engine pumps and heavy consumers). The PTU can transfer power in either direction and is activated when a 500 psi differential is sensed between Green and Yellow. The PTU can also be powered on the ground by the Yellow electric pump to power

American Airlines Airbus A319, A320, A321 Notes

Green hydraulic. Allows Yellow electric pump to power Green on ground (for example to retract slats on ground).

The PTU is inhibited when:

- First engine is being started. This is identified as when the nosewheel steering disconnect pin is in and only one ENG MASTER switch is ON. (PTU operation is tested on second engine start)
- Cargo doors are operated (Yellow electric normally powers cargo doors, this prevents draining low output of electric pump or accidentally powering Green Hydraulic)
- Parking brake is ON and only one ENG MASTER switch is ON
- PTU pb is off

Note: If a cargo door is operated and then the 2nd engine is started within 40 seconds a PTU fault message may be given (due to inhibition during test period).

The engine pumps (Green and Yellow) each have Fire Shut Off Valves that close when the Engine Fire Pushbuttons are selected open.

Brakes

The brakes are carbon, multidiscs actuated by two independent systems, Normal and Alternate. The normal brakes are powered by the Green hydraulic system.

Normal brakes are available when:

- The A/SKID & N/W STRG switch is ON
- Green hydraulic pressure is available
- The parking brake is OFF

A BSCU (Brake and Steering Control Unit) controls all normal braking functions (anti-skid, autobrakes and brake temps.).

Normal brake pressure is 2000 - 2700 psi. w/ full pedal deflection

Anti-skid is deactivated below 20 kts. Anti-skid may or may not be available when on alternate brakes. If antiskid is inop. then alternate brakes use 1000 psi max to prevent blowing tires.

The alternate brakes are powered by the Yellow hydraulic system and will automatically become selected if Green hydraulic is insufficient for normal brakes. Yellow brakes have the same capabilities as normal brakes except for

American Airlines Airbus A319, A320, A321 Notes

autobrake capability. The alternate brakes are essentially a mechanical system. Think - BSCU on: Normal GREEN - BSCU off: Alternate, YELLOW.

Alternate brakes can be used with or without anti-skid. Anti-skid during alternate brakes is inoperative when:

- Electrical power failure
- BSCU failure
- A/SKID & N/W STRG switch turned off
- Brake pressure supplied by Yellow accumulator only

Parking brake disables all other brake modes (319, 320 only). Parking brake is on Yellow system.

A pressure indicator on the instrument panel indicates Yellow accumulator pressure and Yellow left and right brake (parking brake) pressure on three needles.

Accumulators maintain good parking brake pressure for at least 12 hrs. The cargo door operation will restore parking brake (Yellow system) pressure.

Autobrakes are available on Normal Brakes (Green system) only. Hold pb for at least one second. LO mode delays for 4 seconds after touchdown. MED mode delays for 2 seconds. MAX has no delay. Do not use MAX for landing, MAX is takeoff only.

The Green DECE

L light in the auto brake pb's indicates actual deceleration is within 80% of the selected rate (does not indicate that the autobrake is activated).

Autobrakes activate when ground spoilers are extended. On takeoff they are not armed until 72 kts. 2 SEC's are required for Autobrakes.

Brake Fans are installed in the main gear hubs. They will indicate an amber HOT when the brakes are 300° C or more. Brake temps are shown on the ECAM WHEELS page. An arc will appear above the hottest brake temp. If brake temp is above 300° C then the temp will turn amber. The brakes must be cooled below 300° C (brake fans OFF) before takeoff. Pilot must manually select brake fans on.

Note: Delay selecting Brake Fans on taxi in for at least 5 minutes or until just before arrival at gate. This allows the brakes to thermally stabilize. Carbon brakes actually wear better when heated. However, if turn time is short or if brakes will exceed 400° then cool immediately. Do not select brake fans ON when ground personnel are in area of wheel wells. Turn off fans when sufficiently cooled. (AOM 13.1.1)

American Airlines Airbus A319, A320, A321 Notes

RTO Hot Brakes considerations (AOM 6.4.6)

Maintenance action is required if there is:

- 150° C difference in brake temps on the same strut *and* one brake 600° or greater *or* 60° or less
- a mean 200° C difference between different trucks (no crosswind or asymmetric braking)
- fuse plug melted
- brake temp exceeds 900° C (800° C, A321)

If RTO to full stop, release brakes prior to taxi by disarming spoilers.

Note: On taxi-in do not use brake fans unless temps appear likely to exceed 400°. The higher temps help prevent brake oxidation. If temps exceed 400° use brake fans without regard to possible brake oxidation.

Do not set Parking Brake ON in flight.

Landing Gear

The Airbus Landing Gear:

- Has enclosed gear bays
- Is held by mechanical uplocks
- Uses manual extension by gravity
- Has no mechanical or visual check for gear position
- Uses autobraking on the mains during retraction
- Has a brake band in the nose gear well
- Is hydraulically locked out from operation above 260 kts.

The LGCIU controls the Airbus landing gear operation. The SD will show 2 green down triangles on the WHEELS page for each gear down and locked. There are also gear indicators next to gear handle. Any green triangle (at least one out of three possible) for a gear confirms the gear down and locked. One green and two red triangles for a gear still indicates down and locked. Red shows gear in transit and no triangle indicates gear uplocked.

The gear doors will remain down after manual gravity extension.

The gear lights by the gear handle are powered through (hard wired) LGCIU 1, if LGCIU 1 is not powered the lights will not operate.

The gear handle has a red down arrow that will illuminate if gear is up with flaps 3 or FULL below about 700' (landing configuration). ECAM will alert.

American Airlines Airbus A319, A320, A321 Notes

Nose Wheel Steering

Nose Wheel Steering gets inputs from: **Capt. & F/O steering hand wheels** (max deflection is 75°, starts reducing above 20 kts to 0° at 70 kts.), **Rudder pedals** (max deflection is 6°, starts reducing above 40 knots to 0° at 130 kts.), and **Autopilot**. A rudder disconnect is on the hand steering wheel for use during Flight Control Check. A lever on the nose gear deactivates steering to enable towing. A green NW STRG DISC message will show on ECAM and will turn amber on second engine start when towing lever is activated.

Nose wheel steering is enabled with hydraulic pressure when:

- A/SKID & N/W STRG switch on and,
- Towing control lever in normal position and,
- At least one engine operating and,
- Aircraft on ground
- Nose gear doors closed (some aircraft models)

Nose wheel steering is disabled after manual gear extension.

Nose Wheel Steering is powered by either GREEN HYD (Basic Aircraft) or YELLOW HYD (Enhanced and 321NX Aircraft)

American Airlines Airbus A319, A320, A321 Notes

Flight Controls (ASM 9)

Flight Control Laws:

Multiple failures are required to revert from normal law. “Multiple failures of redundant systems”

Normal Flight-

on ground	takeoff	in-flight	landing	on ground
Ground Mode	Flight Mode	Flight Mode	Flare Mode	Ground Mode
Direct	blend from Direct to Normal	Normal	Normal with pitch down added after 50' for flare	Direct

Normal Law: for a given amount of sidestick deflection a given amount of G loading (pitch, elevators) or roll rate (roll, ailerons, spoilers) regardless of airspeed. Pitch trim is automatic. Flare Mode memorizes pitch at 50' and gives slight pitch down at 30' for normal flare feel. Flare Mode is a blend back to direct mode but with limits. Bank past 33° requires constant input or will automatically return to 33°. “Hard” protections. Green equals signs “=”

Normal Law Protections (think of as “A320 mode”):

Bank	Yaw	Pitch	Low Speed	High Speed	Load
Roll rate proportional to side stick deflection 67° Max (at 45° autopilot disconnect)	Turn Coordination & Yaw Dampening	Load Factor proportional to stick deflection Max 30° nose up Max 15° nose down	Non-overrideable AOA protection α Prot Low energy warn. α Floor α Max	Non-overrideable nose up command prevents overspeed at Vmo/Mmo	Clean/Flaps 1 +2.5G/-1.0G Flaps Extended +2.0G/-0.0G

Alternate Law: Flight control reverts to alternate law after multiple failures of redundant systems. Autotrim still available. “Soft” protections (Stabilities). No protection in roll, roll goes to direct. Pitch goes to direct for landing when landing gear extended (no “flare mode”). Can be in Alternate law without speed Stability and/or Yaw Dampening. Aircraft can stall. Amber “X’s”. No Alpha Floor.

Alternate Law Protections (think of as “737-300 mode”):

Bank	Yaw	Pitch	Low Speed	High Speed	Load
Roll Direct No protections	Yaw Dampening	Load Factor proportional to stick deflection No flare mode, goes to direct for landing	Low Speed Stability Overrideable nose down command to prevent stall Stall Warning	High Speed Stability Overrideable nose up command to prevent overspeed	Clean/Flaps 1 +2.5G/-1.0G Flaps Extended +2.0G/-0.0G

American Airlines Airbus A319, A320, A321 Notes

Normal Law Flare Mode: Flare Mode is different on the A321NX from other A320 family aircraft. On most A320 family aircraft the system goes to a direct mode (stick-to-elevator) mode with some limits at 50 ft. The pitch is frozen (THS stops trimming) at 50 ft. and at 30 ft. a nose down pitch of -2° is introduced to give an artificial “feel” for the flare. On the A321NX the transition to Flare Mode is at 100 ft. The A321NX will transition to a direct mode (stick-to-elevator) with no auto trim and some limits. There is no nose down pitch introduced.

Direct Law: Lowest level of flight control law. Proportional movement between sidestick deflection and flight control deflection. No autotrimming. No protections. Overspeed and Stall warnings available. The default mode on the ground in all cases (think about it, if you are on the ground you cannot have a G load or roll rate). This mode is most like a regular airplane (“DC-9 mode”). Amber “USE MAN PITCH TRIM”

Abnormal Law: This is entered by the aircraft being in an extreme unusual attitude (about double normal limits). When back to normal attitude aircraft is in Alternate Law except does not go to direct law on landing and no pitch protections. Computer reverts to Abnormal when it sees the aircraft in unusual attitude because computer logic says aircraft should not have been allowed by normal law protections into this attitude in the first place, therefore computer sees something is wrong.

Mechanical Backup: Pitch through horizontal stab trim, Lateral through rudders, Differential power. Both stab and rudder use cables going to controller and require hydraulic power. Bottom line here, very little “manual reversion” and if no hydraulic power you are a lawn dart. Red “MAN PITCH TRIM ONLY”

Fly-by-wire, no feedback except for rudder and horizontal stab trim

Two ELAC's – Elevator, aileron and stabilizer control

Three SEC's – Spoiler and standby elevator and stabilizer control

Two FAC's – Electrical rudder control (other warning functions also provided)

Two FCDC's (Flight Control Data Concentrators) process information from ELAC's and SEC's and send data to the EIS and CFDS.

Pitch – Controlled by elevators and horizontal stab. Electrically controlled by ELAC or SEC and hydraulically actuated.

Elevator – Each elevator has two hydraulic power sources and two actuators (one active and one in damping mode).

American Airlines Airbus A319, A320, A321 Notes

Elevator priorities: (Note: unless required by Ground School instructor I would not memorize which hydraulic system supplies which flight control, I add it for reference only)

ELAC 2 → ELAC 1 → SEC 2 → SEC 1

Left Elevator – Blue and Green hyd. Right Elevator – Yellow and Blue hyd.

Horizontal Stabilizer – Electrically controlled by one of three motors or mechanically controlled by the pitch trim wheels (through cable) and hydraulically powered by green or yellow hydraulic. After touchdown the stab trim is reset automatically to zero.

Horizontal Stab. Priorities:

ELAC 2 → ELAC 1 → SEC 2 → SEC 1 (same as elevators)

Green and Yellow hyd., 3 electric motors

Roll Control – provided by ailerons and spoilers. Electrically controlled by ELAC (aileron) or SEC (spoiler) and hydraulically actuated.

Ailerons – Each aileron is powered by Green and Blue hyd. and has two actuators (one active and the other damping). The ailerons droop 5° when the flaps are extended. If both ELAC's fail then droop is deactivated and the ailerons streamline and only spoilers are used for roll control. Ailerons are deflected upward on landing for spoiler effect on some aircraft.

Aileron priorities:

ELAC 1 → ELAC 2

Green and Blue hyd.

Spoilers – Five spoilers are installed on each wing. From the wing root to wing tip they are numbered 1 through 5. All are used as ground spoilers. Numbers 2 through 5 (the 4 outboard spoilers) provide roll control. The middle three (2 – 4) provide in-flight speed brakes. If a SEC fails the spoiler(s) it controls is automatically retracted on each wing symmetrically (if extended) and that spoiler(s) deactivated. There is no reversion to other computers.

Spoiler priorities:

Spoilers 1 & 2 - SEC 3, Yellow and Green

Spoilers 3 & 4 - SEC 1, Yellow and Blue

Spoiler 5 - SEC 2, Green

American Airlines Airbus A319, A320, A321 Notes

Speedbrakes and Ground Spoilers

Green SPD BRK memo on ECAM when speedbrakes extended. Flashes amber when thrust is applied with speedbrake extended. On A320 only, half speedbrake extension is available on autopilot, full speedbrake extension is available with autopilot off. When on autopilot moving speedbrake handle past the ½ mark will not extend them further. When off autopilot they will continue to extend past ½ mark to Full.

Speedbrake extension inhibited when (SAFE-T):

S - SEC 1 & 3 fail

A - Angle of Attack protection active (α prot) or ALPHA FLOOR active

F - Flaps at FULL setting (also config 3: A321)

E - Elevator (L or R) fails (spoilers 3 and 4 only)

T - TOGA on thrust levers (OK, really above MCT but you better be in the TOGA detent if you are above MCT!)

If speedbrakes out when inhibited they will automatically retract. Must restow speedbrake handle for 10 seconds to regain. Do not use speedbrakes below 1000' AFE.

If one speedbrake on one wing fails the corresponding one on the other wing will be inhibited for symmetry.

Ground Spoilers are armed by raising the Speed Brake Lever. The speed brake lever does not move with auto extension.

Ground Spoilers extend automatically:

Partial Extension – On landing –

Reverse selected on at least one engine with other at or near idle –and– one main landing gear strut compressed

Full Extension – On landing or on takeoff above 72 kts. (rejected takeoff) –

Both thrust levers at idle (spoilers armed) –or–

Reverse thrust selected on at least one engine with other at idle (spoilers **not** armed) and both mains compressed.

Note: A change to previous configuration is the ailerons will both deflect upward on landing (spoiler extension). This has been applied to aircraft currently in the fleet but I have no info on what models or if it will be done fleet wide. There is no official performance change with this so any benefit from it will not show in American landing data. This is being done with a software change by Airbus.

American Airlines Airbus A319, A320, A321 Notes

Rudder – Rudder controls yaw. FAC 1 & 2 provide electric control through trim motors and hydraulically actuated. Mechanically controlled by rudder pedals if FAC's fail. Rudder deflection is normally limited according to airspeed but during dual FAC failure full rudder deflection is available when the slats extend. Rudder trim is automatic but can be done manually using electric RUD TRIM switch. A rudder trim RESET pb will reset the rudder to 0 trim (not available during autopilot operation).

ELACs sends signals to FACs and FACs compute yaw damper and turn coordinations. No feedback (rudder pedal movement) during yaw damper corrections or turn coordination. The rudder is not computer controlled to the extent of the rest of the flight controls. It is assisted by the ELAC but does not have the level of "fly-by-wire" that the roll and pitch axis do.

FAC – think of a southern Dragnet, "just the FACs y'all"

Y – Yaw functions, normal and alternate yaw

A – Angle of Attack (flight envelope protection - AoA, High and Low speed limits)

W – Windshear

L – Low Energy warning (speed, speed)

α Prot – Alpha Protection, Angle of attack protection speed, top of amber tiger stripe

A – Angle of Attack instead of Load Factor (g's)

S – Speedbrakes retract

A – Autopilot disconnects

P – Pitch trim inhibited

Flaps

The flap handle has a "trigger" that must be squeezed to allow the flaps to move out of detent with balks at 1 and 3 to prevent "overshoot". The flaps will only provide the configurations that are allowed for each detent, there is no "in between the detents" positioning. The flap handle controls both flaps and slats. Controlled by two Slat Flap Control Computers (SFCCs).

Both flaps and slats are powered by two hydraulic systems, flaps by green and yellow and slats by green and blue. If any hydraulic system fails leaving only one hydraulic system powering either slats or flaps the single powered control will extend and retract at half speed. If only one SFCC is functional the flaps and slats will operate at half speed.

American Airlines Airbus A319, A320, A321 Notes

The flaps have 5 selected positions: 0, 1, 2, 3 and FULL.

Takeoff is allowed with 1, 2 or 3

Landing is allowed with 3 or FULL

Note: when landing with Flaps 3 the LDG FLAP 3 pb on the GPWS overhead panel should be selected ON for proper ECAM indication when landing and also CONFIG 3 selected in PERF APPR for proper approach numbers.

The flap position numbers are just that, position numbers, they do not correspond to degrees of flaps (or slats) and in fact each model (the A319, A320 and A321) has slightly different flap deflection schedules for certain flap lever positions. For example, Flaps FULL for the A319 is 40°, A320 is 35°, A321 is 25° and the A321NX 30°. The A321 also has additional slots built into the flaps to provide additional lift at slower speeds. Procedures remain the same for all models except for higher flap speeds on the A321. The flap “indicator” is in the E/WD and shows the amount of extension for both slats and flaps, with three positions for the slats and four positions for the flaps.

Note: On the A321 for Flaps FULL the slats actually extend more than the flaps so that the FULL position actually provides slightly LESS tail strike protection than Flaps 3. In conditions where Flaps 3 is usable it is preferable to use Flaps 3 for additional tail strike protection.

Flaps 0 (zero) is flaps “UP” with all trailing and leading edge flap devices fully stowed.

Flaps 1 is a “hybrid” with two separate configurations for the same Flaps 1 handle position. However, from a pilot standpoint the difference is transparent as the flap handle is treated the same. Flaps 1 position will provide flaps 1+F for takeoff and anytime you are retracting flaps from a higher setting (2, 3 or FULL). Any other time Flaps 1 will provide Flaps 1 (how about that?). OK, so what is the difference between Flaps 1 and Flaps 1+F? Glad you asked, simply this, the trailing edge flaps. The trailing edge flaps make up the +F as Flaps 1 is slats only in the initial position. During Flaps 1+F the slats and flaps will extend to initial positions.

American Airlines Airbus A319, A320, A321 Notes

Now that I have you completely confused, here is the short story:

- Flaps 1 on ground extending for takeoff – Flaps 1+F (slats and flaps)
- Flaps 1 after takeoff during initial flap retraction from Flaps 2 or 3 – Flaps 1+F (slats and flaps)
- Flaps 1 for landing extending from Flaps 0 – Flaps 1 (slats only)
- Flaps 1 for Go Around retracting from 2 or 3– Flaps 1+F (slats and flaps)

As you can see the only time Flaps 1 gives you Flaps 1 (slats only) is on extension for landing, the rest of the time Flaps 1 is Flaps 1+F (slats and flaps). The E/WD will show either Flaps 1 or Flaps 1+F depending on configuration.

Flaps 2, 3 and FULL all have both slats and flaps extended to some degree.

Flaps have overspeed protection at flap setting 1+F so that at 210 KIAS the flaps will automatically retract to Flaps 1 (slats only). Please note on the A321 it is possible at high gross takeoff weights that F speed will exceed the flap speed for 1+F. In this case the flaps will automatically retract and the pilot will select flaps 0 at S speed which will retract the remaining slats.

Slats have an alpha lock function that inhibits them from retracting from position 1 to 0 when at a high angle of attack or low airspeed.

There are 4 Wingtip Brakes (WTB) that will lock the flaps or slats in case of asymmetry, overspeed, runaway or uncommanded movement. WTB's cannot be released in-flight. If flaps are locked out, slats can operate and visa versa.

Note: A change to previous configuration is the ailerons will both deflect upward on landing (spoiler extension). This has been applied to aircraft currently in the fleet but I have no info on what models or if it will be done fleet wide. There is no performance change with this so any benefit it not show in landing data.

American Airlines Airbus A319, A320, A321 Notes

Sidesticks

Perhaps one of the most distinctive and noticeable differences in the Airbus 320 series from other airliners is the sidestick. Most folks get comfortable with the sidestick within minutes. However, the computerized flight controls that the sidestick activate require some new features:

No feedback (feel) is given. Sidestick is spring loaded to neutral.

System algebraically sums the signals from both sticks if both are operated at the same time (dual input). However, the total input is no more than the max input from a single stick.

A red Takeover pb in the sidestick (also serving as autopilot disconnect) allows one pilot to override the other or to disable a damaged sidestick. If priority is taken an audio "PRIORITY LEFT (or RIGHT)" is sounded.

A red arrow light will illuminate in front of the pilot who has been deactivated when one pilot has taken priority over the other. A green CAPT or F/O light will illuminate in front of the pilot with priority if the other sidestick is out of neutral.

Last pilot to press Takeover pb has priority.

Pressing Takeover pb for 40 secs. will latch the priority condition (pilot does not have to continue to press Takeover pb). However, a deactivated sidestick can be reactivated by momentarily pressing the Takeover pb on either sidestick.

Green CAPT and F/O sidestick priority lights will flash during dual input and an audio "DUAL INPUT" will be sounded.

The Takeover pb and dual input warning system are commonly misunderstood. A green light in front of you means dual input or you have just taken priority in a dual input situation and a red arrow means your sidestick has been deactivated. These are two different things. Dual input is almost always unintentional and unwanted. The takeover priority may be something that needs to be done if a sidestick has gone bad or some other problem has occurred. However, if YOUR sidestick is bad the OTHER pilot must latch it out with their Takeover pb.

Sidestick "locks" in place when on autopilot. Pilot action on sidestick (or trim wheel) at any time will disconnect the autopilot.

American Airlines Airbus A319, A320, A321 Notes

Instrument / Nav / Comm (ASM 10)

ECAM

The ECAM (Electronic Centralized Aircraft Monitoring) system is made up of two primary components, two SDAC's (System Data Acquisition Concentrators) and two FWC's (Flight Warning Computers). A loss of only one SDAC or only one FWC will not result in any loss of function. The second computer can handle all functions alone. The SDAC's receive data from sensors and will send signals to 3 DMC's (Display Management Computer) which generate the screen image. The SDAC's also send signals to the FWC. The FWC will generate various warning/caution messages.

The E/WD (Engine/Warning Display) is the display that shows normal engine readings and ECAM messages. The SD (System Display) is directly below the E/WD and normally shows system pages or status. For information on switching screens in case of failures see EFIS later in this section.

ECAM uses color to indicate the importance of the indication—

RED:	Immediate action required
ORANGE (AMBER):	Awareness but no action required
GREEN:	Normal operation
WHITE:	Titles and remarks
BLUE (CYAN):	Actions to be carried out or limitations
PURPLE (MAGENTA):	Special messages (i.e. inhibition messages)

Note: pulsing green or amber indications are approaching limits

If a FWC fails the Master Caution and Master Warning lights will indicate the failure (along with a warning from ECAM) by the upper or lower light in both the Master Caution and Warning light being out. If the #1 FWC fails then the captains upper lights would be out and the F/O's lower lights would be out. If #2 FWC fails the reverse lights will go out.

Loss of both FWC's will result in a loss of most warning capability. The dual failure of the FWC's will result in an amber caution with no aural.

ECAM system pages are controlled through the ECAM control panel. Use the mnemonic FHPED to check systems prior to departure. Work right to left across ECAM control panel. *Note:* Press FUEL, HYD, PRESS, ENG and then press ENG again to return to default DOOR/OXY page

- F FUEL, balance, configuration, quantity
- H HYD, Hydraulics quantity (pointers in boxes)
- P PRESS, Set to AUTO
- E ENG, Engine oil quantity (min. 1 qts.)
- D DOOR/OXY, Doors armed, O2 pressure (note: overwing slides always armed)

American Airlines Airbus A319, A320, A321 Notes

ECAM Procedures:

Upper ECAM (E/WD)	
Primary Failures underlined "ECAM Actions" <u>ELEC DC BUS 1 FAULT</u>	Secondary Failures starred Affected Systems *ELEC
Lower ECAM (SD)	
Procedures	Inop Systems
Status	Status

When an ECAM warning occurs the first pilot noting it should read the title.

Use the "**FIX Strategy**", **F**ly the plane, **I**dentify the problem and procedure, **eX**ecute the procedure and then manage the situation by evaluating and planning your course of action. PF should first call "**My Aircraft**" to ensure aircraft is under positive control. The Captain can assign PF as needed for the situation. The PM will consult the front of the QRH to reference if the procedure is a Quick Action Item or ECAM Exception.

Once all Quick Action Items are accomplished (if any) and the procedure is not an ECAM Exception the PF should call "**ECAM Actions**". The PM should read the full line of ECAM action items. Confirm all major actions before continuing to next (including thrust lever movement, engine master switch, engine fire pb selection, IDG disconnect, IRU mode selection, cargo smoke discharge pb selection) and have the PF guard good control. Repeat response as you complete action. As you complete the items listed in cyan (blue) (think "Blue to Do") they will be automatically cleared from the screen. Continue until you reach the next underlined item. Read through any boxed item. DO NOT CLEAR a boxed item!

Work in a "Z" fashion from upper left, upper right, lower left, lower right.

Appropriate systems page will be shown on lower ECAM (SD) to help identify problem area(s). Please note that the top displayed underlined system will control the lower SD display.

Note: boxed items indicate failure of a primary system that will cause the loss of another system or systems on the aircraft which will be listed as secondary or *starred systems. When reaching the next underlined title or the end of the procedure then proceed with clearing ECAM. Be sure to do ALL applicable blue action items between underlined titles before proceeding.

American Airlines Airbus A319, A320, A321 Notes

If there are too many steps to all be on the screen ECAM will put a green down arrow to indicate that there is screen "overflow". As you complete the items and they are cleared the overflow items will automatically scroll up onto the screen. If there are too many items that can't be cleared then press the CLEAR pb for the next page.

Note: you may not be able to clear all blue items. In some cases ECAM will not have a way to know that you have done an item, such as "contact ATC". Some may not apply such as during Engine Failure ECAM will give a choice of damage or no damage procedures.

When all action items are finished for an underlined item and you are at the end or the next underlined item the PM asks, "Clear ECAM"? PF will reply, "Clear ECAM" if ready to continue. Be sure that no further cyan messages remain for any underlined item that can be eliminated before clearing. Some blue action items the computer cannot get feedback from, and these will remain on the screen. ALWAYS CONFIRM AN ECAM CLEAR. The SD will automatically display the affected underlined system if there are additional failures.

If the problem stops while doing action items some action items may clear or change automatically. For example, if an engine fire goes out while running ECAM you will see the ECAM ENGINE FIRE go away, the red FIRE pb on the FIRE panel and the red FIRE light on the engine panel will go out and the LAND ASAP will change from red to orange. If the ECAM changes you have to start with the QRC or QRH and do the Immediate Action Items and ECAM Exceptions first before doing the new ECAM.

When ECAM is cleared the next procedure will appear (additional primary failures are listed in the "stack" on the right) or if all procedures are done then ECAM will automatically present the first page of the affected systems on the SD. Affected systems (secondary failures) are listed in amber on the top right of the screen with an *asterisk in front of them (*F/CTL). After reviewing the screen you will clear it and the next system screen will be shown. After each screen you should ask and confirm ready to clear the screen. Continue until all amber is cleared and only green memo messages are left.

Example: PM will then review all affected equipment shown in amber on Flight Control side. When done PM will ask, "Clear Flight Control"?

PF will reply, "Clear Flight Control" if ready to continue.

When all the affected system screens have been cleared the status page will come up automatically. If Status or Inop Systems takes up more than one page on ECAM there will be a green down arrow to indicate to "scroll" to the next page. In this case you will clear ECAM to scroll to the rest of the procedure. After using

American Airlines Airbus A319, A320, A321 Notes

clear to see additional Status or INOP Systems pages you can press the STS key to see the first Status or INOP Systems page again.

Status page will contain items such as procedures, limits, etc.

PM will then read all status items line by line. When done the PM will ask "Clear Status"?

The PF will reply, "Clear Status" if ready to finish.

If PF needs to stop ECAM say "Hold ECAM", when ready to continue say "Continue ECAM".

Pilot verbiage during ECAM is Challenge, Response, Response. (OM 9.1.3)

Example: **PM: Green Engine 1 Pump, OFF**, (push off Green Engine 1 pb), **OFF**

Verify is also used in Non-normal checklists. When Verify is used the PF will repeat the response;

PM: Gear, Verify, Down, 3 Green

PF: Down, 3 Green

When operating critical controls that must be confirmed the PM must allow the PF to confirm the action and guard the good controls. Here are the critical controls:

- Thrust Lever movement
- Engine Master switch
- IR rotary selectors
- Any red guarded switch (Engine Fire PB, IDG disconnect, etc.)

Verbiage in this case will be like this:

For Thrust Lever movement only:

PM: Thrust Lever 1 idle, (PF touch but not move thrust lever 1)
-or- **Thrust Lever 1 confirm idle**, (as presented on ECAM or QRH)
PM: Ensure proper control selected, Confirmed
PF: Idle (PF will bring thrust lever 1 to idle)

For all other Confirm items:

PM: Engine 2 Master, OFF, (PM touch but not move Engine Master 2 with hand)
PF: Ensure proper control selected, Confirmed
PM: OFF (PM will bring Engine Master 2 to idle)

American Airlines Airbus A319, A320, A321 Notes

Additional information on ECAM warnings may be obtained from the ECAM Non-Normal Supplemental Manual if time permits.

A red LAND ASAP suggests landing at nearest suitable airport (more severe).
An amber LAND ASAP suggests the pilot should consider the seriousness of the situation and suitability of the airport before landing (less severe).
Landing Distance Procedure – If the procedure directs you to do the landing distance procedure (LDG DIST PROC) then you will use the A320 Landing App on your iPad. Put it into Non-Normal mode before running the app.

Put the resulting VAPP in the MCDU PERF APPR page under the LSK 5L. When using speed increments ALWAYS USE SPEED SELECT on approach. Do not use managed speed when speed increments have been applied. Use the VAPP set in the PERF APPR to remind you what speed to select when on approach.

Please note that this is a reference distance only, if you have autobrake available you should use it!

Note: If ECAM directs to recycle Flaps/Slats – speed select below 200 kts. and select flaps 2

Note: If the Landing Distance Procedure is listed on ECAM after it warns of flying in icing conditions you only have to do the procedure if you have ice accretion. Don't waste your time doing this procedure unless you have to!

ECAM action should not be taken (except to cancel audio warning through the MASTER WARN light) until:

- The flight path is stabilized and
- The aircraft is higher than 1,000 AFE

Note: Routine ECAM messages may occur due to normal operations and may be read, verbally acknowledged and cleared. The following are considered routine ECAM messages when they occur during the specified conditions:

<i>ECAM</i>	<i>conditions when routine</i>
<u>DOORS</u> CABIN/CARGO	Upon gate arrival
<u>BRAKES</u> HOT	After engine shutdown, brakes 400° C or less (see QRH for temps above 400° C)

American Airlines Airbus A319, A320, A321 Notes

Quick Action Items

Any actions the pilot should take without hesitation are listed in the QRC (Quick Reference Card) Quick Action Index (or QRH cover). All Quick Action and ECAM Exceptions checklists are included on the QRC and are numbered for quick reference. They are also listed on the front cover of the QRH. Find the number of the procedure and locate it on the QRC. Think of Quick Action Items as replacing your old "Memory Items".

ECAM Exceptions

There are times that ECAM may direct the pilot to do a procedure that is not the best procedure to do. In these cases the pilot will not follow the ECAM on the screen and will instead use the ECAM Exception Index to accomplish the checklist.

Examples are if an ECAM directs to turn off the last available source of hydraulic power (no power to any flight controls is a bad thing in any circumstance) or opening the fuel X-feed for fuel imbalance when in fact you have a major fuel leak. As always Captain, it is your aircraft and you have the final decision. Exercise your emergency authority as needed (but always with discretion!).

The front of the QRC lists the ECAM Exceptions Index and the PM will consult these before running any procedures for ECAMS. You will be directed to alternate procedures in the QRH listed as EE procedures (these are also listed on the front cover of the QRH) on the EE pages. Of course there are other possible situations and combinations of events that can be thought of. Currently there are five items listed that you should do according to the QRC before attempting to follow the ECAM. Think of ECAM Exceptions as being procedures where ECAM might not be "smart" enough to keep you out of trouble.

ECAM Methodolgy

1. PF - Maintain Aircraft Control "My Aircraft"
2. Identify the Non-normal, PM - Cancels the Warning or Caution, if applicable
3. PM - Determine if Quick Action or ECAM Exception
4. PM - Accomplish Quick Action Items, if applicable
5. Captain - Assigns PF
6. PM - Accomplish ECAM Non-normal procedure
7. PM - Accomplish ECAM Follow-Up procedures, if applicable

American Airlines Airbus A319, A320, A321 Notes

EFIS (ASM 10.x)

A white diagonal line across the display means that the DMC (Display Management Computer) has failed. The CRT itself is still working. Just switch to the standby DMC on the switching panel to restore the displays as normal.

A failure of the DU Display Unit (display blank) means that you will have to swap screens to view all information. The PFD has priority over the ND and the EW/D has priority over the SD. This means that if the PFD display fails then the PFD will automatically display on the ND display screen. However, if the ND fails the PFD will remain on its normal screen. If you wish to view the ND you can press the PFD/ND XFR switch. In the same way the EW/D has priority over the SD. If the SD needs to be displayed use the ECAM/ND XFR switch on the switching panel to bring that screen up on the CAPT or F/O ND as selected. A failure of both the ECAM screens (EW/D and SD) will require use of the ECAM/ND XFR switch on the switching panel to view the EW/D screen on the ND display and by pressing the required system pb on the ECAM Control Panel you can view the SD info on the ND as needed.

The ND has two brightness controls, outer and inner bezel control knobs. The outer ND bezel controls brightness of the radar and terrain on the ND. The inner knob controls the brightness of all the other normal ND display symbols. Note that if the PFD/ND XFR button is used the outer bezel is disabled and only the inner knob is available for brightness control.

STS in a white box will show on the bottom of the EW/D if there are any systems downgraded to remind the crew of any status information. If there is a system advisory message when the SD has failed the EW/D will flash a white ADV at the bottom of the screen to notify the crew to select the SD for viewing.

The current airspeed is indicated by a fixed yellow reference line. A yellow speed trend arrow will appear from the speed reference line to indicate the anticipated airspeed in 10 seconds.

Green Dot is a (gasp!) green dot on the speed scale and is available only when aircraft is clean (flaps 0). It shows best lift over drag speed (L/D) and is also called V_{FTO} (Final Takeoff speed). Green dot is used during normal takeoff and the engine-out maneuver and gives best angle of climb speed.

On the altitude scale the Landing Elevation is a blue line and is based on barometric information. The Landing Elevation is available only in QNH (below 18,000') and on approach.

Ground Reference display on the altitude scale is a red ribbon and is based on radar altimeter information. Radar altimeter readout comes on screen in green below 2500' AGL and goes amber (if DH is entered) when 100' above DH (CAT

American Airlines Airbus A319, A320, A321 Notes

II/III). If an MDA has been entered the altitude (note: this is the normal altitude readout, not the radar altimeter readout) will turn amber below the MDA (CAT I / RNAV).

Magenta means managed and Blue means selected. For example if the commanded speed is by pilot action (speed select) the speed target index (speed pointer) will be blue. If the commanded speed is controlled by the FMGC (speed engage) the speed pointer will be magenta.

When a new altitude is selected the new target altitude will appear above (during climb) or below (during descent) the altitude scale. The new target altitude will move onto the scale once it is within the altitude scale range (about 600').

Takeoff Warning (AOM 10.1.9)

- Hot Brakes
 - Pitch/Rudder Trim
 - Slats/Flaps
 - Speed Brakes
 - Sidestick Fault
 - Door Not Closed
 - ELEC, 2 generators not powered
 - FUEL low pressure
 - ENG oil low temp
 - HYD low pressure
- the following are only triggered when takeoff power is set*
- Parking Brake On
 - Flex Temp Not Set (not displayed if thrust levers set in TOGA detent)

Altitude Alert

Altitude alert (tone and pulsing yellow altitude windows) is inhibited when:

- Slats are out and landing gear selected down
- Landing gear locked down
- Captured on glide slope

The tone is also inhibited when on autopilot and capturing a normal set target altitude, but pulsing yellow window is still effective.

Windshear prediction and detection

Windshear prediction is radar based and is available below 1500' AGL. It looks out to 5 nm ahead of aircraft. A warning message reading WINDSHEAR AHEAD will appear on PFD and ND. Color of the warning will be red or amber depending on level of warning. Levels include Advisory (display only) and the Warning and Caution messages have an aural warning alert as well. Predictive warnings are

American Airlines Airbus A319, A320, A321 Notes

inhibited during takeoff after 100 kts. until 50' AGL and then again inhibited on landing once below 50' AGL. Windshear prediction uses the normal weather radar and there is only one radar installed. If the normal radar is turned off the windshear prediction will still operate normally if set to Auto. Prediction means that a possible windshear is ahead of you. Predictive windshear will not warn for CAT (Clear Air Turbulence), system must have precipitation to work.

Note: Predictive windshear is inhibited during takeoff after 100 kts up to 50'!

Reactive Windshear detection is controlled by the FAC's and is based on GNADIRS information. Windshear detection means that you are IN a windshear. Windshear detection (when slats/flaps selected) is available 5 seconds after takeoff until 1300' AGL and is again available on landing from 1300' AGL until 50' AGL.

A red WINDSHEAR warning is shown on the PFD and an aural WINDSHEAR alert is given three times during windshear detection.

Note: Windshear detection is NOT available until 5 secs. after takeoff!

American Airlines Airbus A319, A320, A321 Notes

GNADIRS

The Global Navigation Air Data Inertial Reference System (say that five times fast!) provides the FMGS with the data input it needs to navigate the aircraft. The FMGC decides which signals are most accurate and provide a “synthetic” (best guess) aircraft position after weighing all available data. The FMGC can also estimate the accuracy of its synthetic position due to available sensors and data. This information will be used during RNAV approaches. The IRU’s have laser ring gyros that provide a stable reference signal as well as provide attitude information. Be very careful NOT to just turn off the IRU because it gives a bad nav signal. It may still be giving good attitude information and can be selected to attitude information only (ATT). The FMGC can track IR drift and predict aircraft position even when GPS or ground based (VOR/DME) signals are lost.

GNADIRS also provides the aircraft with needed air data information such as altitude, mach, temperatures, airspeed, etc. Failure of an associated air data reference DOES NOT fail the IR! The failed ADR can be turned off by deselecting its pb and still maintain all IR and GPS functions.

There are two independent GPS receivers called MMR’s (Multi Mode Receiver). The MMR’s process position data and send it to the GNADIRU’s. MMR1 sends data to ADIRU1 and MMR2 sends data to ADIRU2. Both MMR’s can send data to ADIRU 3 as needed for backup purposes if ADIRU 1 or 2 fail.

The system is very accurate and reliable with a high degree of redundancy using three ADIRU units and multiple navigation signal inputs from GPS and IR. The FMGC also takes VOR/DME signals (OM 13.3.1, 17.3.1) into account along with the GNADIRS data to compute aircraft position. The third GNADIR is basically a standby that can be selected if #1 or #2 fail.

Amber FAULT light:

- Steady, IR lost
- Flashing, may be available in ATT only, NAV lost

White ALIGN light:

- Steady, in align mode (normal)
- Flashing
 - align fault
 - No entry in 10 mins.
 - 1° difference in lat. & long. from shutdown position
- Extinguished, alignment is complete (normal)

Note: DO NOT move aircraft during alignment. Wait 3 minutes after aircraft stop to re-align or turn off

American Airlines Airbus A319, A320, A321 Notes

EGPWS

Enhanced GPWS provides all normal aural GPWS functions as well as the enhanced terrain avoidance features. The enhanced function is database (computer) driven but it is shown in a radar format. Please note that the radar is NOT being used for terrain detection but the DISPLAY will override the weather radar image display when the terrain on ND pb (TERR ON ND) is selected. If the TERR ON ND pb is not selected and a warning is generated the terrain display will come on automatically and override weather radar display. The Terrain “sweep” is a distinctive middle to the sides to make it obviously different from the normal radar. The enhanced terrain feature can be shut off using the TERR pb on the overhead without losing any of the normal GPWS functions.

Standby Nav, remote tuning

When normal radio navigation is not available you can use the backup nav mode, Standby Nav (STBY NAV), also known as remote tuning. Select Rose VOR for the ND. Press the guarded NAV button on the RMP and the green light will come on indicating that you are now using Standby Nav. To use VOR nav press the VOR button. Then tune the VOR frequency with the normal selector knob in the STBY/CRS window. Press to transfer the freq to active and now you can select the course on the STBY/CRS window using the inner knob of the selector. All autotuning is disabled during Standby Nav. Number 1 VOR will be displayed on Capt's. ND in Rose VOR. Number 2 VOR will be displayed on F/O's ND in Rose VOR.

To tune an ILS first select Rose LS on the ND. Then press the LS button on the FCU. Then press the guarded NAV button on the RMP. Then press the LS button in the STBY NAV area of the RMP. Now tune the ILS frequency by using the normal RMP selector to tune the freq. in the STBY/CRS window. Then press the transfer button to make the frequency active. Now you can select the ILS course using the inner knob of the selector. Number 1 ILS will be displayed on Capt's. PFD when in LS and F/O's ND when on Rose LS. Number 2 ILS will be displayed on F/O's PFD when on LS and Capt's. PFD when on Rose LS

Note: the ILS STBY NAV will display onside tuning on the PFD and offside tuning on the ND. This allows comparison of the signals during approach.

Note: If the STBY NAV is being used during the electrical emergency configuration only RMP 1 has power.

RADNAV Nav, manual tuning: Select the RADNAV key on the MCDU. Enter the VOR ident on LSK 1R or 1L and the course on LSK 2R or 2L. Select VOR Rose for the ND. To manually tune an ILS use the same technique by putting the ILS ident on LSK 3L and ILS course on 4L then select ILS Rose for the ND. Press the LS pb to see DME on PFD.

American Airlines Airbus A319, A320, A321 Notes

Note: when ROSE VOR is selected with a VOR manually tuned the CAPT ND will show VOR1 and F/O ND will show VOR2. However, when ROSE LS is selected with an ILS manually selected the CAPT ND will show ILS2 and the F/O ND will show ILS1.

Communications: Comms are monitored by ECAM for “stuck mike”. All RMP’s will tune any radio. ACP’s may be switched in case of failure using Audio Switching panel on overhead.

American Airlines Airbus A319, A320, A321 Notes

Tune, Talk, Listen – RMP and ACP

When you come to a railroad crossing you should Stop, Look, Listen but when using the Airbus RMP and ACP you should Tune, Talk, Listen. The Airbus has a very flexible setup for tuning radios but it takes a little getting used to. First of all any RMP (Radio Management Panel) can tune any radio in the aircraft. This means that if you lose two RMP's you can still tune any radio with the third RMP. While this redundancy is great you have to be able to keep track of it all!

Further the ACP (Audio Control Panel) allows the pilot to transmit or listen on any radio or interphone. Again there are three installed.

The pilots will have their own RMP and ACP on the center pedestal on their side with the third "standby" on the overhead. For the pilots the RMP is mounted above the ACP. Fortunately Airbus helped us out a little bit by lining up all the functions for each radio in a "stack". The table below is greatly simplified to show you the "stack" for each radio and includes controls on both the RMP and ACP.

VHF 1	VHF 2	VHF 3
Tune	Tune	Tune
Talk	Talk	Talk
Listen	Listen	Listen

When using the RMP or ACP you must realize that every control is independent. For example you can tune on VHF 2 while listening on VHF 1 while transmitting on VHF 3. On the RMP a green triangle light will indicate which radio is being tuned and on the ACP a triple bar green light will indicate which radio is set to transmit. On the RMP only one radio may be tuned at a time, selecting VHF 1 for tuning will deselect the prior selection. The ACP transmit is the same way, only one radio may be selected for transmit from that ACP at one time.

On the ACP the pilot will select "up" or "out" the radios or interphones to listen to. You may select as many as you wish and set independent volume control on each. Please note that you must select out a radio to listen to even if you have pressed to tune or talk on it, the audio is NOT automatically selected when you use the RMP.

Note: ACARS is set on RMP 3 (standby on overhead) and VHF 3 and ACARS cannot be set to use any other radio.

American Airlines Airbus A319, A320, A321 Notes

Auto Flight System “Levels of Automation”

First, a little general autoflight theory! The Airbus has four layers or levels of control or automation if you wish to call it that. The first or lowest level is manual control. This would be the pilot controlling through the sidestick and the thrust levers.

Level 1 - “Manual”

Pilot	
Flight Controls	Thrust

In this case the pilot is controlling any flight control movement by use of the sidestick, which sends its signals through the appropriate computers to the hydraulic actuators and finally the flight control itself. The pilot can command any flight control movement that stays within Flight Control Normal Law. The same holds true for thrust. The pilot can manually control the thrust levers to command any thrust level that stays within the normal engine operating parameters. This is hand flying as you have always done. Do not confuse the flight control computers (i.e. ELAC, SEC and FAC) with the flight management guidance computers (FMGC).

Level 2 – “Manual with or without Flight Director or Autothrust”

Pilot	
Flight Director	Autothrust
Flight Controls	Thrust

In this example the pilot maintains manual control of the flight control but is being guided by the flight director. The flight director (F/D) may be getting its cues from the FMGC or from the settings on the FCU.

The next level of control is autoflight. This is when the autopilot and autothrust are engaged. In this case the pilot is controlling the aircraft through the settings on the FCU for the autopilot and the thrust levers. The pilot is telling the autopilot and autothrust directly what is wanted. For example, if a heading of 90 is required the pilot just sets a heading of 90 in the FCU and the autopilot holds that heading. If the pilot wants a climb of 1000 fpm then the pilot sets 1000 fpm in the FCU.

Level 3 - “Autoflight”

Pilot	
Flight Director	
Autopilot	Autothrust
Flight Controls	Thrust

American Airlines Airbus A319, A320, A321 Notes

This level is basically the same as any other aircraft you have flown with autopilot and autothrust. The autopilot and autothrust are controlling through the same flight control system that the pilot uses when hand flying.

The final and most sophisticated level is computer guided. In this case the pilot enters the desired settings in the FMGC and the computer calculates the proper flight path and track. The FMGC then commands the autopilot and autothrust to properly maintain the computed track and path. If the pilot wishes to make changes or revisions to the flight plan then it is done to the FMGC which then recalculates the needed information. For example, if the pilot wishes to change the flight plan route to go direct to a new fix, the new fix is typed into the MCDU and entered into the DIR page. The FMGC now computes the new course and commands the autopilot to turn to the new heading.

Level 4 - "Computer Guided"

Pilot	
FMGC	
Flight Director	
Autopilot	Autothrust
Flight Controls	Thrust

Each higher level uses all the previous levels. In other words computer guided flight is also using the autoflight and manual levels. The pilot can always "drop down" from one level to a lower level by disengaging the appropriate equipment. For example, the pilot may be climbing under computer control in Managed Climb. By selecting a vertical speed of 1500 fpm on the FCU the pilot has now put the vertical path in autopilot control. The FMGC is not controlling the climb rate. If the pilot then disengages the autopilot the aircraft is now under manual control and the pilot is now manually controlling the climb rate.

Two things that should be pointed out. You can have various levels of control at one time. For example, the track may be computer guided by the FMGC while the vertical path is under autopilot control. Another example is when the pilot is hand flying but using autothrust (which is very common). In this case the flight controls are in manual but the thrust is in autoflight. The other thing to point out is that when hand flying the pilot may use the Flight Director so that while the aircraft is under manual control the pilot is still getting autoflight or computer guided assistance.

Autopilot

There are two autopilots installed. Normally you will only use one autopilot at a time (Capt. using A/P 1 and F/O using A/P 2). However, for every ILS approach you will engage both autopilots (except, of course, when the second is inop.).

American Airlines Airbus A319, A320, A321 Notes

The autopilot can be controlled either directly from the FCU (Flight Control Unit) or through the MCDU and the FMGC. In both cases you must monitor engagement status on the FMA. The FCU has four places to make inputs, Speed, Heading/NAV, Altitude and Altitude Hold/Vertical Speed. In each case the knob for the selection can be pressed or pulled. Pressing the knob will tell the autopilot to use the FMGC for guidance. Pulling the knob will tell the autopilot to use a pilot selected value. Think PRESS to GIVE control to FMGC and PULL to TAKE control for pilot.

When the autopilot control is engaged (push) on the FMGC for a setting a white dot will appear on the LCD readout for that setting. If the autopilot control is selected (pull) to a pilot set value the pilot value will appear in the LCD readout. Always confirm settings on the FMA at the top of the PFD.

Speed: Pull to select to KIAS or Mach by pilot, dial to needed speed. Press to engage in Managed speed mode in FMGC

Heading: Pilot can dial to set desired heading then pull to select HDG mode. Pressing HDG knob will engage Managed NAV and allow autopilot to track FMGC route.

Altitude: Value set by pilot, pulling will allow open climb/descent (full power climb, idle descent), pressing will engage to allow Managed climb/descent on FMGC

Altitude Hold/Vertical Speed: Pulling knob will select vertical speed mode. Dial knob to select amount of climb or descent in hundreds of feet per minute. Pressing knob will engage an immediate level off in altitude hold.

For Example (OM 2.9.11):

“Speed 170” – pilot selects new speed of 170

“Managed Speed” – speed controlled by FMGC, known as managed speed.

“Heading 280” – pilot selects new heading of 280.

“Nav” – track controlled by FMGC route

American Airlines Airbus A319, A320, A321 Notes

Autopilot	“Autopilot Off” or “Autopilot 1 (2)”
Flight Directors	“Flight Directors Off” or “Flight Directors On”
Speed	“Speed _____” or “Managed Speed”
Heading/Nav	“Heading _____” or “Nav”
Open/Managed Climb (Descent)	“Open Climb (Descent)” or “Managed Climb (Descent)”
Vertical Speed	“Vertical Speed Plus (Minus)_____” or “Vertical Speed Zero”

- Select is always knob pulled to you (pilot is “taking” the control of the autopilot). When using select if you are changing the amount from what is in the window then say amount after naming control.
- Managed (Hold) is always knob pushed away from you (pilot is “giving” control of autopilot to FMGC).

Memory and Non-memory autopilot limits (AOM 18.6.1)

After Takeoff (if SRS indicated)	100’ AGL
Enroute	500’ AGL (321: 900’)
Non-ILS Approach	250’ AGL
CAT 1 ILS Approach (no autoland, CAT 1 in FMA)	160’ AGL
CAT 2,3 ILS (no Autoland, CAT 2 or 3 in FMA)	80’ AGL
ILS Autoland	Touchdown
After a manual go-around in SRS mode	100’ AGL

American Airlines Airbus A319, A320, A321 Notes

Autothrust

The big picture on Airbus autothrust; During ground operations handle the thrust levers as on a “normal” aircraft. At takeoff push the thrust levers up to 50% on N1 or 1.05 EPR until both engines stabilize, then push the thrust levers up to FLX/MCT (two clicks) or TOGA (three clicks). When LVR CLB flashes (normally about 1000') on the FMA reduce the thrust lever back to CL (one or two clicks). The thrust will now be controlled through the FMGC or the FCU. The thrust levers in normal operation will not move again until landing when at about 30 to 50' the PF will reduce the thrust lever to idle and the autothrust will automatically disconnect at that point. There is no physical connection between the thrust levers and the powerplant. It is all done electronically which is called FADEC (Full Authority Digital Engine Control).

Thrust is now set by selecting Open Climb (OP CLB) or Open Descent (OP DES) or Managed climb or descent. Managed climb or descent means that the FMGC is controlling in either. Open mode simply means using either full climb thrust for climb or idle thrust for descent. Autothrust controls to a limit in Open, either the climb limit or the idle limit.

The other “FCU” method to control thrust is to set vertical speed (V/S) which allows the thrust to maintain speed and climb rate is controlled through pitch. In this case autothrust is maintaining speed and is in Speed mode. Of course, during cruise and approach the altitude or glide slope is held through pitch with the autothrust maintaining the required speed. Managed thrust is controlled by the FMGC.

If you don't get anything else out of this little discussion please understand that the autothrust works in one of two modes, Open (controlling thrust) and Speed (controlling speed). Further, Open mode can be either climb or idle thrust.

Most of the time if you are going to have a problem it is in the Open mode (controlling to thrust). If you are having problems with thrust doing something other than what you think it should you can possibly try:

- Turn off flight directors (if hand flying), this will cause autothrust to go to Speed mode (“Autopilot OFF, Flight Directors OFF”)
- Select vertical speed (if in Open climb or descent), this will cause autothrust to go to Speed mode
- Select Speed Select (if in Managed speed), this will force the commanded speed to what you desire.

American Airlines Airbus A319, A320, A321 Notes

Arm A/THR (autothrust):

Arm on ground (with at least one FD on):

- Set thrust lever in FLX/MCT if FLX temp is set
- Set thrust lever to TOGA

Arm in flight:

- Press on the A/THR pb on FCU when thrust levers not in active range or setting thrust levers out of active range. Blue A/THR in FMA.

Activate A/THR:

Note: on ground you will set takeoff thrust to either FLX/MCT or TOGA which are manual thrust settings. When coming back to the CL detent after takeoff you are putting the thrust levers to the A/THR active range, thus activating autothrust.

- A/THR pb pressed on when autothrust in active range
- Set thrust levers to active range when A/THR pb armed
- ALPHA FLOOR protection activated (not a great way to activate!)

Disconnect A/THR (Match and Mash):

- Press instinctive disconnect pb on thrust levers
- Place both levers to idle detent
- Press off the A/THR pb on FCU when system active (green light goes out) (not recommended)
- Set one thrust lever beyond MCT or both beyond CL detent when RA is below 100'

① *Make your flight instructor happy!:* The following is in bold print because it will make your life easier. **Always match the TLA to the thrust before disconnecting (using instinctive disconnect pb), no matter what kind of thrust situation you are in. This works in normal autothrust, THRUST LOCK and TOGA LOCK. Although not always technically necessary, by matching TLA to thrust you always avoid any unintentional thrust “excursions” and use good practice. Think “Match and Mash”.**

American Airlines Airbus A319, A320, A321 Notes

Note: Be aware that when you “Match and Mash” you have turned off Autothrust (put it in standby) and you now are in manual control. You MUST set the desired thrust on the thrust levers until you are ready to re-activate autothrust.

Examples:

DO - Pilot decided to fly visual approach with manual thrust. They bring the thrust levers back from the CL detent until the TLA “donuts” match thrust and then press the red instinctive disconnect buttons in the thrust levers. The thrust reverts to manual with no discernable change in thrust.

DO - Pilot decides they are slightly high and fast on a visual approach as ATC has turned them in a little early while trying to work in another flight behind them. In order to reduce power quickly the pilot swiftly pulls the thrust levers to idle. In fact this is a “match and mash” as the thrust will be limited until the TLA matches the actual thrust. Then the thrust will be reduced as the thrust levers are pulled further back. Once at Idle the Autothrust will disconnect on it’s own. A very fast way to “match and mash”, this is also the way Autothrust is disconnected on landing. Very normal and natural!

DO – Pilot encounters unusual attitude and during recovery finds the thrust has gone to TOGA LOCK. Pilot recovers thrust by putting both thrust levers to TOGA and pressing the red instinctive disconnect buttons. Then the thrust levers are repositioned to CLB and autothrust re-engaged by pressing the A/THR pb on the FCU.

DON’T - Pilot decides to disconnect Autothrust on approach. They push OFF the A/THR pb on the FCU. Nothing happens except a ding every 5 seconds. The pilot brings the levers back but continues to get a ding. Finally they push OFF the red instinctive push buttons and get rid of the ding. Frustrating and counterproductive!

DON’T – Pilot wants to disconnect Autothrust so they push OFF the red instinctive push buttons. The thrust immediately goes to Climb Thrust as the thrust levers are in the CLB detent. Pilot is confused and not wanting a huge surge of power and quickly reduces the thrust lever setting but not until they have upset the passengers and destabilized their approach. Not good!

Note: Pulling back the thrust levers from the CL detent during autothrust operation will allow the pilot to limit autothrust upper limit but autothrust is still active until levers are at idle. Chime and ECAM warning will sound every 5 seconds to remind pilot to either disconnect autothrust or reset thrust levers to CL detent. The proper way to disconnect autothrust and begin manual thrust operation is to bring thrust levers back until the TLA “donuts” are matched to thrust indicators and then press instinctive disconnect pb on thrust lever.

American Airlines Airbus A319, A320, A321 Notes

① *Airbus Gotcha: Warning: If autothrust is disconnected and then thrust levers are pulled back from CL detent the thrust will immediately go the power selection commanded by the thrust levers and indicated on the TLA donuts. Be sure power is at the intended setting when A/THR is disconnected to avoid power surge.*

① *Airbus Gotcha: Warning: If autothrust is disconnected by pressing the A/THR pb on the FCU the aircraft won't know if the pb was pressed off or signal was lost and will give an ECAM warning to move thrust lever. It will think you are in a Thrust Lock situation. Bottom line here, just use the instinctive disconnects (or idle when at flare) to disconnect the auto thrust.*

Alpha Floor – Angle of attack between α Prot and α Max at which the autothrust will command TOGA regardless of thrust lever position.

Alpha Floor will give:

- A FLOOR in green with flashing amber box on FMA and in amber on E/WD
- TOGA LK in green with a flashing amber box around it on the FMA when the A FLOOR condition is left. TOGA thrust is frozen regardless of Thrust Lever position.

To cancel ALPHA FLOOR or TOGA LK disconnect the autothrust. To disconnect TOGA LK you MUST put the Thrust Levers in TOGA, then push the instinctive disconnects. This is the one time “Match and Mash” is required.

ALPHA FLOOR is available in NORMAL law only.

ALPHA FLOOR is enabled at liftoff and active during flight, disabled at 100' RA on approach to let you land the aircraft.

ALPHA FLOOR is disabled if you press the instinctive disconnects for 15 secs.

Please note that Alpha Floor has to do with autothrust while Alpha (α) Prot and Alpha (α) Max are actually to do with flight controls.

THR LK – Thrust Lock occurs if the autothrust system fails. THR LK flashes on the FMA and ECAM memo displays AUTO FLT A/THR OFF. The thrust will be frozen at the last commanded setting until the pilot moves the thrust levers, then thrust will follow the movement of the thrust levers and be controlled manually.

During every approach you will need to confirm autothrust is in SPEED mode on FMA or off by 1000'

American Airlines Airbus A319, A320, A321 Notes

Missing Link or AP/FD & A/THR interaction

Well, OK, it isn't *that* missing link but there is a link between the autopilot and/or flight director and the autothrust. The A/THR and the AP/FD work together to maintain speed and trajectory (altitude, glide slope, vertical speed). If one is maintaining speed the other will maintain trajectory and visa versa. If you think about it you are used to doing this yourself when flying manually. On climb you set climb power and maintain speed with pitch but when leveling for cruise at altitude you use pitch to maintain altitude and power to hold speed. The Flight Guidance acts in the exact same way. There are two basic ways the autoflight maintains control.

AP or FD in trajectory mode (example: altitude hold, V/S, G/S)	A/THR in SPEED mode maintain speed or MACH in cruise and approach
---	---

Or

AP or FD in SPD/MACH AP or FD adjust pitch to hold speed	A/THR in THR mode Steady thrust set to either THR CLB (OPEN CLB) or THR IDLE (OPEN DES)
---	--

There are times that the autoflight cannot hold what has been set and will have to change modes. This is called mode reversion when the modes change automatically without the pilot calling for it. This is both a part of normal flying and also part of the system to prevent flight outside the envelope.

An everyday example is during a climb the autopilot normally will control pitch to keep speed in OPEN CLB and the autothrust will maintain climb thrust (THR CLB). On approaching level off at the target altitude pitch will now revert from speed to vertical speed and thrust will revert from climb thrust to speed. This will be true even if the pilot reselects a new altitude before the level off is complete. The vertical speed mode will remain until the pilot reselects something else.

Basically, be aware that if the autopilot is controlling pitch then the autothrust is controlling speed and visa versa. Only one controls pitch or speed at a time, never both controlling the same thing together.

A common reversion mode is if the aircraft is climbing in Open Climb or Managed Climb and the pilot is suddenly given a new altitude. The new altitude is below the current altitude. The mode will revert to V/S set to the current vertical speed upon reversion. The pilot can then change the vertical speed to a descent or select Open Descent.

American Airlines Airbus A319, A320, A321 Notes

Reversions can also happen when hand flying if you don't follow the flight director. If in Open climb or descent and you allow the speed to hit max or min the autothrust will go to SPEED mode and attempt to regain the selected speed while the flight director bars will be removed! Turn OFF FD when hand flying!

① *Airbus Gotcha: or How to be an Airshow Pilot:* You are hand flying with the flight director on (bad thing!). You are getting ready to level off just prior to the Final Approach Fix on an approach. However, you are not quite level at the set altitude and the FMA does not yet show ALT* for capture. You are slowly leveling off just a little high without realizing it and as you have been in Open descent the thrust remains in the commanded idle. Speed decays to below V_{LS} . Suddenly climb thrust is commanded even though you are now wanting to continue descent. Sounds like a flyby to me!

American Airlines Airbus A319, A320, A321 Notes

FMA – Flight Mode Annunciator

The FMA allows the pilot to know what modes the autoflight systems are in and what can be expected. There are times when changes will occur in the modes without pilot action. This mode reversion cannot be tracked on the FCU, you must look at the FMA to know what is actually happening. The FMA is broken into columns as shown below:

COLUMN NAMES				
THRUST	VERTICAL	LATERAL	APPROACH CAPABILITY STATUS	AUTOFLIGHT ENGAGEMENT STATUS

Each column has rows for messages and memos. There are up to three rows available for each column to use. The first three columns, Thrust, Vertical and Lateral have the following rules:

- Top row, Green – Active or Engaged, White - Armed
- Middle row, Blue or Magenta – Armed (Magenta shows ALT CSTR from FMGC)
- Bottom row, Messages about flight control first priority
- Bottom row, Messages about FMGS have second priority

ROWS	COLUMNS				
	THR	VERT	LAT	APP STAT	ENGAG STAT
ACTIVE, ENGAGED MODES	MAN THR	ALT*	NAV	CAT 3	AP1+2
ARMED MODES		G/S	LOC	DUAL	1 FD 2
MEMOS, SPECIAL MESSAGES	LVR ASYM	SET HOLD	SPEED	DH 100	A/THR

This is what the FMA looks like at the top of the PFD:

THR IDLE	ALT* G/S	<div style="border: 1px solid black; display: inline-block; padding: 2px;">NAV</div> LOC	CAT 3 DUAL DH 100	AP1+2 1 FD 2 A/THR
----------	-------------	---	-------------------------	--------------------------

The FMA is at the top of the PFD and allows the pilots to see exactly what the various modes of the auto flight system are. The above examples are just given to allow you to see what type of messages would be in the FMA, not an actual flight situation. A starred message (ALT*) means that portion is in the process of capturing. A white box message means mode change or automatic switching has just taken place in past 10 seconds. The OM has a complete list of all messages and meanings (OM 14.2.1).

American Airlines Airbus A319, A320, A321 Notes

Oxygen (ASM 16)

Crew oxygen is supplied from one cylinder. A green over pressure disk is located on the outside of the aircraft skin below the Captains windows. Blowout of this green disk indicates thermal discharge. Crew oxygen is turned on using a pb in the overhead panel. Crew oxygen pressure is indicated on the SD and if low the pressure indication will have a half amber box around it. However, the Airbus low pressure is not the same as the American limit, therefore the half amber box should be ignored and crew action to check pressure is not required until pressure is less than 1000 psi. A chart is available in OM 1 Limitations 1.15.3 to indicate amount needed for number of crewmembers. Masks are full-face and have clear "tear-off" strips. If face mask has surface contamination, the tear-off strip can be removed to clear an area to see through.

Passenger oxygen is chemically generated. Passenger oxygen is located at passenger seats, lavs, galleys and at each F/A station with 2, 3 or 4 masks to a group. All EXIT and cabin signs will automatically illuminate when cabin altitude exceeds about 11,000 ft. Masks will automatically deploy when cabin altitude exceeds 14,000'. May be manually deployed by pilot using red guarded MASK MAN ON pb. Oxygen generators last approximately 13 minutes after first mask in group is used. Passenger oxygen SYS ON light only means that the signal was sent, some masks may not deploy and F/A's may have to manually open some doors.

American Airlines Airbus A319, A320, A321 Notes

Powerplant (ASM 17)

319: CFM 56-5B or IAE V2500
320: CFM 56-5B or IAE V2500
321: CFM 56-5B, LEAP-1A or IAE V2500

Engine Crosswind Limits (AOM 18.10.2):

LEAP-1A	Start: 45 knots (gust included)	Takeoff: 35 knots (gust included)
CFM-56	Start: 35 knots (gust included)	
IAE 2500	Start: 35 knots (gust included)	

Min oil for dispatch - 13 qts (AOM 18.10.5)

FADEC controlled (Full Authority Digital Engine Control)

Each FADEC is a two channel computer with one channel active and the other used as backup. Each FADEC has its own alternator that powers it once N2 is above a certain value. If the alternator fails normal ships power will take over.

Three idle modes:

- Modulated: Varies with demand, in flight with flaps at 0
- Approach: Depends only on altitude, activated when flaps not at 0
- Reverse: Selected when on ground and thrust levers at idle, slightly higher than forward idle.

Five Thrust Lever Detents:

- TOGA: Takeoff go-around
- FLX/MCT: Flex takeoff, Max continuous
- CL: Climb thrust
- IDLE: Idle thrust for forward and reverse
- FULL REV: Maximum reverse thrust

Continuous ignition provided automatically (with Mode selector in NORM) when:

- Engine Anti-ice selected ON on IAE and non-updated CFM engines
- Engine flameout in-flight detected
- EIU fails

Continuous ignition may be selected manually by positioning the ENG MODE selector to IGN/START

American Airlines Airbus A319, A320, A321 Notes

Normal Start Sequence:

Note: start ENG 1 first to pressurize Green Hydraulics

- ENG Mode selector to IGN/START
- ENG Master switch to ON (after amber X's go away)
 - At 16 % ignition ON
 - At 22% starts fuel flow
 - At 50% start valve closes, ignition off
 - Engine idle should stabilize at about 58%
- ENG mode selector to NORM

Normal Idle – 2,4,6,6 – Approx. 20% N1, 400° C EGT, 60% N2, 600 lbs/hr FF

Manual Start Sequence:

- ENG Mode selector to IGN/START
- ENG MAN START pb ON
- At Max Motoring (min. 20% N2) select ENG Master switch ON
 - Fuel and ignition will begin when ENG Master selected ON
 - At 50% start valve closes, ignition off
- At idle, about 58%, ENG MAN START pb OFF
- ENG mode selector to NORM

N2 background “grays out” during start, returns to normal when stabilized at idle
Ignition A or B will show on SD during normal start, A & B during manual start

Note: (AOM 5.2.4, 13.1.2) For first flight of day run engines for at least 5 mins. before applying takeoff thrust, for subsequent flights (with 1 ½ hrs shut down or less) warm up engines at least 3 mins. Run 3 mins. at idle after landing.

The CFM will reference N1 speed and the IAE EPR. The IAE will default to N1 in the case of EPR failure. If sensed EPR is lost the engine will be in N1 mode. If computed EPR is lost the engine will be in degraded N1 mode. Overboost at TOGA is possible in degraded N1 mode.

The IAE gets fan blade flutter at fan speeds of 60% to 74 % N1. A computer called the EEC that will prevent the engine from stabilizing at those critical fan speeds. The pilot will sense this as a “gap” in power setting while taxiing the aircraft. The EEC will only let the engine speed up or down through this N1 speed range, not keep it at that selected speed.

Thrust bump is installed on IAE aircraft. This allows extra thrust for takeoff when at TOGA thrust. The controls are on the forward part of the thrust levers under a cover. Lift the cover and push the red button on either lever. The system should be armed while taxiing out and both engines are running. The engine must be in EPR mode. This should only be used when performance dictates it.

American Airlines Airbus A319, A320, A321 Notes

APU (ASM 4)

APU can supply electrical up to 39,000' and supply full electrical load up to 25,000' and bleed air up to 20,000'. Electrical takes precedence over bleed air. APU bleed is NOT permitted for Wing anti-ice. The APU is fed fuel from left fuel manifold. If no other fuel boost is available the APU will activate a separate dedicated APU fuel pump. In flight (above 100 kts.) on bat only the APU will not start (RAT failed). With RAT (loss of GEN 1 & 2) the APU is allowed 3 minutes for a start attempt. The APU can supply the entire electrical system on the ground. In the air the APU will not supply the main galley shed busses. During Engine Bleed OFF takeoffs the APU bleed is selected on to keep cabin air on.

For APU fire the APU will auto shutdown and fire the extinguisher bottle on the ground but not in-flight. In-flight the APU must be manually shut down and extinguished for fire. If the APU SHUT OFF pushbutton on the external panel or the APU FIRE pb on the overhead FIRE panel is pressed the APU will shutdown but the extinguisher will not automatically fire. *Note:* APU will auto shutdown in-flight for reasons other than fire.

The APU generator will automatically come online if engine GENs or EXT is not already online. The APU is ready for bleed and electrics when reaching 95% for two seconds or 99.5%. The green AVAIL light will show in the APU START pb and green APU AVAIL on EWD display when APU gen is ready for use.

APU bleed may be selected as needed and APU will allow bleed to come online (when practical wait 3 minutes for temperature stabilization). On shutdown the APU Master is pushed off. The APU will continue to run for a cooling period before shutting down. If the APU Master is pressed back on before the APU shuts down the APU will continue to run. When shutting the APU down wait 2 mins. after APU Avail light goes out or until APU flap shows fully closed on ECAM APU page before switching batteries off. If APU is left running, leave batteries on for fire protection. APU "Bleed" supplied by APU load compressor is not a real bleed.

To start the APU: Press APU MASTER SW pb ON, the blue APU MASTER SW ON lights up. Wait about 5 seconds then press APU START pb ON. The APU START blue ON will light up. When the APU is ready the APU START pb will show green AVAIL and the APU START pb blue ON will go out. When needed press APU BLEED pb ON (*Note:* APU BLEED pb is on AIR COND panel).

That's it! If EXT PWR is not already established online the APU GEN and APU bleed air will automatically come online. Isn't technology wonderful!

Min Oil for starting APU: ECAM

Note: APU ECAM Advisory of LOW OIL LEVEL allows APU to be started and used. Maintenance is required within 10 hours of operation.

American Airlines Airbus A319, A320, A321 Notes

FMGS (ASM 5.2)

A little general theory: All FMS systems that I have used function or think in a “Mode” pattern. This is to say that the FMS must always be in a mode or phase and be aware of what the aircraft is doing to “know” what mode it should be in. The FMS will have many different ways to identify a mode change but it will need to change modes during every flight. The pilot should be aware of the modes and their changes (this is starting to sound like marriage counseling...). The Airbus is no different. For vertical planning the FMGC has modes called Flight Phases that are named Preflight, Takeoff, Climb, Cruise, Descent, Approach, Go Around and Done. In addition the FMS needs to know when the aircraft is in taxi, engine-out and landing modes. With the pilot entering the proper needed data during initialization the FMS is able to properly plan and control a flight through all the necessary phases or modes.

Further, the pilot must enter a route of flight to allow for lateral planning. This will also involve modes, in this case, takeoff runway, SID (if applicable), enroute, STAR (if applicable) and approach/go around and landing runway. The pilot will enter the needed route data before flight and modify it in-flight as necessary.

Some changes the pilot will make are considered Strategic (entire flight) and some are Tactical (current flight phase or mode). As you learn the different functions of the FMGC and the Autoflight system be aware of whether a function is Strategic or Tactical. For example the Cost Index is strategic but the descent speed is tactical.

If a page is longer than one screen can show you will use the scroll or slew keys (up/down arrow keys, ↑↓) to show additional information. If there is more than one page to a key you can press the NEXT PAGE arrow key to see the succeeding pages. Sometimes additional information can be accessed from a page and you will see an on screen prompt (<, >, or *) to present that new page. See OM 17.6.1 for full information.

FMGC Stuff: Now for some general info on the FMGC!

DIR key: This key is one of the most used and will allow the pilot to go direct to any fix that the FMGC will recognize. If the FMGC doesn't recognize the fix then the pilot can build a temporary waypoint and insert the new waypoint into the direct command to be able to navigate to the fix. This will be gone over more later in waypoints and reroutes.

F-Plan Key: When you select the F-Plan key the default (normal) Flight Plan view will have the FROM waypoint at the top of the MCDU screen (first line). The next (second) line will be the TO waypoint and all succeeding waypoints will continue down the screen. The FROM waypoint is usually the last VOR or intersection you crossed but it can also be PPOS (Present Position) or T-P

American Airlines Airbus A319, A320, A321 Notes

(Turning Point). PPOS simply means that you are not on any nav segment and the FMGC is just tracking where you are with no nav guidance available. This will occur after takeoff when the runway is automatically cleared and you don't have a nav segment to join yet. T-P will show when you use the Direct function, which we will go over later. The second line is the TO waypoint and is in white while most of the rest of the lines are in green. However, it is possible that a pseudo waypoint may be on line two and therefore it may be white but not the TO waypoint. We will go over pseudo waypoints later as well.

You can always scroll up or down on the F-Plan page but the FROM will always be at the top when you select the F-Plan key. Think of the FROM as being what is behind you. Think of the TO as being what is just ahead of you next. The FROM is important because to use lateral navigation you must define a nav segment for the FMGC to follow and this means that you must have two points for any given nav situation to define a segment. This will become more clear when we go over Reroutes.

DISCONTINUITY is a line that shows two points are not joined and they do not form a segment. If DISCONTINUITY is showing then the FMGC will NOT continue to the next waypoint. Think of it as a gap in your navigation. In fact that is exactly what it is, a gap between two NAV points. This is something that you want if you will be given radar vectors at a certain point. You will most commonly see DISCONTINUITY after the runway when initializing when you will expect radar vectors to your first fix and after the last fix on your route prior to beginning your approach. There are times when you will need to clear a DISCONTINUITY and we will look at that in a moment. If you are in NAV mode and reach a discontinuity in the flight plan the autopilot will just drop to heading mode on the current heading or entered heading if one is entered in the FCU. Note that the Heading "window" will only hold a heading for 45 seconds if not selected (who knows why!)

The scratchpad is the bottom line of the MCDU and is where you will enter data. After you type info into the scratchpad you will then select it up into the FMGC by using the LSK (Line Select Keys) on either side of the MCDU. Note that you cannot select data from the FMGC into the scratchpad. You will also get various warnings in the scratchpad and they can be cleared by pressing the CLR key in the bottom right hand corner of the keys.

AIRPORT Key: The AIRPORT key simply allows the pilot quick access to any airport that is entered into the flight plan. This would include the departure airport, arrival airport and the alternate airport. Press this key and the display will place the next available airport in the FMGC flight plan on the first (top) line in the MCDU. This just gives the pilot a fast way to "scroll" the flight plan display to the next airport.

American Airlines Airbus A319, A320, A321 Notes

→ ← *NEXT PAGE Arrow Keys:* The NEXT PAGE right and left Arrow keys (→,←) give access to additional information for some screens when there is more than can be shown on one screen. Think of NEXT PAGE as scrolling horizontally. The F-PLAN and INIT screens use the NEXT PAGE function. When there is more than one page the pages are referred to as PAGE A and PAGE B as in INIT PAGE B. This would require you to select INIT and then press arrow left or right to NEXT PAGE to access INIT PAGE B.

↑↓ *Keys:* The ↑↓ keys (up/down arrows, slew keys) allow the pilot to scroll a page vertically. You will also use them for changing values. This is most commonly used when selecting Runways and Arrivals. You will also very commonly use them for scrolling the F-Plan screen to see waypoints that continue in the flight plan beyond the MCDU screen display.

DIR Key: The DIR key allows the pilot to go direct to any waypoint entered. The TO waypoint will become whatever is entered as the direct and the FROM waypoint will become a T-P (position the aircraft is at when the DIR is entered). You may either press the LSK next to the direct fix or type the fix in the scratchpad and press the DIR TO LSK.

PROG Key: The PROG key will actually access a number of different pages depending on the phase of flight you are in. In every case you will see a PROG page but the name will change depending on the phase. For example, when in cruise flight the page will be name PROG CRZ and in climb PROG CLB and so forth. This PROG page along with F-PLAN will be used most of the time when you are not accessing some other page. The PM should have PROG on their side unless they need something else.

The PROG page will show the planned cruise altitude (as loaded during INIT or as modified) as well as the optimum cruise altitude and the recommended maximum altitude. Optimum (OPT) is based on cost using the COST INDEX you entered. Recommend Maximum (REC MAX) is based on 1.3 G protection and should only be used in smooth air.

You may change the planned cruise altitude anytime by coming to any PROG page.

Another handy feature is the Bearing / Distance to feature. Just put in any airport or fix and you can immediately see how far you are from it and what heading to take to it. Even better, this is one of the few features that does not “crosstalk” with the other FMGC so each pilot can load a different fix to use. This is a great place to come when planning a crossing restriction before you get it loaded into the Flight Plan to be sure you won’t miss the fix.

Finally, PROG is also where you will change the required accuracy for RNAV GPS approaches.

American Airlines Airbus A319, A320, A321 Notes

PERF Key: The PERF key allows the pilot to see and enter data for the various phases of flight. You will use this key when initializing to enter takeoff information, changing climb, cruise and descent speeds and entering approach data. Only the preflight and done phases do not have pages. Press the PERF key and then press the LSK at the bottom of the screen to move to the next or previous phase page. If you aren't sure what phase the FMGC is in just look at the top of this page as each phase is named here. For example in takeoff phase the PERF page is named PERF TO page and in cruise it is named PERF CRZ page.

RADNAV Key: The RADNAV key stands for Radio Navigation and is the page to check when you wish to determine which nav aids are being tuned. Normally the Airbus will autotune the radios and you will not be aware of what nav aids are being utilized. However, there are times that you will need to "lock" a frequency for tuning, such as when a DME is used for departure on a SID. Just press the RADNAV key and then type the nav aid identifier (you may also use the frequency by using a leading slash, for example /115.0) in the scratchpad. Then select the identifier to the VOR1 or 2 LSK at the top of the MCDU. This will keep that side tuned to that frequency. The "locked" identifier will be in LARGE letters. You can then use the NAV or ROSE VOR so see the raw data. If you wish to enter a VOR course you type it in (020 for the 020 radial) and select ROSE VOR. You can also manually enter an ILS here by putting the ILS identifier (such as IIAS) in the LS on LSK 3L. This will load the ILS just like it would be from the FMS Flight Plan.

FUEL PRED Key: The FUEL PRED key allows the pilot to view fuel prediction info on destination, alternate and fuel management data. This is the page to use to enter Weight and Balance Closeout data. If the INIT page B is showing on the MCDU on engine start the FMGC will automatically "rollover" to FUEL PRED for weight data to be entered. Gross weight and CG data are entered on LSK 3L. For example, 144,190 lbs. with a MAC of 23.2 would be entered as: 144.2/23.2

INIT Key: The INIT key is used when getting ready during preflight. You initialize the FMGC from this page. This page will be gone over in more detail later.

SEC F-PLN Key: The SEC F-PLN key allows the pilot to have a second flight plan to use for what-if scenarios or to load anticipated changes that might occur in the primary flight plan. You are able to copy the primary flight plan in order to make changes to it or you can program a new flight plan.

① **Airbus Gotcha:** If the initial fix in the Secondary flight plan is different from Active flight plan you must be on Heading to activate. You cannot change an active NAV segment while NAV is engaged.

American Airlines Airbus A319, A320, A321 Notes

DATA Key: The DATA key will allow the pilot to view the various sources of data for the FMGC and determine whether it is valid or not.

MCDU MENU Key: The MCDU MENU key allows selection whether to work in FMGC or ACARS or another area such as AIDS. Only one MCDU can be set to ACARS at one time. If the opposite side is selected to ACARS then you will "locked" out of ACARS until it is selected back out of ACARS.

CLR Key: The CLR (clear) key is a delete key. You can use it to delete characters or phrases in the scratch pad or to delete data from the FMGC. To clear the scratch pad just press the CLR key and the last entered character will be deleted. If you continue pressing the entire phrase in the scratchpad will be cleared. The CLR key can also get rid of warning messages. To delete data entered into the FMGC press the CLR key while there is nothing in the scratchpad. CLR will be entered into the scratchpad. Now select CLR to the LSK that corresponds to the data you wish to delete. This is how to delete a discontinuity. Press the CLR key and then press the LSK that corresponds to the discontinuity and it will be deleted with the waypoints on either side of the discontinuity now joined as a segment.

OVFY Δ Key: One of the more obscure keys on the MCDU, the Overfly key has basically only one function. When you are coming up to a waypoint the FMGC will normally compute the turn at the waypoint and due to the radius of the turn the aircraft may begin its turn early to be able to turn smoothly onto the airway centerline. There may be times that you need to actually fly exactly over the fix before turning. In those cases press the OVFY Δ key and then line select it up to the appropriate fix as a lateral revision. The FMGC will now make sure to fly directly over the fix even if it will cause overshoot on the far side of the turn.

Well, OK, there is one other function for the Overfly key. When using freetext in ACARS you will use the overfly key to put a space in the text as you would use the space bar on a word processor.

Pseudo Waypoints

OK, besides just sounding weird what *are* pseudo waypoints anyway? Basically they are lines of information on the Flight Plan page that are not something that you can navigate to. They are mostly to do with vertical profile information and are therefore not for lateral navigation. Pseudo waypoints on the MCDU will consist of the following:

T/C – Top of Climb (hockey stick)

T/D – Top of Descent (hockey stick)

S/C or S/D – Start of Climb or Descent for Step Climb/Descent (hockey stick)

SPD LIM – Speed Limit (M&M)

DECEL – Deceleration to approach phase (circle D brand)

I/P – Intercept Point (lightening bolt)

Please note that while you cannot navigate laterally using the pseudo waypoints they will show on your ND using various symbols. If a pseudo waypoint is on the second line of the flight plan it will be white even though it cannot be the TO waypoint. The MCDU logic simply makes the second line white whether it is actually the TO waypoint or not.

Also you will have some pseudo waypoints that show on the ND that are not on the MCDU such as the Energy Circle and Crosstrack Error.

The Energy Circle (green dashed arc) is available only in Descent and Approach Phases. It shows how far the aircraft will go until reaching landing elevation in the current configuration until 1500' AGL then configure for landing and descend to landing elevation. It is interesting to note that Flaps 1 provides longer range than Flaps 0 (clean), this is due to the higher engine idle speed with Flaps 1.

Crosstrack Error will show how far the aircraft is from the active nav segment or leg. This is very useful when cleared for approach or when cleared to join the departure or arrival.

The Intercept Point will show as INTCPT on the course when on heading to join the active nav leg.

American Airlines Airbus A319, A320, A321 Notes

Initializing the FMGC

When initializing the FMGC during pre-flight use these pages to enter data:

DIFRS FP

D DATA
I INIT PAGE A, INIT PAGE B
F F-PLAN PAGE A, F-PLAN PAGE B
R RAD NAV
S SEC F-PLAN

F FUEL PRED
P PERF

Note: Allow at least 3 minutes after initial power up on a cold airplane for all internal tests to be completed before pressing buttons.

DATA:

Press DATA key, then A/C Status. Check database validity and dates. Enter BIAS from flight plan on PERF for performance factor on LSK 6R. New database is effective at 0900Z on the date of change.

INIT Page A:

Press INIT key. Enter the city pair codes in FROM/TO. For example, for Charlotte to Phoenix use KCLT/KPHX or use company route number such as KCLTKPHX1.

Enter the alternate city code. Example: for Greensboro use KGSO.

Enter flight number. Type in AAL followed by the flight number. For example for flight 1210 type **AAL1210**. Do not use a leading zero (0). For example for flight 52 type **AAL52**, not AAL052. *Note:* AAL flight number is used for ADSB identification purposes for ATC so this is now important.

Check lat/long coordinates. It is safer to use the airport coordinates from the database as this avoids the pilot typing in gross errors that are not caught.

Cost Index. Use the Cost Index listed on Release. Look for code of CI0070 for Cost Index of 70.

Cruise flight level. Enter intended cruise altitude on the CRZ FL (350 for 35,000') and modify the anticipated cruise temperature with /TEMP (/–49 for minus 49).

American Airlines Airbus A319, A320, A321 Notes

Press the ALIGN IRS key (LSK 3R). ALIGN IRS should be pressed within 15 minutes of turning GNADIRS to NAV to avoid excessive drift. DO NOT move aircraft during align process.

INIT Page B:

Press the INIT key. Press the NEXT PAGE key. This will take you to the second INIT page. Check that the reserve time is 45 min. on FINAL/TIME line.

F-PLAN Page A:

Press F-PLAN key to program the filed route. Do a lateral revision from the departure airport. To do this press the LSK 1L on the left side of the MCDU next to the departure airport code. Then select DEPARTURE. Now select RWY for anticipated departure runway, then SID if needed and TRANS if needed.

Insert first fix or waypoint in flight plan route. If there is victor or jet airway routing from the fix then use a lateral revision to enter the needed airway. For example for a route from BOS VOR on Jet 75 that ends at CMK press the left LSK next to BOS in the flight plan. Now enter J75/CMK in the VIA/ GO TO. Then INSERT if OK. Any fix that is a direct with no published route you can simply press on the next line of the flight plan. For example to go direct from BOS to CMK simply press CMK on the line below BOS LSK. This will place CMK after BOS in the flight plan as the next fix.

Note: pressing a fix on top of a fix places the new fix ahead of the previous one and a discontinuity is in between the two fixes now. You will need to clear the discontinuity if you want to join the fixes to make a segment. To clear a discontinuity press the CLR (clear) key and then press the LSK next to the discontinuity. This will join the two waypoint on either side of the discontinuity.

Enter any vertical restrictions (cross LAX VOR at or above 10,000') by typing the altitude in the scratch pad and pressing it on the right LSK for that fix. You can also enter a vertical revision by pressing the right LSK for that fix and putting it into the proper field. If you have an at or above clearance put a + in front of the altitude before entering it (use – for at or below)

Example: at or above 10,000' use +10000, at or below FL240 use –240.

Enter any anticipated arrival and approach by pressing the left LSK (lateral revision) for the destination airport. Enter appropriate Arrival, Transition and Runway Approach and Insert if OK.

American Airlines Airbus A319, A320, A321 Notes

Check distance at bottom of F-Plan page against the total distance showing on Release. This is a gross check and should be close but does not need to be exact as arrival and approach routings may add mileage not on release.

Flight Plan page B:

Access this page by using the F-Plan key followed by the Next Page key. Forecast winds may be entered here for each waypoint as desired to improve FMGC accuracy in planning. Take the winds from the flight plan on the release and type them into the scratch page in the following format: DIR/SPD so that DIR is wind direction and SPD is wind speed. In this example the wind is 265 at 83 kts. and you would type 265/83. Now press the LSK on the right hand side that corresponds to the waypoint you are adding winds to. The left hand side of this screen will be similar to the Flight Plan page A. The center of the screen will show the estimated fuel on board (EFOB) at each entered waypoint.

RAD NAV:

Press the RAD NAV key and be sure that if a DME mileage is needed during a departure that you enter the ID for the station here. For example, when doing the HORNET departure off of 18R you need the CLT DME 1.6 nm fix. Press CLT into the 1L or 1R LSK (Capt. or F/O) to “lock” CLT into the autotuning. In order to read VOR DME use the ADF/VOR selector switch on the EFIS control panel. Just select the appropriate switch (VOR 1 or VOR 2) to the VOR setting. The DME readout will be on the bottom of the ND page (bottom left for VOR 1 and bottom right for VOR 2). After completing the departure return the switch to the OFF position. If you enter a VOR on RADNAV the tuning letters will be bold, if the system is autotuning the letters will be little normal.

Note: if the DME is from an ILS then press the ID for the ILS into the ILS/FREQ on LSK 3L and press the LS pb to display the ILS DME on the PFD. If nothing is showing in the RADNAV page then check to make sure that STBY NAV is not selected on the RMP.

SEC F-PLAN:

Press the Sec F-Plan key. Press the LSK for Copy Active. This will give you a “practice copy” of the flight plan with which you can later play “what if” scenarios with if you should so choose or to enter possible route changes (such as different than filed arrivals) to quickly activate as an active flight plan if needed. There may also be Engine Failure Procedures that can be loaded here for use if you lose an engine on departure.

Note: If the initial fix in the Secondary is different from Active flight plan you must be on Heading to activate. If Secondary has been copied then PERF will be

American Airlines Airbus A319, A320, A321 Notes

available as a prompt on SEC page. This PERF will allow you to enter the performance data for the secondary flight plan

After engine start:

FUEL PRED:

After engine start you will use the FUEL PRED key to enter W&B. Enter the actual gross weight (RAMP weight) and CG from the W&B printout on GW / CG on LSK 3L. You will not have to enter the fuel as the FMGC reads it on it's own.

Example: 133.6/24.8

Before engine start leave the FMGC on the FUEL PRED page and you will have the proper page ready for use. If you receive the Weight and Balance Closeout message before engine start you may type the weight and CG in the scratchpad for entry after engine start if you wish.

PERF:

Press the PERF key and you will now be on the PERF TAKEOFF page. Enter V1, V2 and VR speeds on their LSK's. Enter FLEX temp if needed. Enter THR RED/ACC (thrust reduction/accelerate) and ENG OUT ACC altitudes from W&B printouts. Enter the flaps setting and stab trim settings in units of UP or DN on the FLAPS/THS LSK (example: 1/0.5DN or 2/1.0UP). If using an intersection departure enter the distance from the end of the runway to the intersection on the TO SHIFT LSK. Now type the "0" (or clean) speed in the scratchpad. Select NEXT OMASE and put the clean speed in the CLIMB *SPD LSK. This allows the aircraft to accelerate to "green dot" after takeoff instead of 250.

When taking off from an intersection you should enter the amount of distance the intersection is from the end of the runway. For example, in PIT it is common to use runway 28L intersection P. From the TPS pages you can determine the distance available for takeoff (or just ask Ground Control!). Subtract that from the full runway length and you have the intersection 1500' from the end of the runway. Enter 1500 on the TO SHIFT LSK.

If approach data (PERF APPR) is not entered within about 180 nm of destination then MCDU will give error message saying so. So go ahead and get approach data loaded, the electrons are free!

① *Airbus Gotcha:* If not within 200 nm of destination then aircraft will not initiate descent in PERF DESCENT mode. Descent will be made in PERF CRUISE mode as a "cruise descent". During descent in cruise mode the FMGC will not "see" crossing restrictions in the flight plan.

American Airlines Airbus A319, A320, A321 Notes

① *Airbus Gotcha:* The aircraft will not initiate descent automatically from cruise altitude when reaching a descent point (known as T/D or Top of Descent). The pilot must set in new altitude and then push the ALT knob to enter Managed Descent.

① *Airbus Gotcha:* When the aircraft is in HDG mode and the pilot enters direct to a waypoint the autopilot will automatically engage NAV with no other action on the pilot's part. In other words, the autopilot will change modes automatically from HDG to NAV when a DIR is entered in the FMGC. The point here is to be sure of where the waypoint is when you enter DIR as the airplane will automatically turn to the new waypoint as soon as it computes the new course. DIR will always turn the shortest distance to the point. If the aircraft begins to go the wrong place or turn the wrong direction (for example turn left instead of an assigned right turn) use HDG mode until you can correct the problem.

① *Airbus Gotcha:* Changing the arrival or runway after putting in crossing restrictions will delete pilot entered crossing restrictions and you will have to re-enter them.

To enter a new waypoint you have several options. Of course, you can always just type in the name if you know it, in this case BURLS intersection on the SHINE arrival into CLT. If you do not remember the format for creating a new waypoint just type HELP and press a LSK just as you would enter a waypoint. You will then be shown the four formats for new waypoints to be entered.

LAT/LONG (latitude / longitude)	Example: 3551.5N/08158.3W (dot, slash, dot)
P/B/D (Place / Bearing / Distance)	Example: CLT/314/64 (slash, slash)
P-B/P-B (Place – Bearing / Place – Bearing)	Example: CLT–314/HMV–171 (dash, slash, dash)
PD (Along Track Waypoint)	Example: Shine/10 or Shine/–10 (waypoint slash plus, minus)

Note: Along Track waypoints or waypoint “slewing” or uptrack/downtrack on the course using a + or – is NOT available for the original FMS. Use a P/B/D on the course if possible.

Note: In the flight plan on the MCDU a P/B/D is shown as a PBD. The pilot created waypoints will be numbered so the first PBD is shown as PBD01 and the second as PBD02 and so on. The P-B/P-B waypoints are shown as PBX so they appear as PBX01, PBX02 and so forth. Along Track waypoints are PD01, PD02, etc. LAT/LONG waypoints are shown as LL01, LL02 and so forth. FIX INFO

American Airlines Airbus A319, A320, A321 Notes

down track waypoints are DXXXEL where XXX is the radius you use. So 120 NM radius from ELP will be D120EL.

To make a lateral revision to flight plan (F-PLAN button selected on FMGC) press a LSK on the left side of the MCDU (LSK 1L through 6L). To make a vertical revision press a LSK on the right hand side of the MCDU (LSK 1R through 6R).

To enter a new destination (diversion not to alternate) use a lateral revision on any waypoint in flight plan (NOT current destination) and then enter NEW DEST on LSK 4R.

To enter holding into flight plan use a lateral revision on intended hold point then press the HOLD LSK on 3L.

① *Airbus Gotcha*: Autopilot must be in Heading Select to delete a TO or FROM waypoint. You can't delete the current NAV leg.

Phase Triggers (ASM table 5.1)

I think Phaser triggers belong in Star Trek but these are phase triggers. Phases are very important and you can look at the top of the PROG and PERF pages to see what Phase you are currently in. You will better understand how the Airbus FMGC “thinks” if you understand what triggers the FMGC Flight Phase change.

- Taxi to Takeoff – Set TOGA or FLEX, SRS Mode and N1 above 85% (or EPR above 1.25) or ground speed above 90 kts.
- Takeoff to Climb – Reaching the acceleration altitude loaded in the FMGC during initialization on PERF page.
- Climb to Cruise – Reaching planned cruise altitude listed on PERF page.
- Cruise to Descent – Start of descent from current cruise altitude (within 200 nm of destination).
- Descent to Approach – Passing DECEL fix on ND or Activate and Confirm Approach on PERF DES page. This will drive managed speed to approach speed.

Note: If the ECAM takeoff memo hasn't yet come up on the screen during taxi just press the T.O. CONFIG test button on the ECAM control panel. This will force the taxi phase and the ECAM takeoff memo screen to come up.

Note: If descent is initiated before 200 nm from destination then descent will be made in CRUISE DESCENT at 1000 fpm and will not honor any descent crossing restrictions. The FMGC will prompt for a new cruise altitude as a warning.

Note: The FMGC Flight Phases are different from the phases for the FWC (Flight Warning Computer)

Reroutes

One area that gives many new Airbus pilots problems is making changes to the FMGC flight plan once under way. There are several very common ways to enter reroutes into the FMGC, depending on the nature of the reroute.

Note: You will be doing a lot of lateral and vertical revisions when doing reroutes. Be aware that you are given different screens for either lateral or vertical revisions depending on where you select them from. For example: You can take a lateral revision from Departure, From, Enroute and Destination and they will all have a different screen with different options. So lateral and vertical revisions are “context sensitive” which means you have to choose the correct LSK (line select key, the buttons on the side of the MCDU) for the proper lateral or vertical revision. Be aware which one you want so you don't get “lost in space”.

Direct: Press the DIR key and type in the fix (VOR or intersection). Press the LSK 1L key to enter the fix. The FMGC will automatically enter a T-P (turning point) to create a FROM waypoint and the fix that is entered will become the TO waypoint.

Direct then as filed: Use the above method or press the DIR key and then find the cleared fix in the flight plan. Press the LSK next to the desired waypoint and it will become the TO waypoint. Using either method all waypoints before the fix are now cleared and the remainder of the flight plan will be available as filed.

Note: if you are on heading when DIR is used the mode will change to Managed NAV automatically (in other words, when you select direct in heading mode the aircraft will automatically engage NAV and go to the direct fix).

Heading to intercept then as filed: Select the cleared intercept heading on the HDG selector on the FCU. Then you must determine if the segment you have been cleared to join exists in your flight plan. If it does you only have to clear any waypoints that are ahead of the segment until you have the proper fix as the TO waypoint. Use the CLR key to clear any unwanted waypoints then engage NAV.

If the needed segment is not available you must build it. Use the Direct function by pressing the DIR key. Then put in the navaid or fix you will be referencing. Now you can use the Radial IN or Radial OUT function on the right side of the Direct page. For example if you wish to intercept the CLT 270 radial and then track inbound you would type in CLT then put it in the DIR prompt. Then type 270 and put it on the RADIAL IN LSK. Then select the heading you are to intercept on and finally press the HDG knob to engage NAV. If you need to track away from the navaid or fix then use RADIAL OUT. In that case the aircraft would intercept and track outbound from the CLT VOR on the 270 radial. Then make sure the next fix is in flight plan and clear the discontinuity.

American Airlines Airbus A319, A320, A321 Notes

Offset: To parallel your current course use a lateral revision at the FROM waypoint. Type in the amount of distance (up to 50 nm) to the side you wish to parallel the current course and right or left of course. For example for 20 miles left of course type 20L and for 35 miles right of course type 35R. Now select the amount into the OFFSET prompt on LSK 2L. You can see the anticipated new offset course on the ND. If you wish to adjust it press ERASE and type in the new amount. Once satisfied with the new course press INSERT. Aircraft will take a 45° cut to the new course. To resume the original course access the same OFFSET prompt and clear or go DIRECT to a fix on the original flight plan.

New Runway/SID: Press the LSK 1L key for the Departure airport. Now select DEPARTURE, then select the departure runway. If you are using a SID select the appropriate SID (*NOTE: you may have to scroll to see all available SIDS*). If there is a transition to the SID you can select it on the right side of the MCDU. Once everything is selected press INSERT. *NOTE: Ensure any unwanted DISCONTINUITY is erased. Ensure new Takeoff Performance data is entered!*

New STAR or Approach or Runway: Find the DEST (destination) airport at the bottom of the Flight Plan page on LSK 6L. Press the left LSK for the airport for the lateral revision page. Now select ARRIVAL on LSK 1R. Select the appropriate approach and/or runway if needed. Scroll as needed to see additional approaches if the needed one is not on screen. If you don't need a new approach or runway simply press Next Page arrow key to see the Arrivals. Next select the appropriate STAR (*NOTE: you may have to scroll to see all available STARS*). Now select any transition as needed on the right hand side of the MCDU. When all has been selected press the INSERT prompt on the 6R LSK. If a transition is used that is already in the flight plan then there will not be a discontinuity to clear in the flight plan. However, if you do not have a transition then please be aware that the arrival and the flight plan will not have a common point and therefore will have a discontinuity.

① *Airbus Gotcha: Changing the STAR, approach or runway will delete any pilot entered crossing restrictions on an arrival. Make sure you confirm any crossing restrictions after making any arrival changes. Also make sure you enter a new MDA or DH for any newly inserted approach.*

American Airlines Airbus A319, A320, A321 Notes

New Route: To enter a new route you will program just like you did for the flight plan initialization. Take a lateral revision (left LSK) from the last common fix. Select AIRWAYS, then use the VIA/ GOTO in the following format J75/BOSOX. If the new flight plan ends in a common fix then there will be no discontinuity and no fixes to clear. However, if the routing results in no common fix then you will need to go back and clear all the old fixes.

Holding: Press the left LSK for a lateral revision at the holding fix. If the fix does not appear in your flight plan (you are really having a bad day!) then use DIR first to enter the fix. Now press the HOLD selection on LSK 3L. If the hold is as published then check all data on the DATABASE HOLD page and if it is all good then press INSERT on LSK 6R. If you need to make changes or there is no published hold (COMPUTED HOLD) then make the needed changes to the Inbound Course, Turn Direction (L or R), and the time or distance needed for legs. Once all data for the hold is good press the INSERT selection on LSK 6R. For immediate hold, take lateral revision at FROM waypoint and select <HOLD.

New Destination: Make a lateral revision from any waypoint in the flight plan (not an airport) by pressing the left LSK for that waypoint. Now select the NEW DEST prompt by typing in the new airport identifier (example: KCLT for Charlotte) and pressing the LSK 4R key. You may now go to the flight plan to modify the arrival information as needed for the new destination.

New Alternate: The new method is to just go to INIT and put in the updated or new ALTN. The older method is to press the left LSK for a lateral revision from the Destination airport. Then select the <ALTN prompt on LSK 3L. Enter the new airport identifier on the blue line on LSK 3L over the old alternate or in the brackets if there was no alternate. Now press LSK 3L again to select the new alternate. Now press INSERT. Alternate should now be entered in the flight plan and on the FUEL PRED page.

Sec F-Plan: For a planned reroute (or at least anticipated!) you may wish to use the Secondary Flight Plan page. In most cases you will want to copy the active flight plan and then make any needed changes in the secondary flight plan. This will work well when descending into the terminal area and you anticipate a change in your STAR assignment. A good idea to store a secondary flight plan in case of "programming error" or the FMGC dumps on you.

Along Track Waypoints: To create a new fix along the current flight plan track you may wish to simply use a current waypoint and add or subtract the distance from that fix. For example Approach tells you to descend to cross 55 miles out from CLT VOR at 13000' and 250 kts. While you are on the MAJIC arrival you look and see that MAJIC is 45 DME from CLT so you just want to add a waypoint 10 miles before MAJIC. You type MAJIC/-10 (MAJIC slash minus 10) and press the LSK over MAJIC intersection. A new PD waypoint will be created 10 miles

American Airlines Airbus A319, A320, A321 Notes

before MAJIC (the first one will be PD01, second PD02 and so forth). You can now add any speed or altitude info just like any other waypoint. If you wish the fix to be after the “parent” fix then leave the minus sign off, for example MAJIC/10 for 10 miles after MAJIC. In either case, whether the new fix goes before or after the parent fix press the LSK to put the fix over the parent fix and the FMGC will place in the appropriate place.

NOTE: You cannot insert the new waypoint in a nav segment apart from the parent waypoint. The new Along Track Waypoint must be sequential.

FIX INFO, Draw the Line and Draw the Circle:

FIX INFO is a great feature that has been added to the Airbus. There are several nice features to FIX INFO that we will cover. It is not really a Reroute but it will very much help in navigation at times.

Draw the Line: OK, not technically a reroute but the Airbus can “draw” a blue dashed line on the ND for you for situational awareness. This uses the FIX INFO feature. For example if you are on a departure and required to remain east of a certain radial you can enter that radial in this fashion to allow you to see it on the ND. Use a Lateral Revision (left LSK’s) on the Flight Plan page from any waypoint and select FIX INFO> on LSK 1R. Then put in the required fix such as VOR, intersection or airport. Then enter the radial needed. You can enter 2 fix radials per page or you can put in an abeam line. There are up to 4 FIX INFO pages you can choose by using the NEXT PAGE arrow key.

Draw the Circle: Using the FIX INFO feature you can also create a dashed blue circle with a set radius. Use a Lateral Revision (left click) on any waypoint (not airport) and type in the fix IDENT (such as JEN or KDFW). You can then put in a radius of up to 256 nm. You will now have a big blue dashed circle around the selected fix.

If you double click when you put in the radius it will put the fix in the flight plan where the circle arc crosses the flight plan. In other words you can use the FIX INFO radius feature to put in an along track waypoint by double clicking the radius when you enter it. This is a great feature for adding a random crossing restriction waypoint that ATC throws at you.

If you need more than one “circle” such as when departing ORD on the O’Hare Departure and you need a 5 and 8 mile radius from ORD you can enter the same fix more than once. The FIX INFO feature has up to 4 pages! So just use the NEXT PAGE arrow key and enter the same fix on the next page with the new radius. You can now see both blue circles with the 5 and 8 mile radius off ORD.

Where is it?: Closest Airport is the feature you want if you need an immediate divert. Press the DATA key, then LSK 5L <CLOSEST AIRPORT. The nearest 4 airports will be shown as with bearing to, distance and time to airport in UTC.

American Airlines Airbus A319, A320, A321 Notes

You may enter a fifth airport at your discretion. LSK 6R allows you to select to see EFOB (estimated fuel on board at arrival) and wind used to calculate data to the airports.

Try to remember this feature as your PFD will only be displaying airports ahead of you in the normal view. This allows you to see airports that are available in any direction.

Note: the closest airport in distance may not be the closest in time due to winds. This feature will help you quickly decide which is the best airport from both a time and distance perspective.

RTA: Required Time of Arrival is a feature that allows the pilot to cross a particular fix at a set time. Do a vertical revision (click LSK on right side) for the fix in question and select RTA> (LSK 1R). Then enter time required using hr.min.sec format.

Re-Cruise: Again, not technically a reroute but if you begin a descent and the FMGC goes into Descent mode when you want it to still be in Cruise mode you can force the FMGC back into Cruise mode by entering an altitude below the current altitude in the PROG page. Just go to PROG and put in a lower altitude or Flight Level. Just be aware that if you are still descending you will descend at only 1000 fpm if you are in managed descent. If you need a different descent rate while in Cruise Descent you will need to use OPEN Descent or Vertical Speed, not managed. Also, the FMGC will not respect the crossing restrictions you put in the FMGC while in Cruise mode.

Note: For any reroute if you change the current NAV segment in use (the current FROM and TO waypoints) you will have to select HEADING first before you can ENTER the change to the Flight Plan. You cannot make a change to the current FROM/TO waypoints without being in HEADING.

American Airlines Airbus A319, A320, A321 Notes

Taxi

It is Captains discretion as to when visibility is good enough to taxi. (AOM 5.6)

No more than 40% N1 for breakaway thrust without clearance. (AOM 5.2.1)

Max taxi speed on straightaway – 30 kts. (AOM 5.3.2)

Max taxi speed on turns - 10 kts.

Minimum pavement width for 180° turn: 100' (A321 105') (AOM 5.3.5)

Ensure at least 5 minutes for engine warm up after engine start before applying takeoff thrust for first flight of day. Plan for 5 minutes and allow at least 3 minutes for subsequent flights for that day within 90 minutes turn time. (AOM 5.2.4)

During taxi in icing conditions run-up engines to shed fan ice:

CFM: approx. 70% N1 for at least 30 secs. Every 30 minutes.

IAE: 50% N1 momentarily at intervals not greater than 10 minutes. (avoid 61-74% range)

Note: Do not exceed 75% N1 for CFM A319, A320, 70% for CFM A321 and 1.18 EPR IAE on both engines with parking brake ON.

① *Airbus Gotcha:* If you do not get the Flight Control page on ECAM when you do the Flight Control check you need to turn off the Engine Mode switch from IGN/START to NORM. Next time try to remember your After Start flow!

Single Engine Taxi (AOM 5.2.1) – Single engine taxi is at Captain's discretion with factors such as weight, ramp condition, passenger comfort, etc. Allow 5 minute warm up for first flight of day, 3 minutes on subsequent flights within 1 ½ hrs of prior engine shutdown. Allow 3 minutes for engine cool down on taxi in.

For Single Engine Taxi:

- Yellow Electric Pump ON and Yellow Accumulator pressure in green.
- Engine 1 will normally be used during single engine taxi.
- Use APU if available during single engine taxi.

APU is normally used for starting second engine as it is more fuel efficient than a crossbleed start. However, if APU or APU bleed is not available single engine taxi may still be used and crossbleed procedures used for second engine start. Therefore APU is to be used if available during single engine taxi out. If APU bleed is being used during single engine taxi then select X-BLEED AUTO, if APU bleed off then select X-BLEED OPEN. Normally APU is not used during taxi in.

American Airlines Airbus A319, A320, A321 Notes

Takeoff

Two takeoff profiles. *Note: Rolling takeoffs are normal, expected and will meet all performance requirements.*

Takeoff Procedure	Thrust Reduction Altitude (THR RED)	Acceleration Altitude (ACC)
Normal Takeoff Profile (NADP 2)	1,000 AFL	1,000 AFL
Noise Abatement Profile (NADP 1)	1,500 AFL	3,000 AFL

Crew will use the Normal Takeoff Profile (NADP 2) except when specifically required to use the Noise Abatement Profile (NADP 1).

NADP 2 will indicate LVR CLB (set thrust levers to CLB) at 1000 feet AFL and will adjust pitch to accelerate to 250 or as set.

NADP 1 will indicate LVR CLB (set thrust levers to CLB) at 1500 feet AFL but will maintain pitch to hold $V_2 + 10$ until 3000 feet AFL, then it will lower pitch to accelerate to 250 or as set.

① *Make your flight instructor happy!:* When setting power for takeoff, the thrust levers should be set to 50% N1 (CFM) or 1.05 EPR (IAE) on the TLA (doughnut) and once both engines stabilize then position both levers to FLEX or TOGA. Set takeoff thrust by 40 kts. (AOM 6.2.2)

① *Make your flight instructor happy!:* If not a rolling takeoff release the brakes once the initial 50% or 1.05 EPR is set. If you go to full takeoff power before releasing the brakes it will be a rather abrupt jolt that you and your passengers won't like! This is a powerful jet not a little prop plane!

Note: Allow at least 5 minutes for engine warm up before applying takeoff thrust for first flight of day. After first flight of day use a minimum of 3 mins. warm up if engine is shut down 1 ½ hrs. or less.

Do not use aileron into the wind during a crosswind (AOM 6.1.1). During a takeoff with crosswind component exceeding 20 kts. or tailwind apply full forward sidestick to be taken out by 80 to 100 kts. During all normal takeoffs use half forward sidestick pressure until 80 to 100 kts. Ensure the aileron is neutralized by looking at the "control pointer cross" on the PFD or relax the sidestick to center during the takeoff roll. This will ensure that you do not have any roll in the initial rotation and liftoff. During crosswind takeoff let engines stabilize at (CFM) 50% then increase to 70% N1 then increase to FLEX or TOGA by 40 kts. ground speed or (IAE) 1.05 EPR and stabilize, then increase to FLEX or TOGA by 40

American Airlines Airbus A319, A320, A321 Notes

kts. ground speed. Slowly release any rudder being held during crosswind takeoff during the rotation. By liftoff have rudder neutral during a crosswind takeoff.

Note: If using FLEX and during takeoff you have not rotated with 2000 ft of runway remaining select TOGA immediately.

① *Airbus Gotcha:* If on taxi out you do not have the V speeds showing in your PFD (after entry in MCDU), make sure that your Flight Director is turned on.

Note: If no FLEX temp is set (TOGA) and thrust levers are set to FLEX on takeoff the thrust will go to TOGA at 80 kts. This is to avoid an underperformance takeoff.

On takeoff, PF should have the PERF-TAKEOFF page, PM the F-PLN page

Use a radar tilt of 5-8° UP if radar required during takeoff.

Set a departure heading for selection at 400'. *Note:* set the heading you will need at 400'. If using a SID departure where NAV is required NAV mode will engage at 30' automatically, do not set a heading for NAV departure.

Use ARC or ROSE NAV on takeoff on your EFIS ND settings. Do not fly around in PLAN. Only use PLAN as a momentary reference in-flight.

Captain makes all takeoffs when visibility is less than 1600 RVR or ¼ mile visibility or if no RVR reported.

On takeoff the aircraft will “blend” from direct to normal law as it goes from ground mode to flight mode and the backpressure that you need to hold the nose up will reduce to zero once normal law autotrim activates. It's typically not noticeable as the aircraft will be climbing quickly but you release the backpressure around 100 to 200 ft. as the trim kicks in or the nose will “balloon”. A new Airbus pilot learns to minimize input as the pilot can induce a slight amount of sidestick pressure without realizing it. Remember, the less input on the stick the better. You don't want to “confuse” the computers (or the pilot!).

New Airbus pilots tend to get into the habit of “slapping” the Thrust Levers back from TOGA or FLX/MCT to the CL detent. This isn't good technique and can be very noticeable in back to the passengers and harder on the engines when using TOGA or lesser FLEX reductions. When the FLEX temp is around 60° there will be little or no power reduction when coming out of FLX/MCT to CL and this is why pilots get used to just “slapping” the levers back. At TOGA or lower FLEX the immediate reduction is very noticeable. Ease the thrust levers back from FLX/MCT or TOGA to the CL detent slowly just as you would on any other aircraft. Your passengers and engines will appreciate it!

American Airlines Airbus A319, A320, A321 Notes

PF	PM
Begin Takeoff Roll: -Advance Thrust Levers to about 50% N ₁ (CFM) 1.05 EPR (IAE) -Advance thrust levers to FLX or TOGA -Check MAN FLX or MAN TOGA annunciated on FMA	
“FLEX” or “TOGA”	Verify proper takeoff thrust set “Thrust set”
<i>Note: Captain will assume/maintain control of thrust levers after thrust set for possible Rejected Takeoff.</i>	
At 80 kts “Checked”	“80” (check STBY speed)
<i>Note: Captain will remove hand from thrust levers at V₁</i>	“V₁”
Rotate at 3° per second up to 15°	“Rotate”
Verify positive rate of climb “Gear Up”	Verify positive rate of climb “Positive Rate” Position Gear Selector UP
Above 100 AFL “Autopilot 1” or “Autopilot 2”	Select Autopilot ON as requested
At or above 400 AFL “Heading___” as required	Select HDG as requested
At thrust reduction altitude LVR CLB flashes (NADP2 1000’, NADP1 1500’), Move Thrust Levers to CLB detent “Climb”	Verify Thrust set to CLB “Climb Set”
Follow pitch guidance to reduce pitch and accelerate at Acceleration Altitude. When at or above F Speed and accelerating- “Flaps 1”	<i>Note: Flaps 1 retraction is only used on Flaps 2 or Flaps 3 takeoffs.</i> Check airspeed above F Speed Select Flaps 1
When at or above S Speed- “Flaps Up, After Takeoff Checklist”	Check airspeed above S speed Select Flaps 0 Disarm Spoilers

American Airlines Airbus A319, A320, A321 Notes

RTO – Rejected Takeoff (AOM 6.4)

ECAM will inhibit all warnings/cautions that are not paramount from 80 kts. to 1500' AGL. All rejects done by captain.

- The captain calls **“Reject, My Aircraft”**
- F/O calls **“Your Aircraft”** (if control transferred)
- Thrust Levers idle (when the thrust levers go to idle the ground spoilers extend, which then trigger the autobrakes, ensure maximum braking)
- Select Full Reverse
- F/O call (if applicable) **“Single Reverse”** or **“No Reverse”**
- F/O monitor autobrakes, call **“Autobrakes OFF”** if they do not engage or when they are disengaged
- F/O notify tower
- F/O call **“80”**
- F/O call **“60”**
- Maintain slight forward pressure on sidestick
- Stop aircraft
- If evacuation NOT IMMEDIATELY required - Capt. inform passengers and flight attendants “This is the captain, remain seated”, etc.
- If evacuation IMMEDIATELY required – Call for QRH Evacuation procedure.

After Reject consider:

- Aircraft condition
- Clear the runway if helpful (if autobrakes MAX used, release brakes by disarming spoilers)
- Passenger evacuation or not

Hot Brakes – (OM 6.4.6) AML entry and maintenance action is required if:

- 150° C difference in brake temps on the same strut *and* one brake 600° or greater *or* 60° or less
- a mean 200° C difference between different trucks
- fuse plug melted
- brake temp exceeds 900° C (800° - A321)

Note: If necessary, maximum reverse may be used until aircraft comes to complete stop. Also, if aircraft comes to full stop with Autobrakes you must disarm the spoilers to taxi.

Note: Autobrakes will not activate below 72 kts.

American Airlines Airbus A319, A320, A321 Notes

Max Rate of Climb: (AOM 7.3.4)

A319: 260 KIAS / .76M

A320: 260 KIAS / .76M

A321: 280 KIAS / .76M

Max Climb Angle: Slow to Green Dot Speed with OP CLB. EXPED climb pb will give maximum climb angle by applying maximum climb thrust and controlling speed to down to green dot. *Note:* EXPED pb can produce a rapid change and is not intended for routine use. Use above FL 250 should be avoided.

V1 Cuts (AOM 6.5)

Pick a line and stick to it no matter what on every takeoff. You will find that you will just naturally put in the correct rudder for V1 cuts if you practice this on every takeoff. You don't have to hit the centerline lights but stay right on the centerline. You should have the aircraft already stabilized with rudder before rotation (assuming the cut is before the Rotate call). Bring the nose up to 12.5° (park it on the 12.5° "shelf") and hold it. Then follow the flight director. The only real Gotcha here is that the aircraft takes off in Direct mode. It will then blend to Normal. This means that you will have autotrim kicking in just after takeoff. Remember in direct you will be holding back pressure to keep the nose at 12.5° until Normal law with autotrim comes in and then you will need to release the back pressure on the sidestick. In fact this is what happens on every takeoff. Be sure that you don't try to trim off the rudder so quickly that you are diverted from flying during the blend from direct to normal as the trim coming in will cause you to pitch up if you aren't watching for it. Since technically the autopilot can be put on at 100' some folks try to show how good they are and start trimming rudder right away. Better to wait until the blend is complete around a few hundred feet first and then trim the rudder and then get it on autopilot. You don't get any bonus points for a quick rudder trim while losing speed and pitch control!

Note: If taking off in FLEX the PF has the discretion to leave thrust levers in FLEX or to increase to TOGA. If aircraft is heavy, runway is short, aircraft must be maneuvered for obstacle clearance, aircraft is on fire or has other time critical problem pilot should consider using TOGA if not already selected. Thrust should be increased to TOGA in a slow, deliberate manner in order to not destabilize the situation. You may do this while on the runway. If airborne it is best to do this once on autopilot. If increasing to TOGA while airborne do it while on autopilot and below 1000 ft and still climbing. Once level you should only reduce from FLEX to CLB and then back to MCT.

Note: If thrust levers are left in FLEX during engine out takeoff then they must be positioned to CLB or TOGA and reset back to MCT (same detent as FLEX) when engine out procedures call for reduction to MCT. This is due to the fact that the

American Airlines Airbus A319, A320, A321 Notes

same detent is used for FLEX and MCT. By selecting from FLEX to CL or TOGA and then back to the MCT detent the logic is satisfied for the FMGC.

FMS Engine Failure Procedures

American uses FMS Engine Failure Procedures for takeoff. Engine Failure Procedures are used at airports with difficult terrain or departure issues such as Reno (KRNO), Washington DC (KDCA), San Francisco (KSFO), San Diego (KSAN) among many that have these procedures. The procedure is listed in the Jepp app under the Company (CO) pages. They will be named RWY __ TO __. This lists the runway and shows it is a takeoff procedure for which aircraft. For SAN runway 09 they use RWY 09 TO ALL AIRCRAFT. This reads as Runway 09 Takeoff All Aircraft. For KDCA they use RWY 01 TO A32F. This shows it is a procedure for Runway 01 Takeoff for the A320 Family (A319, 320, 321). This procedure will be named at the top of the page using AA and the runway if the procedure is available as an FMS procedure. For example at Reno the procedure is AA34L for runway 34L.

You should select SEC F-PLN, then INIT and enter the departure airport for both airport codes. For example for Reno enter KRNO/KRNO. Then select the runway in the SEC F-PLN and use the Engine Failure Procedure as the departure (SID). This will make the procedure available if you have engine failure on takeoff. Just have the PM select the SEC FLT PLAN and ACTIVATE it. You can then easily fly the Engine Failure Procedure on managed autopilot.

Not all procedures have an FMS departure built. You may want to use the FIX INFO page to build a reference on the PFD. For example at KSAN you could use a radius of 7 nm from MZB to build a reference circle for the turn at MZB D7.0 to turn to heading 220.

At KPHX you can build the departure using fixes that are already built and made. Just use the names they give. For example runway 08 uses fixes of PHX01 and PHX02 while runway 07L uses PHX03 and PHX04.

Note: American does not build separate procedures into the FMGC for Engine Failure on Missed Approach. If a procedure is listed for Missed Approach (MA) it typically will be the same as the takeoff procedure. There is a separate engine failure procedure for missed approach you will normally have to load the takeoff procedure. This means you will have to load the arrival city just as you did the departure city in the SEC F-PLN. For example if you are flying from PHX to RNO you would enter KRNO/KRNO in the SEC F-PLN to initialize it. Then enter the procedure as listed. You may need to DELETE the current SEC F-PLN if you had one already loaded for a different airport. Do not use the CLR key to try to change the airport codes. Just use the DELETE command.

American Airlines Airbus A319, A320, A321 Notes

First Pilot noting engine failure: “Engine Failure”	
PF: “My Aircraft” “TOGA” (if desired) Maintain centerline, minimize sidestick inputs	PM: “TOGA SET” (if requested)
	At VR – “Rotate”
“Gear UP”	“Positive Rate” Position gear lever UP and disarm spoilers
After blend from direct to normal law (about 200’) trim off rudder as needed	
“Autopilot 1” (or 2) as needed above 100’ RA	Select autopilot ON as called for
At 400’ select heading if needed, Comply with engine out departure procedures if specified for airport or runway	
At 1000’ or engine out acceleration altitude push V/S or request “Vertical Speed Zero”	Push V/S if called for
At F speed and accelerating call “Flaps 1” Note: only if Flaps 2 or 3 used	Check airspeed and select Flaps 1
At S speed and accelerating call “Flaps Up” Accelerate to Green Dot (VFTO)	Check airspeed and select Flaps 0
Continue climb if needed Select or request OPEN CLIMB Select or request Green Dot speed Maintain Green Dot	Select Open Climb if called for Select Green Dot speed if requested
Select MCT on thrust levers (or if in FLEX select TOGA if on runway or climbing or CLB if level and then MCT) “MCT”	“MCT Set”
“ECAM actions”	Captain normally assigns F/O as PF. QRC is referenced as needed.

Approaches

The Airbus can fly ILS, LOC, RNAV, VOR and NDB approaches. See Authorized Instrument Approach Procedures (OM I 2f.3.4) for full list.

ILS and Non-ILS

ILS includes CAT I, II & III approaches, LDA (with glideslope), ILS PRM and LDA PRM approaches. Non-ILS include everything else. A chart of this would look something like this:

Approaches	
ILS	Non-ILS

Further, ILS would break down into two groups, Autoland and Manually landed. Non-ILS would also break down into two groups, Managed and Non-Managed. The chart would now look something like this:

Approaches			
ILS		Non-ILS	
CAT I, Manually land	CAT II/III, Autoland	Non-Managed, External Guidance from LOC and G/S	Managed, Internal Guidance from FMS
ILS CAT I, LDA (with glideslope), ILS PRM, LDA PRM	ILS CAT II and ILS CAT III.	LOC, ILS G/S out, LDA w/o G/S.	RNAV, VOR, NDB
(pilot takes manual control for flare and landing, autopilot OFF)	(autopilot ON for landing until during landing rollout)	(lateral track from LOC signal and FPA used for vertical guidance)	(FMGS provides both lateral and vertical guidance)

As approaches are discussed keep the four basic types of approaches in mind to help stay clear as to what procedures you should be using.

Before any approach you must enter the applicable approach data and then activate the approach on the PERF APPR page of the MCDU. Activating the approach will drive managed speed (magenta speed bug) to approach speeds. I suggest activating the approach when out of 10,000' and on selected speed (blue speed bug). If you accidentally activate the approach you can simply use Speed Select for remainder of flight or enter current cruise altitude on PROG page for CRZ altitude. Entering the current altitude as the cruise altitude on the PROG page will force the FMGC back to Cruise phase (re-cruise).

American Airlines Airbus A319, A320, A321 Notes

Once on vectors with approach control you can clear out any remaining flight plan in the FMGC that is not needed to allow only the planned approach to be shown. This is sometimes referred to as “clean up the box”.

When in the terminal area I suggest 170 kts. and Flaps 2. This is a very flexible configuration that will allow you to quickly slow or descend using speedbrake, gear or Flaps 3. This is a great configuration/speed for turning base to final.

Both Flaps FULL and Flaps 3 are normally available for landing. So far I generally prefer Flaps FULL better. Flaps 3 seems to work better when very light weight or in gusty conditions.

Note: If flaps 3 is to be used then CONF3 should be selected on PERF APPR page and the overhead GPWS LDG FLAP 3 pb ON.

When using approaches that utilize barometric settings (MDA, DA) such as ILS CAT I, LDA and RNAV the minimums setting is on the MDA line (line select key 2R) on the PERF APPR page.

When using approaches that utilize radar altimeter (DH, AH) such as ILS CAT II and CAT III the minimums setting is on the DH line (line select key 3R) on the PERF APPR page.

All approaches are to be stable by 1000' AFL (AOM 10.2)
If unstable at 1000' in VMC you may continue to 500', call correction and be stable by 500' or go around.
No configuration changes (gear, flaps) below 1000' AFL

TERR ON ND must be selected by at least one pilot prior to 18,000' unless both pilots must use radar. (FM1 10.2.1)

① *Make your flight instructor happy!:* When making any change in modes such as arming an approach or turning off the flight director or autopilot make sure you look at FMA (at the top of the PFD) to see what mode you actually are in.

① *Airbus Gotcha:* If you cannot get the proper ILS frequency and course showing on the PFD when you select the ILS pb, then check your RAD/NAV page and see if a navaid has been entered and is locking out autotuning. Also be sure that an RMP NAV pb is not selected as this will turn on the NAV backup mode and disable FMGC tuning. This can simply “glitch” and not display when it should. We were able to fix it by reselecting the runway/approach.

Continuing is called when cleared to land, in position to safely land and runway environment will stay in sight. On all instrument approaches (other than Autoland CAT II/III) PM calls, “**Approach Lights**” then “**Runway**” and PF calls “**Continuing**”. The continuing call is only made for the Runway call. After

American Airlines Airbus A319, A320, A321 Notes

Continuing call the PM continues to monitor for deviations. If runway environment is not in sight at minimums the PM will call **“No contact”** and PF will initiate the Go-Around maneuver. PF responds to minimums calls with either **“Continuing”** or **“Go Around, TOGA, Flaps_”**. For CAT II/III the PF will call **“Continuing”** at “Flare Green” for NO DH approaches or at “Minimums” call for DH approaches unless of course “No Contact”. **“Continuing”** is not required for VFR approaches.

Note: For Non-precision or CAT I approaches if only the approach lights are visible at minimums you are permitted to continue the approach to 100’ above TDZE and continue if you then see the runway environment. For CAT II/III you will already be past the approach light by minimums and you will only see runway environment if anything.

Remember: **WAFPPC** for working in the sim.

Weather (check destination weather, make plan)

Advise (ATC, F/A’s, company)

F–PLN (insert new destination if needed, then new approach)

PROG (if RNAV approach, insert required RNP)

PERF (ACTIVATE and CONFIRM, then insert approach data on PERF APPR)

Checklist (call for Descent checklist)

Backward Z, Double D - It may be helpful to notice a “backward Z” flow to the keys on the MCDU when doing the F-Plan, RADNAV, PROG and PERF for the approach. You can use this “backward Z” for any landing flow. Add “double D” (Data, Data) for RNAV.

American Airlines Airbus A319, A320, A321 Notes

VAPP (OM 18.6.5)

The approach speed is automatically computed by the FMGC (of course!). This VAPP Target is shown on the PFD airspeed scale as a magenta triangle. VAPP is shown on the PERF APPR page on the FMGC. It is computed by taking the highest of two different figures. After you enter the steady state winds (no gusts) and the approach runway the FMGC figures the headwind component. It then takes 1/3 of the headwind and adds this to VLS. However, VAPP cannot be less than 5 kts. above VLS or more than 15 kts.

$VLS + 1/3 \text{ headwind component} = VAPP$

So for runway 18 a wind of 180 at 30 kts. would result in a VAPP of +10 kts. If VLS is 120 then VAPP would be 130 (+10).

With runway 18 and wind 270 at 20 the VAPP would be +5 as a minimum of plus 5 must be added and a crosswind adds no additional speed.

Now comes the other way to figure VAPP Target, the infamous GS Mini. While it sounds like either a new Mini car or a new mini-skirt style it will actually figure the safest minimum ground speed for your approach. Remember, the GNADIR's know your ground speed and the wind the aircraft is experiencing at the moment. You entered the runway so it can now know what the ground speed should be on approach. Ground Speed Mini takes the VAPP that has been already figured (130 in our example) and then subtracts the whole headwind component from it. This leaves only the ground speed and the previously added 1/3 wind "cushion" of 10 kts, so in this case $130 - 30 = 100$ kts. ground speed. While this sounds slow remember that VLS was 120. If we had a head wind of 30 kts. that would result in a ground speed of 90 kts. So you can see that the "cushion" has actually added 10 kts. to the minimum ground speed. If the FMGC sees the ground speed going below the minimum of 100 kts. then it will increase the VAPP Target to maintain the minimum ground speed. This will ensure that even if all headwind was lost at once that the aircraft has sufficient energy to fly through the loss of speed. GS Mini may increase the VAPP beyond the normal plus 15 limit to maintain the minimum ground speed required.

$VAPP - \text{headwind component} = \text{GS Mini}$

The VAPP Target will be the higher of these two airspeeds, VAPP or GS Mini.

One point to remember when putting in the wind component. It won't help you to "cheat" and put in a greater wind than actually exists. Putting in a greater wind speed will actually result in a lower GS Mini (remember the FULL wind speed is subtracted from VAPP) which will result in less protection on approach. If you wish to increase the VAPP Target it is better to simply enter the desired VAPP speed on the PERF APPR page while using accurate wind numbers.

American Airlines Airbus A319, A320, A321 Notes

While the FMGC will add airspeed for headwind components it will not add anything for crosswinds. It will be up to you to add anything to VAPP on the PERF APPR page if you have heavy crosswinds and you wish to have additional airspeed on the VAPP Target.

You will only have VAPP target shown when in APPR phase. You can force the FMGC to approach phase by selecting PERF and then ←ACTIVATE APPR PHASE and *CONFIRM APPR PHASE. This will drive the managed speed to approach speed. Normally you will be on speed select when you do this but when you command speed engage the speed will be VAPP. Note that VLS will change depending on the flaps configuration selected and therefore the VAPP will also change with landing flap configuration.

① *Airbus Gotcha:* The VAPP is calculated from the weight and balance closeout data you put in the FMGC on taxi out. The VLS on the airspeed scale is computed from the FACS based on current aircraft performance. Especially on the A321 you may see the VAPP less than 5 knots from VLS as the two numbers may be coming up different in the FMGC. You want to add enough onto the VAPP on the PERF APP page to ensure a 5 knot difference.

All approaches must be briefed on the following outline (OM 2e.9.3, FOM 5.10.1, Checklist briefing aid). The list is on the back of the checklist. Use the following aids during your approach briefing:

American Airlines Airbus A319, A320, A321 Notes

Approach chart(s): (Note: visual approach is defined as 2000 & 3 or better)

- Arrival, transition, top of descent, first constraint
- Airport, approach name (required Day VFR) and page number
- Landing runway (required Day VFR)
- Briefing Strip info
- Required approach minimums
- Planned runway turnoff and taxi route
- Expected runway exit and taxi route (include hotspots/runway crossings)

PFD (be sure LS pb is selected for ILS):

- ILS frequency (does not apply for RNAV approaches)
- Final approach course
- DA, DH or AH as applicable

F-PLN page:

- Glide path angle (RNAV only)
- Missed approach procedure review (not required for day visuals)

SD:

- Brief aircraft model (i.e., A319, A320 or A321) and check landing weight, landing flap setting (landing performance assessment), autobrake setting.

Also include in brief any threats such as unusual procedures, windshear, anti-icing, runway conditions, 10-7 page engine-out procedures, MEL's, etc.

Note: for RNAV approaches enter 0.3 RNP or specified RNP on the PROG page to ensure FMGC accuracy prior to the approach. Check that the required RNP is showing on both MCDUs.

NOT that it has happened to me but if you forget what aircraft model you are in here is the gouge. On the ECAM DOOR/OXY page on the SD check the number of overwing exits and slides per side – if there are:

A319 – One exit and one slide
A320 – Two exits and one slide
A321 – Two exits and two slides

(OK, the panel placard or DATA key, <A/C STATUS page will show aircraft type)

Minimum Safe Altitudes

MSA, within 25 nm of defined navaid: On approach chart

MEA, Airway centerline, number on airway: 10,000

MOCA, 4 nm of airway centerline, number with "T": 4,000T

Route MORA, 10 nm of airway centerline, number with "a": 3200a

Grid MORA, within defined grid sector, number near center of grid

American Airlines Airbus A319, A320, A321 Notes

ILS Approaches

Note: For LDA approaches use ILS procedures.

LS pb should be selected before approach briefing so pilot can read ILS freq., and course off of the PFD. This allows the pilot to double-check the actual ILS being used as well as ensures that the LS pb is selected before the approach begins. If wrong ILS freq. is showing make sure that RADNAV ILS is cleared.

Note: if LS pb is not selected when approach is armed then ILS will flash in amber on the PFD

MDA - If the approach uses a DA (Decision Altitude) then the barometric altimeter is being used and no autocalout will be made for 100 above or minimums. Enter DA information in MDA (Minimum Decision Altitude) position on approach page in MCDU (PERF APPR).

DH or AH - If DH (Decision Height) or AH (Alert Height) is being used then radio altimeter is being used. Use the DH line select key for entry of minimums information in MCDU (PERF APPR). Autocalouts are available for 100 above and minimums except for AH CAT III Dual

For DH CAT II use the specified RA value in the RADIO field.

For DH CAT III Single use 50 in the RADIO field.

For AH CAT III Dual use NO in the RADIO field.

When cleared for approach press the APPR pb on FCU. Then press to engage the second autopilot on FCU. Both autopilots should be engaged for all ILS approaches. Note blue GS and LOC on FMA indicating glideslope and localizer are armed for capture. Must capture localizer first, then will capture Glide Slope. Disconnect autopilot prior to descent below DA for CAT I ILS.

A nice trick to enter all the fixes in the approach is to wait until you are on vectors then reselect the approach but select NO STAR. Obviously you must wait until you no longer need the STAR but now you will have better situational awareness as you will have all the waypoints and fixes on the approach instead of just the final approach fix.

LDA Approaches

LDA approaches use same procedures as ILS approaches, LDA must have glide slope, LDA in database as LOC. KDCA Roselyn LDA is NOT authorized.

American Airlines Airbus A319, A320, A321 Notes

ILS CAT I Callouts and Procedures	
<i>PF</i>	<i>PM</i>
Flaps 1	Speed Verified (check speed and select flaps)
Flaps 2	Speed Verified (check speed and select flaps)
Cleared for approach: Select APPR on FCU Select & Verify both AP1 and AP2 on Verify GS and LOC show Blue on FMA	Verify both AP1 and AP2 engaged Verify GS and LOC show Blue on FMA
When LOC is captured: LOC Capture Verify LOC* in Green on FMA	Verify LOC* in Green on FMA
When at 1 ½ dots below G/S or 3nm from FAF: Gear Down	Gear Down (check speed and select gear lever down)
When at ½ dot below G/S or 2 nm from FAF: Flaps 3 , If landing flaps 3, Before Landing Checklist Arm Spoilers	Check speed Speed Verified Select flaps Complete Before Landing Checklist
At Glideslope capture Glideslope Capture. Set Missed Approach Altitude	Set missed approach altitude on FCU
On G/S or 1 nm from FAF Flaps Full (if required) Before Landing Checklist	Check speed Speed Verified Select flaps Complete landing checklist
At 1000' AFL	1000 (normally auto callout) Stable (Go Around) if unstable in IMC or at night)
At 500' AFL (Go Around if unstable)	500 (normally auto callout) Stable, Target, Sink ___ -or- Stable, +/- ___, Sink ___ -or- Unstable, Go Around
At 100 above DA (H)	100 Above (normally autocallout)
At DA (H) if runway not in sight: Go Around, TOGA, Flaps _ -OR-	Minimums (normally auto callout), No Contact
At DA (H) with runway in sight: Continuing Verify Autopilot disengaged by 80' AFL (160' AFL if CAT I in FMA)	Minimums (normally auto callout), Approach Lights or Runway not required if PF has called "Continuing"

CAT II/III Approaches

Captains approach only. Captain is always PF for CAT II/III

Captain must brief the CAT II or III approach from the QRH:

- F/O will call out “**Land Green**” or “**No Land Green**” if LAND doesn’t show before 350 ft.
- Mandatory Go-Arounds - No Land Green below 400 ft., AUTO LAND warning light, no FLARE in FMA at about 40 ft.
- Considerations – if Captain fails to respond to minimum call best course of action is most likely to continue autoland.

Note: any CAT II RA not AUTH approaches are based on inner marker. You may use the inner marker GS crossing altitude in the MDA as a reminder.

AH stands for Alert Height and allows for continuing the approach only on electronic indications (no visual confirmation of runway environment required). The Airbus 319/320/321 requires that CAT 3 Dual be annunciated in the FMA before AH is used. When entering Radar Altimeter information in the FMGC on the Approach page use NO in the RADIO window for the AH. Autocallouts will not be made at 100 above and Minimums as the runway does not have to be visually confirmed before landing. The CONTINUING call is made on the 400’ LAND GREEN callout. This means it is possible that the runway may not be seen by the pilots before minimums. When shooting a CAT II or III approach the PF must make callout of *CAT 3 dual* (or *single*) or *CAT 2* based on FMA information when armed for approach. *NOTE: Above 8,200’ AGL (max valid radar altimeter range) FMA will show CAT 1, confirm FMA below 5,000’ AGL.*

If CAT 3 Dual is not shown in the FMA (for example CAT 3 Single or CAT 2) then DH must be used if doing a CAT II or III and runway must be seen. Dual will be shown when both autopilots are in use, and Single when only one autopilot is in use or loss of some other required redundant system. Engine-out approaches are limited to CAT IIIA (CAT 3 Single, requires 50’ DH). Captain retards throttles on the 10’ “Retard” callout, disconnect autopilot by 60 kts. on runway. Enter 50 in the RADIO field for CAT III Single and enter the specified RA value for CAT II.

The autoland fail light will flash red if the following conditions occur below 200’ while in LAND mode (OM 14.1.6):

- Both AP’s off below 200’ RA
- Excessive LOC ($\frac{1}{4}$ dot – above 15’ RA) or GLIDE (1 dot – above 100’ RA) deviation – LOC and GLIDE scales flash
- Loss of LOC (below 15’) or GLIDE (below 100’) signal

American Airlines Airbus A319, A320, A321 Notes

- Difference between radar Altimeters is greater than 15' (FD bars flash)

LAND green on FMA below 400 ft. indicates that the autopilot is “locked in” and will “ignore” inputs on the FMU (autopilot panel). Basically at this point it is only looking for a TOGA selection or to complete the landing.

CAT II/III Go-Around Mandatory if –

- No LAND GREEN below 350 ft.
- Autoland warning light comes on
- FMA does not show FLARE at about 40 ft.

Note: If autoland capability degrades above 1000' the pilots have the option of changing the minimums on the PERF APPROACH page if this is done before 500' AGL and the captain understands the new minimums are a decision height (not an electronic alert height AH). The existing visibility must also meet or exceed the new approach minimums.

If auto callouts are not available the F/O (PM) will need to make the 100 Above and Minimums callouts.

Autopilot should be disconnected on ground before 60 kts. Remember that the autopilot will be steering the aircraft through nosewheel steering until disconnected.

Autobrakes should be used for CAT II/III approaches.

Low visibility taxi systems (SMGCS) will be activated when RVR is below 1200.

Practice autoland approaches may be done on CAT I runways only if (OM 18.6.11) runway is listed as approved for autolands in Airport Advisory pages and approach is done in CAT I or better weather conditions with CAT I mins.

Note: when doing autoland during CAT I or better weather the ILS hold line is not being protected and signal may be poor. ATC has a long checklist to run before CAT II/III is actually flown and this will not be done during CAT I weather.

Max elevation for Auto Land:	
A319	9200 MSL
A320 Tails 663-680	6500 MSL
A320 all others	2500 MSL
A321	5750 MSL

Engine-out autoland authorized for CONFIG 3 or FULL (except A320 is CONFIG FULL only) (AOM 10.1.12).

American Airlines Airbus A319, A320, A321 Notes

Note: American does not allow CAT II approach to be flown with CAT2 status in FMA. CAT II must be flown with higher CAT3 Dual or CAT3 Single. CAT2 status in FMA can only be flown for CAT I Approach. This is shown in QRH.

American Airlines Airbus A319, A320, A321 Notes

ILS CAT II/III Callouts and Procedures Same as CAT I but add below changes	
<i>PF</i>	<i>PM</i>
Cleared for approach: Select APPR Select second autopilot CAT 3 Dual -or- CAT 3 Single Verify both AP1 and AP2 engaged Verify GS and LOC show Blue on FMA	Verify approach capability status Verify both AP1 and AP2 engaged Verify GS and LOC show Blue on FMA
On G/S or 1 nm from FAF Flaps Full (if needed) Before Landing Checklist (note: A320 engine out Autoland requires Flaps Full)	Speed Verified (check speed and select flaps)
At Glideslope capture Glideslope Capture. Set Missed Approach Altitude	Set missed approach altitude on FCU
1000' AFL	1000 (auto callout) Stable
500" AFL	500 (normally auto callout) Stable, Target, Sink _____
Verify LAND GREEN (approx 400' RA) At 100 above without DH Continuing	Land Green -or- No Land Green
At DH if runway NOT in sight: Go Around, TOGA, Flaps_ -OR-	100 Above, Minimums (auto callout)
At DH with runway in sight: Continuing Verify Autopilot disengaged by 60 knots on runway for Autoland	100 Above, Minimums (auto callout)
	If FMA does not display FLARE at approx 40' No Flare (mandatory Go-around)
Disconnect autopilot and manually track centerline Ensure autopilot is disconnected prior to runway exit.	On rollout if aircraft is not tracking the localizer: Centerline

Note: Big difference between CAT I and CAT II/III callouts is that the PF (Capt) in CAT II/III watches for visual cues and makes Continuing or Go-Around call while in CAT I the PM will make call on visual contact or No Contact, Go-Around.

Note: Autoland means LEAVE THE AUTOPILOT ON until you are on the ground!! Autoland does not work if you turn off the autopilot.... Just saying...

PRM Approaches

Note: For LDA PRM use ILS PRM procedures. For RNAV PRM the approach will utilize the same fixes, crossing altitudes and missed approach procedures as the overlying ILS or LDA approaches. ILS PRM and LDA PRM use normal ILS approach procedures. RNAV PRM approaches use normal RNAV procedures.

Precision Radar Monitoring approaches allow closer than normal spacing between parallel runways and simultaneous approaches. This allows higher traffic flow during IFR periods for airports with closely spaced parallel runways. Since there is reduced margin for error procedures have been put in place to ensure quick response to any loss of separation. PRM approaches will be flown either with ILS or LDA facilities or an RNAV that “copies” those approaches. All procedures for ILS and LDA are the same except an offset LDA will be flown to a MAP followed by a visual segment. Use normal ILS or RNAV procedures except for the changes below.

- Captain is always the PF for PRM approaches
- Review procedure on Jepp chart. Every PRM has both generic and approach specific information that must be reviewed every approach.
- Must use autopilot, flight directors and if available autothrust
- Put TCAS in TA/RA, if RA is received during approach follow the RA
- Dual VHF frequencies are used for the approach. When handed off to Tower frequency the pilots will maintain listening watch on both frequencies. **DO NOT EXPECT** to be told when to monitor the monitor only frequency! When assigned Tower frequency dial in the normal tower frequency and talk and listen as normal on this frequency. On the number two radio put in the monitor only frequency and select to listen only, not to transmit on this frequency. This means that you are listening to two frequencies while you are talking to tower on one. If the tower gets blocked by a stuck mike or whatever you can still the PRM controller.
- A breakout is similar to a go-around but must be followed immediately. A breakout command will begin “**Traffic Alert**” followed by instructions. All breakouts must be hand flown. Breakouts may be used for a climb or a descent and will normally include an immediate turn.
- If an RA is received on TCAS during a PRM follow the RA as normal (Autopilot off, Flight Directors off). However if during the RA the controller gives a turn follow the controllers command since the TCAS cannot give steering commands.

American Airlines Airbus A319, A320, A321 Notes

<p>PRM Climbing Breakout: “Traffic Alert”</p> <p>Captain (PF)</p>	<p>First Officer (PM)</p>
<p>On “Breakout” climb command from ATC:</p> <p>“Breakout TOGA”</p> <ul style="list-style-type: none"> ➤ Autopilot off ➤ Thrust to TOGA ➤ Turn to new heading ➤ Establish climb (if RA received follow RA) ➤ Select Thrust Levers back to Climb when able ➤ “Climb” 	<ul style="list-style-type: none"> ➤ “TOGA Set” ➤ Set and select heading on FCU ➤ Set altitude on FCU (don’t select) ➤ If RA received turn off Flight Directors ➤ “Climb Set” Verify climb set when called for ➤ Monitor flight path and speed and call out deviations

<p>PRM Descending Breakout: “Traffic Alert”</p> <p>Captain (PF)</p>	<p>First Officer (PM)</p>
<p>On “Breakout” descend command from ATC:</p> <p>“Breakout”</p> <ul style="list-style-type: none"> ➤ Autopilot off ➤ Verify thrust in Climb Detent ➤ Turn to new heading ➤ Establish descent (not to exceed 1000 fpm) 	<ul style="list-style-type: none"> ➤ Set and select heading on FCU ➤ Set altitude on FCU (don’t select) ➤ If RA received turn off Flight Directors ➤ Monitor flight path and speed and call out deviations

Note: After a descending Breakout the Go-Around phase will not be activated. If TOGA is not subsequently selected you will need to re-insert the required approach into the flight plan.

American Airlines Airbus A319, A320, A321 Notes

Non-ILS Approaches

At American Airlines in typical operations the most common approach is the ILS. However there are times that the ILS is not available or is not the best approach for the circumstances. If you cannot do an ILS approach you will need to use a Non-ILS approach.

Note: Non-ILS approaches not allowed when in Direct Law

Non-ILS approaches break down into two groups:

Managed: RNAV, VOR and NDB

Non-Managed: LOC, ILS (no G/S) and LDA (no G/S)

Managed approaches have coded vertical guidance built into the approach and will display FINAL APP on the FMA when used. Both lateral and vertical guidance will be generated by the FMGC.

Non-Managed approaches will use pilot selected vertical guidance and will display FPA X.X | LOC on the FMA. The lateral track will be guided by an external localizer signal and will use LOC on the autopilot.

Minimums, DA vs. DDA

When setting the approach minimums for Non-ILS approaches use the following:

- For Managed Non-ILS approaches: If DA(H) minimums are listed (associated with LNAV/VNAV & RNP capability) then use the published DA. Otherwise use DDA (add 50' to minimums).
- For Non-managed Non-ILS approaches: *Always* use the DDA (add 50' to MDA minimums). The gouge is MDA stands for "Must Do Arithmetic"

Note: DDA (Derived Decision Altitude) adds a 50 foot pad to the normal DA (Decision Altitude) to help ensure the aircraft will not go below DA during missed approach procedures. Short story, if MDA is listed use MDA plus 50 ft.

Here is what our chart would look like for Non-ILS Approaches:

Non-ILS Approaches	
Managed	Non-Managed
RNAV, VOR, NDB	LOC, ILS w/o G/S, LDA w/o G/S
Both Vertical and Lateral Guidance from FMGC	Lateral Guidance from LOC and Vertical Guidance from FPA (Pilot selected).
May use DA if DA(H) mins listed	Always use DDA (add 50 ft.)

American Airlines Airbus A319, A320, A321 Notes

Engine Out Non-ILS

All Engine out managed Non-ILS approaches must be flown manually and with CONF 3.

RNAV Approaches

Of course things can't be so simple as to only have one type of RNAV Approach. So there are two categories of RNAV Approaches:

- RNAV (RNP)/RNP (AR)
- RNAV (GPS)/RNP

I have no idea how they came up with these names...but the key here is that the pilot will use an RNP of .3 for all RNAV (GPS)/RNP approaches. If you are flying a RNAV (RNP)/RNP (AR) approach the RNP value will be from .3 down to .1 and you will use the PUBLISHED value. Enter the RNP for the RNAV approach on the PROG page. The higher accuracy approaches require additional authorizations so they are AR (Authorization Required).

The basic breakdown here is there are two "types" of RNAV approaches based on the precision of the approach. The more accurate approach will have tighter parameters and will require higher accuracy from the FMGC. The higher accuracy RNAV approaches will require a minimum RNP of .10 nm while the standard RNAV approaches will require .3 nm. No LPV approaches. Here is our chart now:

Managed RNAV Approaches	
RNAV (RNP) or RNP (AR)	RNAV (GPS) or RNP
Requires RNP .3 to .1 (as published) (higher accuracy required)	Requires RNP .3 (not published) (lower accuracy required)
Approach names: RNAV (RNP) RWY XX RNP RWY XX (AR)	Approach names: RNAV (GPS) RWY XX RNAV (GNSS) RWY XX RNP RWY XX

Note: you must know the SEL (Special Equipment List) Code for your plane before starting the whole decision tree. There are 3 codes - SEL 8, 9 and 10.
SEL 8 - RNAV approaches WITHOUT any published RNP value **RNAV (GPS)**
SEL 9 - RNP value of **0.3 RNAV (RNP)**
SEL 10 - RNP from 0.3 down to **0.1 RNAV (RNP)**
See FM 6.1.8 for complete SEL list, See your release for SEL Codes.

RNAV Approach Procedures:

Managed, Non-ILS

- ILS or LS pb OFF
- CSTR pb ON
- Autopilot ON (all RNAV (RNP), RNP (AR) and any RNAV below 1000/3)
- FLTPLN Select and validate the appropriate approach
 - start “backward Z, double D” pattern here
- PROG enter .3 (or lower value if published)
- Ensure GPS PRIMARY and ACCUR HIGH are displayed
- PERF Enter DDA (MDA + 50 ft) for minimums or DA (see RNAV decision tree in QRH)
- DATA deselect RADIONAV (go to POSITION MONITOR, SEL NAVAIDS, RADIONAV DESELECT)
- DATA, GPS in NAV mode (select GPS MONITOR) and check 3R and 6R

When cleared for RNAV Approach:

- Select APPR pb to arm
- Note FMA indication of FINAL and APP NAV
- Note vertical deviation on right side of PFD

Prior to the RNAV FAF:

- Descend to altitude of FAF to capture vertical profile. Once FINAL APP is showing do not change vertical mode.
- Set ND to 10 nm scale
- Fully configure aircraft for landing

After the RNAV FAF:

- Ensure FMA shows FINAL APP
- Set Missed Approach Altitude
- At or prior to MDA or DDA disconnect autopilot and land visually or execute Missed Approach

PM should callout:

“TRACK” after IAF if crosstrack error reaches:

.2 nm (GPS/RNP) -or-

½ RNP (RNAV (RNP)/RNP (AR))

“PATH” if vertical deviation gets to ½ dot after FAF

American Airlines Airbus A319, A320, A321 Notes

Missed Approach should be executed if:

- GPS PRIMARY LOST or NAV ACCUR DOWNGRADE on ND or MCDU
- Failure of any required equipment (as listed in QRH)
- Crosstrack error reaches or exceeds the RNP value
- Vertical deviation at $\frac{3}{4}$ dot (75 ft) after FAF
- ECAM Message: FM/GPS POS DISAGREE, FMS1/FMS2 POS DIFF or MAP NOT AVAILABLE

When executing a missed approach due to position error pilot should use HDG and any ground based nav aids to avoid terrain. Use TOGA and climb to MSA if required.

Note: for RNAV visual approaches you will not have an associated DA or missed approach. Use 250' above AFL for MDA and reference any associated approach for the same runway for missed approach expectations.

Non-Managed, Non-ILS (LOC, LDA no G/S, ILS no G/S)

The Non-ILS, Non-Managed approaches are going to have some sort of Localizer tracking with no Glide Slope signal. This will include LOC (only), ILS (No G/S) and LDA (No G/S) approaches. In these approaches you will allow the aircraft to track the Localizer signal just as it would with an ILS but you will follow a descent angle down to a DDA (Derived Decision Altitude, MDA +50). The aircraft will produce it's own descent angle using FPA (Flight Path Angle). This is very different from Non-ILS Managed approaches. So be aware that you will use very different procedures.

The Localizer will be tracked by using the LOC p/b. This will work just as it does during an ILS approach for lateral tracking. Vertical path will be controlled by setting an angle for descent. Typically the pilot will set -3.0 for the FPA (Flight Path Angle). This allows a very smooth and stable decent that is close to the profile an ILS would have. The pilot will select FPV for Flight Director prior to reaching the FAF. At about .3 nm from the FAF the PF will set select to begin descent using FPA. Typically the pilot will "preselect" -3.0 in the FPA and then pull the knob for starting descent at around .3 nm from the FAF.

The PF can adjust the FPA up to one degree as needed if the aircraft is getting too high or low on the approach. So the allowed range of FPA for descent is -2.0 to -4.0. Usually if any adjustment is needed it is only a tenth of a degree or so. The descent is maintained until the PF has visual contact and the autopilot is turned off for manual landing or until DDA is reached and a go around is initiated for missed approach.

American Airlines Airbus A319, A320, A321 Notes

Procedures for Non-Managed, Non-ILS Approaches:

- LS (ILS) pb ON
- CSTR pb ON
- Autopilot ON (required for weather 1000/3 or less)
- Ensure proper procedure is set on FLT PLN page (check sequencing of waypoints)
- Ensure proper frequency is shown on RAD NAV page.
- Enter the DDA/DA on PERF page in the BARO field.
- Ensure Approach phase is activated prior to approach

- Press LOC pb prior to joining localizer
- Use DES, OP DES or V/S or FPA to descend to FAF altitude

- Once at FAF altitude and tracking LOC select FPV on Flight Director (if not already selected). Pre-select -3.0 degrees on FPA. Notice you must use a negative value so you don't climb! At around 0.3 nm from FAF select the FPA to begin the descent. You select the FPA slightly prior to the FAF to ensure not overshooting the vertical path. Adjust the FPA slightly (a click or two usually) to match the vertical path.

- After FAF inbound select Missed Approach Altitude

- PM will call "Path" or "Track" if deviating. After FAF call "Path" for vertical deviation of ½ dot (50 ft) and "Track" for .2 nm or ½ RNP for crosstrack (lateral) deviation.

- At DDA/DA, Disconnect the autopilot and land visually –or– execute a Missed Approach.

Call for Missed Approach if:

- GPS Primary LOST or NAV ACCUR DOWNGRADE message
- failure of required equipment
- crosstrack error at or exceeding the RNP value
- ¾ dot (75 ft) vertical deviation
- FM/GPS POS DISAGREE, FMS1/FMS2 POS DIFF or MAP NOT AVAILABLE ECAM

VOR/NDB approaches

VOR Approaches are also flown similar to the Managed, Non-ILS RNAV LNAV approaches. Just as the RNAV LNAV approach the VOR and NDB approaches are flown to an MDA but is using an artificial glideslope to create a stabilized approach. These approaches basically let the RNAV substitute for the VOR or NDB signals. If the VOR or NDB raw data is not available the approach may still be flown. For VOR approaches use the Managed RNAV procedures except:

- NAV must be utilized for approach VIAs (do not select APPR until cleared for approach and intercepting the intermediate segment)
- A coded VNAV flight path angle (FPA) in the FMGC is required for the final approach segment.
- Raw data may be monitored by the PM or flown in Map mode. Must remain within 5° of course.
- Do not change RNP on the PROG page
- NAV accuracy downgrade does not require a missed approach
- Add 50' to the MDA(H) to create DDA (Derived Decision Altitude)

Raw data may be monitored by manually tuning the PM's RADNAV page to the VOR. Select VOR identifier on PM's side. Raw data does not need to be monitored if you fly in Map mode (FM I 10.2.6)

Position PM VOR selector to VOR.

Both pilots should continue to use the PF's NAV display to monitor approach progress and improve situational awareness. Maintain within + or - 5° needle deflection.

PM should call "**VOR**" if raw data reaches 2 ½ degrees on the ND (except for station passage). Call "**Path**" at ½ dot (50 ft) vertical deviation.

Call for Missed Approach if:

- failure of required equipment
- More than 5 degrees deviation
- ¾ dot (75 ft) vertical deviation

Engine-Out Approaches

All single-engine approaches follow the same procedures as normal two engine approaches except that Flaps 3 will be used (exception: A320 must use Flaps FULL for autoland engine out approach). The aircraft is certified for autoland with single engine operation down to CAT IIIA single which will allow autoland approaches down to a DH of 50'. Also, all Non-ILS approaches must be flown manually.

① *Airbus Gotcha*: If an engine-out condition is detected by the FMGC the appropriate performance page will be brought up on the MCDU with an amber EO CLR* on LSK 1R (OM 17.6.39 & 18.3.7). This is asking if you wish to force the FMGC back to normal two engine data. If you press the EO CLR you will clear out the engine-out condition and the FMGC will revert back to the normal two engine data. Of course if you get a spurious EO CLR* during normal operations then you would want to clear the engine-out performance from the FMGC, which is why the prompt is there. The point here is during engine-out operations do not press the amber EO CLR* LSK!

Missed Approach procedures for Engine Failure will be listed in the Jepp App for airports with difficult terrain or departure procedures. This is similar to the Takeoff procedures for Engine Failure. For example, for Reno runway 16L the procedure is listed in the Company pages (CO) as RWYS 16L/R MA A319/A320/A321. This missed approach procedure can be loaded into the SEC F-PLN. However, for some reason the procedures are only listed as takeoff procedures if they have been built to be pre-loaded. So you must enter the Arrival airport as the Departure airport in the SEC F-PLN INIT. For example, for Reno enter KRNO/KRNO and then you can select the proper runway for the departure. If you lose an engine on missed approach select the SEC F-PLN to fly the proper procedure.

Visual Approaches

① *Airbus Gotcha*: Both Flight Directors should be turned off when cleared for visual approach and hand flying. This will ensure SPEED is showing for Thrust on the FMA and will help avoid unwanted “thrust excursions”. Once established on the final if you have instrument guidance (either ILS or RNAV) you may turn the F/D’s back on and select APPR *if* you will follow the Flight Director.

GET USED TO SAYING “AUTOPILOT OFF, FLIGHT DIRECTORS OFF”

Open descent prohibited below 1000’ AGL on a visual approach (OM 2.13.1)

When using speed select (manual speed selection – blue bug) I suggest the following speed ranges for a given flap setting. Note that this is based on my observation of managed speed, not on a written profile, and is simply my suggestion of comfortable speed ranges for a given flap setting. Of course you are able to select from V_{MAX} down to V_{LS} whenever needed but the following are suggested as flexible and comfortable speeds to use in line operations. As well, by using these “ranges” you have a visual reference in front of you at all times:

- Flaps 0 – down to green dot (suggest about 210)
- Flaps 1 – below VFE NEXT down to S speed (green S) (suggest 190)
- Flaps 2 – below VFE NEXT down to F speed (green F) (suggest 170)
- Flaps 3 – below VFE NEXT down to F speed (green F) (suggest 160)
- Flaps Full or 3 – Managed Speed – before 1000’

Note: recall that VFE NEXT is the amber equals sign on airspeed scale

Note: A321 may need slightly higher suggested speeds at heavy weights.

The alternate ILS technique (OM 18.6.6) works well for conservative Visual approaches as well (assuming on glideslope) and is similar to RNAV technique. If you plan on using this technique the FAA wants you to state “alternate ILS technique” in your approach briefing. (in parentheses is full ILS equivalent):

- Plan and configure to arrive prior to 3 nm from FAF with Flaps 2
- 3 nm from FAF – gear down (Dot and a half G/S)
- 2 nm from FAF – flaps 3 (Half dot G/S)
- 1 nm from FAF – flaps FULL (G/S intercept)

American Airlines Airbus A319, A320, A321 Notes

Go Around (AOM 11.1)

Set thrust levers to TOGA, this will activate go around mode and (if turned off) will turn on Flight Director. Go around flaps are to select one step up from the approach flap setting (i.e. if flaps Full, then select flaps 3, if flaps 3 then select flaps 2). During acceleration when at F speed go to flaps 1 whether you are at flaps 2 or 3. Single engine go around follows same procedure except you will not bring thrust levers back to CLB immediately. At acceleration altitude begin engine out clean up procedure

Note: TOGA will only activate Go Around Mode when Flaps are selected. At Flaps 0 TOGA will not activate Go Around Mode.

Once thrust is set to TOGA please note that autothrust is now manually set and WILL NOT reduce until brought back to the Climb detent by the pilot (as during a normal takeoff). This means that the autothrust will not reduce on level out while in TOGA detent. When in TOGA the aircraft will continue to accelerate when level until it hits the Vmax limit and Normal law takes over. If you TOGA on go around above 1000 AGL be ready to reduce thrust faster than normal if leveling at a low altitude. The “Soft Go Around” procedure has the pilot put the thrust levers in the TOGA detent and bring them back immediately to Climb.

Go Around Callouts (Soft Go Around)

PF	PM
“ Go Around, TOGA, Flaps_ ” (Thrust Levers to TOGA) ensure Nav/HDG set	“ TOGA Set ”, ensure TOGA set, Retract flaps to go-around setting (2 or 3), ensure Nav/HDG set
“ Climb ” Retard to CL detent (If TOGA not required)	Check THR CLB on FMA “ Climb Set ”
Verify positive rate of climb “ Gear Up ”	Verify positive rate of climb “ Positive Rate ” Position gear lever UP
Fly missed approach procedure or as directed by ATC	
“ Set Missed Approach Altitude ”	Set or verify altitude set. Advise ATC of missed approach or go around.
“ Autopilot 1 ” (or 2) (at or above 100')	Select requested autopilot
At or above 400 ft. “ Heading ____ ” if needed	Select heading as requested -or- Engage/Ensure NAV selected as needed.
At F speed “ Flaps 1 ”	Check airspeed above F speed and accelerating, select Flaps 1
At S speed “ Flaps Up, After Takeoff Checklist ”	Check airspeed above S speed and accelerating, select Flaps 0, disarm spoilers, After Takeoff Flow and Checklist

American Airlines Airbus A319, A320, A321 Notes

Engine Out Go Around Callouts

PF	PM
“Go Around, TOGA, Flaps_” (Thrust Lever to TOGA) ensure Nav/HDG set	“TOGA Set” , ensure TOGA set, Retract flaps to go-around setting (2 or 3), ensure Nav or HDG set
Verify positive rate of climb “Gear Up”	Verify positive rate of climb “Positive Rate” Position gear lever UP
“Set Missed Approach Altitude”	Set or verify altitude set. Advise ATC of missed approach or go around.
“Autopilot 1” (or 2) (at or below 100')	Select requested autopilot
Comply with any runway specific engine out procedures	
At or above 400 ft. “Heading ___” if needed	Select requested heading as requested Engage/Ensure NAV selected as needed.
At or above 1000 AFL (or as specified in published engine out procedures) Push V/S knob or request Vertical Speed 0	Push V/S knob if requested Verify Vertical Speed is 0
At F speed “Flaps 1”	Check airspeed above F speed and accelerating, select Flaps 1
At S speed “Flaps Up, After Takeoff Checklist”	Check airspeed above S speed and accelerating, select Flaps 0, disarm spoilers, After Takeoff Flow and Checklist
At Green Dot Select/request Open Climb Select/request Speed for Green Dot	Select Open Climb if requested Select Green Dot speed if requested
At Green Dot Speed Select MCT “MCT”	Verify thrust lever at MCT “MCT Set”

Note: A go-around at low altitude may result in the aircraft touching down on the runway. If this occurs while on autopilot the autopilots will remain engaged and accomplish the go-around. Be aware that if TOGA is selected *after* touchdown the autopilots will disengage to prevent an auto go-around. This is designed to prevent an inadvertent auto go-around takeoff during a touch and go.

Note: Normal Go-Around procedures do not have to be used above 1000' AFL. At pilot's discretion the aircraft could be flown without utilizing TOGA and Go-Around procedures. For example, while being vectored ATC decides spacing is too close and gives you a turn and has you level at 2000". Pilot could maintain configuration while complying.

American Airlines Airbus A319, A320, A321 Notes

Landing

Note: these are my personal tips and not necessarily procedures.

Bring thrust levers back to idle at about 20' in normal conditions. In gusty condition you may want to carry thrust longer. In gusty conditions I use 10' to go to idle. The aircraft has plenty of airspeed and energy with managed speed being flown and you will not need to delay thrust reduction to ensure proper flare in normal conditions. Don't let nose drop when normal nose down pitch is added at 50' in flare mode. I was used to flying smaller (and shorter geared!) jets and found it helpful to move my aim point on the runway from the 1000' marker to halfway between the 1000' and 1500'. Try to have the flare started by the 10' call. Do not carry thrust to the flare as the autothrust will begin to command climb thrust as speed deteriorates if you do not bring back idle. This will cause a "thrust bump" that will have you floating down the runway with excess energy.

On touch down use positive nose down to lower the nose. Be careful not to let the nose ride up when reverse is selected. Select Full Reverse as you lower nose. As the aircraft slows through 80 knots slowly push the thrust levers back toward idle reverse so as to be at or near idle reverse at 60 knots. Be sure you push the thrust lever all the way back through the detent into forward idle. Then retard the lever again against the stop to ensure minimum forward thrust in idle.

Landing Callouts:

"Pitch" or **"Bank"** if limits exceeded (PM)

"Deployed" when spoilers extended (PM)

Any abnormalities (**Single Reverse, No Reverse, No Speedbrake,**

No roll out, etc.) (PM)

"Manual Braking" when PF overrides autobrakes (PF)

"Autobrakes Off" when autobrakes disengage (PM)

"80", at 80 knots (PM)

"60", at 60 knots (PM)

Flaps 3 landings will tend to float more than Flaps Full. Be very careful when using Flaps 3 on shorter runways that you ensure touch down in a timely manner. Aircraft seems to level out in flare with Flaps 3 more quickly than with Flaps Full. Use a more "subtle" flare with Flaps 3 than with Flaps Full.

PM should make **"Pitch"** callout if the nose is at 10° or higher (A319, A320) or 7.5° (A321) during flare. Note that some aircraft had an automated PITCH callout installed. PM should make **"Bank"** callout if bank reaches 7°.

American Airlines Airbus A319, A320, A321 Notes

Crosswind Landings – Despite rumors, the Airbus uses conventional crosswind landing technique. Two points however; first, as the Airbus uses roll rate for the ailerons the pilot cannot HOLD the sidestick in the crossed control position. The sidestick must be released once the bank angle is established. Think of “bumping” in the needed bank. It is more intuitive than it sounds! Second, the sidestick is as sensitive in the flare as in cruise. Care must be taken to use measured inputs to the sidestick. The OM recommends aligning the aircraft with the runway centerline during the flare with the rudder. I normally use about 30 ft. to start aligning the nose. Be gentle with the rudder, it won't take much! Maintain the aircraft on the centerline with roll control. Release all roll input when the aircraft is on the ground. Autobrakes are required for crosswind component of 10 kts. or more. Recommend autobrakes for “short, wet, cross, cat” - Short runway, wet or contaminated, crosswind and CAT II/III

A persistent myth is that the Airbus will blend back to direct law during the flare mode. This is not completely true. The aircraft remains in normal law but normal law has a flare mode that begins at 50'. At 50' it takes a “snapshot” and the adds adds a pitch down at 30'. The pitch mode will change to a direct stick to elevator mode with some “damping” for load. Why do they add this pitch down? It is just to add an artificial feel of nose heaviness. Autotrimming is disabled in Flare mode. If autotrim was not turned off for the flare autotrim would just trim off your flare. Then you would balloon and pitch over, it would retrim and you would start all over again. So the pitch over is to give you an artificial back pressure to feel during the flare and Autotrim is turned off to prevent you getting into a situation of “chasing” the pitch. This will give more direct control to pitch but it is not a full blend back to direct. You will go to direct once you are on the ground.

Another common problem is that some folks will reduce the power very slowly. However, remember that autothrust is active until the thrust levers are all the way to idle (assuming autothrust is already active). So once you bring the thrust levers out of the Climb detent you aren't actually reducing thrust until the levers get all the way back to where autothrust has them commanded. You will only be limiting the amount of thrust that can be commanded. If you bring the levers back slowly you are only reducing the maximum amount that can be commanded but not actually reducing the thrust until you get them very far back. If you wait too long you get the thrust bump we just talked about as autothrust is still trying to maintain the speed.

In gusty conditions don't be afraid to use the full throw of the sidestick! In normal smooth air the stick can be very sensitive to slight pressures and is easy to overcontrol. However, in gusty conditions you may need to use full throw of the sidestick. You can always take it back out if you don't need all of it.

Maneuvers

Maneuvers are not considered “memory items” but the pilot is expected to be able to accomplish them immediately and appropriately in the given situation. Time to do that Pilot Stuff!

Windshear (AOM 17.3, QRH OD-11)

Takeoff – use TOGA, use longest suitable runway, use minimum allowable flap setting, consider increasing rotation speed if possible

Landing – Use Flaps 3, consider increasing approach speed

During a windshear encounter (reactive warning: Windshear, Windshear, Windshear!) the first pilot to recognize the windshear should call: **“Escape, TOGA”**, The PF should then call **“My Aircraft”**, apply TOGA thrust, roll wings level. Pitch up to 17.5° or follow Flight Director if available.

First pilot to recognize the windshear should call: “Escape, TOGA”	
PF	PM
“My Aircraft”	
<ul style="list-style-type: none"> ➤ Set TOGA thrust ➤ Roll wings level ➤ Pitch up to 17.5° or follow Flight Director if available. ➤ Autopilot may be used if engaged and useful, otherwise disengage autopilot (it may disconnect on it’s own). ➤ Use full back on sidestick if needed ➤ Maintain current gear/flap configuration until windshear exited 	<p>Ensure all actions are accomplished</p> <p>PM should call altitude from radio altimeter and climb/descent trend: “300’ descending, 200’ descending, 400’ climbing”, etc.</p> <p>Don’t change gear/flap configuration until safe (ensure Speedbrake stowed).</p> <p>Issue PIREP to ATC</p>

Reactive windshear warning is available from ground to 1300 ft. AGL. on takeoff and 1300 ft. AGL to 50 ft. AGL on landing. Reactive windshear is calculated from the FAC’s and means the aircraft senses it is already in a windshear condition. A reactive warning means you are IN windshear.

For a Predictive Windshear warning reject takeoff or go around on landing for Caution (amber and aural “Monitor Radar Display”) or Warning (red and aural “Windshear Ahead”). Do not reject takeoff/go around for Predictive Advisory (no aural). Basically, only reject takeoff or landing for an aural alert as the Advisory has no aural, use TOGA to continue for Advisory alert takeoff. On landing if

American Airlines Airbus A319, A320, A321 Notes

Predictive Windshear warning or caution given execute a normal go-around (you may reconfigure flaps and gear). Be aware on landing that you can do a normal go around if given a Predictive Windshear as you are not in windshear yet. It may be possible to still AVOID windshear if you get a Predictive Windshear warning. Consider turning to avoid shown windshear if possible.

Predictive Windshear protection is only available below 1500 ft. AGL to 50 ft AGL and up to 5 miles . On the ground it is available on takeoff until 100 kts.

Caution: Predictive Windshear is radar based and can only function with precipitation, it will not work in dry conditions. The severity of the warning (Advisory, Caution, Warning) is based on nearness and position of windshear, not strength of windshear.

EGPWS (AOM 17.4)

If “PULL UP” or “TERRAIN, TERRAIN PULL UP” or “OBSTACLE, OBSTACLE PULL UP” occurs at night or in IMC.

First pilot to recognize the EGPWS Alert: “TOGA”	
PF	PM
PF: “My Aircraft”	
<ul style="list-style-type: none"> ➤ Set TOGA thrust “TOGA” ➤ Autopilot off ➤ Roll wings level ➤ Sidestick FULL AFT until at safe altitude <p>Don't change gear/flap configuration until safe (ensure Speedbrake stowed).</p> <p>When clear of terrain, decrease pitch slowly to normal and accelerate. Retract flaps and gear and resume normal flight.</p>	<p>Verify all maneuver actions have been accomplished. Then the PM should call altitude from radio altimeter and climb/descent trend: “300’ descending, 200’ descending, 400’ climbing”, etc.</p> <p>PM call out safe altitude: “MSA is 6,500 ft.”</p>

TCAS RA Maneuver (AOM 17.5)

If a traffic resolution is given (CLIMB, DESCEND, MAINTAIN VERTICAL SPEED MAINTAIN, ADJUST VERTICAL SPEED ADJUST):

PF	PM
“My Aircraft”	
“Autopilot OFF, Flight Directors OFF”	Select BOTH Flight Directors off. Ensure Autopilot is OFF. Notify ATC

PM should ensure Both Flight Directors are turned OFF and all actions are completed.

Adjust vertical speed as required to remain in green area of vertical speed scale (stay outside of red). Avoid excessive maneuvers, if needed use full speed range from V_{max} to α_{max} . Go Around must be performed if RA CLIMB or INCREASE CLIMB is given on final approach. After clear of conflict autopilot and flight directors may be put back on.

Low Energy Warning (AOM 21p.1.3)

If during approach conditions additional thrust is needed to recover a positive flight path you will get a synthetic voice: SPEED, SPEED, SPEED
Increase thrust until warning stops. Selecting MCT on thrust levers will work well.

American Airlines Airbus A319, A320, A321 Notes

Approach to Stall (AOM 17.1)

ANY aircraft can be stalled if critical Angle of Attack is exceeded, including the Airbus. Even though Normal Law should prevent this from happening you are expected to be able to recognize and properly respond to a stall situation. A stall can happen at any speed or attitude. You may have to lower the nose well below normal in order to get the wing flying again. The Airbus A320 series has powerful engines that are low slung beneath the wing. This may cause a pitch up when at low speed that could cause a secondary stall. Bring in power slowly once you have broken the stall to avoid an unwanted pitch up at slow speed. Always respond to the first indication, aural, buffet or visual.

Approach to Stall – Recognize and Confirm the Situation	
PF	PM
“My Aircraft”	
Autopilot - Disconnect	
<ul style="list-style-type: none"> • Pitch – Apply nose down elevator (reduce thrust if needed to lower pitch) • Roll – Roll in shortest direction to get to wings level • Thrust – Adjust as needed • Configuration – Do not change gear/flap configuration during recovery. 	<ul style="list-style-type: none"> • Verify all actions and call out any omissions. • Monitor attitude, airspeed and attitude • Monitor radio altitude and call out flight path information: “300 feet descending” “200 feet descending” “400 feet climbing”, etc.
After Stall Recovery: <ul style="list-style-type: none"> • Increase thrust smoothly as needed • Speedbrake – retract if extended • Recover flight path smoothly • If below 20,000 feet and clean extend Flaps 1. 	Select Flaps 1 as requested

Stall Warning on Takeoff	
PF	PM
“My Aircraft” “TOGA” – set TOGA thrust	Ensure TOGA thrust set “TOGA set”
Autopilot – OFF Pitch – attitude 15° up Roll – wings level	<ul style="list-style-type: none"> • Ensure all actions have been accomplished • Monitor attitude, airspeed and altitude
After a safe flight path and speed are accomplished, if stall warning continues, consider it spurious	

American Airlines Airbus A319, A320, A321 Notes

Upset Recovery (AOM 17.2)

If the pilot is presented with these scenarios it is assumed that the aircraft has been forced into them due to outside forces (Wingtip vortices, extreme windshear, etc.) or by system failures. Normal Law would normally preclude these situations from happening. Assumes aircraft not stalled.

Nose High Recovery	
PF	PM
At first indication of nose high upset “My Aircraft”	
Autopilot – OFF (if needed) A/THR – OFF (if needed) Pitch – nose down Thrust – adjust as needed Roll – adjust as needed	Monitor airspeed and attitude throughout the recovery and announce trends away from recovery.
When airspeed is sufficiently recovered Recover to normal level flight	

Note: During Nose High recovery if pitch is not reducing enough you may need to bank the aircraft up to 60° bank in order to lower nose to the horizon.

Nose Low Recovery	
PF	PM
At first indication of nose high upset “My Aircraft”	
Autopilot – OFF (if needed) A/THR – OFF (if needed) Recover from stall (if needed) Roll – adjust as needed Thrust and Drag – adjust as needed Pitch – nose up	Monitor airspeed and attitude throughout the recovery and announce trends away from recovery.
When airspeed is sufficiently recovered Recover to normal level flight	

Note: keep low G loading while rolling wings level as this will increase roll rate while lowering stresses on aircraft

American Airlines Airbus A319, A320, A321 Notes

Wake Turbulence (AOM 17.8)

Wake Turbulence Recovery Actions	
PF	PM
Autopilot - Disconnect	
Pitch <ul style="list-style-type: none"> Apply nose down elevator if needed to recover from stall and to aid in rolling wings level Roll <ul style="list-style-type: none"> Roll to shortest direction for wings level Thrust <ul style="list-style-type: none"> Adjust thrust as needed 	<ul style="list-style-type: none"> Ensure all actions completed and callout any omissions Monitor altitude, airspeed, attitude Monitor radar altitude and callout flight path information
<ul style="list-style-type: none"> Adjust pitch to horizon Check airspeed/adjust thrust Initiate go-around if on approach and probability of another encounter 	Advise ATC as needed

Driftdown and One Engine Cruise (AOM 17.7, QRH FC-2, 10-4)

Driftdown and One Engine Cruise will be used for descent when a loss of thrust means the aircraft is not going to be able to maintain altitude but the crew does not want to descend any more than necessary. For example loss of an engine over the ocean and far from diversion airport or loss of engine and over mountains. The goal is to maintain as much altitude as possible for terrain clearance and/or decreased fuel burn.

Driftdown and One Engine Cruise	
PF	PM
<ul style="list-style-type: none"> THR LEVERS – MCT A/THR – OFF Turn – if not in radar contact 45° left or right hand turn SPD/MACH – SPD Speed Select – GREEN DOT Altitude – At Green Dot select lower altitude 	<ul style="list-style-type: none"> ATC – Notify Exterior Lights – all ON Apply QRH procedure for Driftdown and One Engine Cruise

American Airlines Airbus A319, A320, A321 Notes

Emergency Descent (AOM 17.6)

Emergency Descent is to be used when a lower altitude is needed in a minimal time. For example loss of pressurization or fire in cabin. The goal is to lose altitude as rapidly as possible without danger to passengers and flight attendants in cabin in order to deal with the emergency.

Emergency Descent Actions	
"Emergency Descent"	
PF	PM
"My Aircraft"	
Altitude <ul style="list-style-type: none"> Descend to 10,000 feet or minimum safe altitude whichever is higher Continue descent to 10,000 feet when able Heading <ul style="list-style-type: none"> Select turn or proceed straight ahead as needed Airspeed <ul style="list-style-type: none"> SPD V_{mo}/M_{mo} Limit speed if damage suspected Wait at least 10 seconds then: <ul style="list-style-type: none"> Extend Speedbrakes slowly Consider extending landing gear 	Apply Emergency Descent procedures from QRC Oxygen masks if needed PA - Emergency descent, Be seated Seat Belt sign ON Engine Ignition ON Transponder 7700 Altimeter setting to local Check safe altitude If cabin altitude above 14,000', PAX MASK MAN ON When cabin below 10,000' notify Flight Attendants

Loss of Braking (AOM 16.8)

If Autobrake is selected: Press Brake Pedals to override Autobrake
If no braking available: <ol style="list-style-type: none"> Select MAX REV Brake Pedals – Release A/SKID & NW STRG – OFF Brake Pedals – Press MAX Brake Pressure – 1000 psi
If still no braking: Parking Brake – short & successive applications

A to Z Acronyms and Abbreviations

These are just my short list of favorites and there are many others but for the most part these should get you by.

The really short list of Airbus acronyms and abbreviations (complete list found in back of OM):

α – Stands for ALPHA as in α PROT. Refers to Angle of Attack.

ACM – Air Cycle Machine

ACP – Audio Control Panel, allows pilot to select which radios or interphones to listen to.

ADIRS - Air Data Inertial Reference System, now replaced by GNADIRS

ADIRU - Air Data Inertial Reference Unit

AMU - Audio Management Unit

ASAP – as in LAND ASAP, As Soon As Possible (this really is listed, I'm not making this up)

A/SKID - Anti-skid

BSCU - Brakes Steering Control Unit (computer)

BTC - Bus Tie Contactor

CFDS - Centralized Fault Display System

CRC – Continuous Repetitive Chime, used to be called the fire bell.

DDA – Derived Decision Altitude, during RNAV approaches and VOR approaches the pilot will add 50' to the original MDA to create a new DDA unless a note specifying use of VNAV DA(H) is present. This adds a pad to allow room to go-around from the now stabilized descent instead of the level-off of the MDA.

DDRMI – Digital Distance and Radio Magnetic Indicator (RMI with DME)

DMC - Display Management Computer

DU - Display Unit (CRT, or "TV screen")

American Airlines Airbus A319, A320, A321 Notes

ECAM - Electronic Centralized Aircraft Monitoring

EIU - Engine Interface Unit

ELAC - Elevator Aileron Computer

EO - Engine Out

E/WD - Engine/Warning Display, upper display for aircraft systems.

FAC - Flight Augmentation Computer

FM – Flight Manual

FCU - Flight Control Unit (autoflight panel)

FMGC - Flight Management Guidance Envelope Computer, what actually performs the computations when you type into the MCDU.

FMGS - Flight Management Guidance Envelope System

F-Plan - Flight Plan

FPA - Flight Path Angle

FWC - Flight Warning Computer

FWS - Flight Warning System

GCU - Generator Control Unit

GLC - Generator Line Contactor

GNADIRS – Global Navigation Air Data Inertial Reference System, GPS, Air Data information and Inertial attitude/guidance all in one.

Green Dot – Best L/D (lift over drag) speed, normally used as the target speed at end of takeoff or for single engine climb out. Technically called VFTO (Final Takeoff Speed). On the Airbus a green dot on the airspeed scale.

IDG – Integrated Drive Generator (the old CSD and generator all in one unit)

INIT - Initialization

American Airlines Airbus A319, A320, A321 Notes

JFA – Just Flying Along, used a lot in ground school as in: “...there you are just flying along when the demodulator quits causing the blah blah ECAM blah blah amber FAULT blah blah second channel blah blah and that’s all there is to it.”

L/G - Landing Gear

LGCIU - Landing Gear Control Interface Unit (I think this one is extra credit, we just called it the linguini)

LSK - Line Select Key (keys used on MCDU screen)

MCDU - Multipurpose Control and Display Unit (this is the actual box used to enter data into the FMGC, you getting all this?)

MEA- Minimum Enroute Altitude, provides terrain clearance on airway and normally assures nav signal coverage.

MOCA – Minimum Obstacle Clearance Altitude, provides terrain clearance on airway, not signal coverage. Denoted by letter “T” after altitude.

MORA – Minimum Off Route Altitude, provides obstacle clearance within 10 nm of airway centerline. Denoted by letter “a” after altitude.

MMR – Multi Mode Receiver, the GPS receiver for the GNADIRS, two are installed

MSA – Minimum Safe Altitude, on an approach chart the lowest you can safely descend if not on a charted route. Normally based on 25 nm from depicted nav aid, can be expanded to 30 if shown. MSA’s provide 1000 ft. of obstacle clearance but do not ensure signal coverage. May be divided into sectors not less than 90° each.

ND - Navigation Display (has all those nice little pictures on it to let you know where you are)

N/W – Nose Wheel

OM – Pilots Handbook, Operating Manual

pb – pushbutton

PF – Pilot Flying, the person actually handling the control or autopilot input. Also the person to blame for the bad landing.

PFD - Primary Flight Display, the display you will look at the most, has airspeed, altitude, attitude, heading and more. Remember, Blue Up, Brown Down!

American Airlines Airbus A319, A320, A321 Notes

PM – Pilot Monitoring, the non-flying pilot, used to be called PNF (Pilot Not Flying). A politically correct way to say this guy is just a professional critic, don't blame him for the landing.

PTU – Power Transfer Unit, pump that is able to transfer power (but not fluid) between the green and yellow hydraulic systems

QRH – Quick Reference Handbook

RAT - Ram Air Turbine, an air driven backup pump for blue hydraulic

RMP - Radio Management Panel, allows pilot to select which radio to tune or transmit on.

SD - System Display, lower display for aircraft systems.

SDAC - System Data Acquisition Concentrator

SEC - Spoiler Elevator Computer

SFCC - Slat/Flap Control Computer

SRS - Speed Reference System

THS - Trimmable Horizontal Stabilizer

TLA - Thrust Lever Angle, the TLA indicator is a white “donut” on the N1/ EPR gauge. This indicates the setting of the thrust lever.

TOGA – Takeoff Go Around. Highest selectable thrust level. Selected by putting thrust levers in TOGA detent. Also a mode for the Flight Director.

TRU - Transformer Rectifier Unit, also known as TR, transformer rectifier

UTC - Universal Coordinated Time (a politically correct way to say Zulu or GMT)

VFTO – Final Takeoff Speed, normally called “Green Dot”, best lift / drag

WHC – Window Heat Computer

WTB – Wing Tip Brake

XFR - Transfer

American Airlines Airbus A319, A320, A321 Notes

ZFCG - Zero Fuel Center of Gravity

ZFW – Zero Fuel Weight

Z time – Zulu Time or UTC. The old Greenwich Mean Time said another way.

Bonus – what persons names are on the Airbus instrument panels?

Answer – Max, Norm, Rose, Agent 1 & Agent 2, Rat Man

Extra Bonus – How do Airbus pilots celebrate their first line trip? Answer – they have a TOGA party. I know, bad one...

American Airlines Airbus A319, A320, A321 Notes

Legal Stuff

Minimum F/A staffing (for flights with passengers)

	Standard Complement	FAA Minimum for flight (including boarding / deplaning)	Through flights at gate with passengers onboard
A319	3	3	1
A320	3	3	1
A321	4	4	2

Cabin Configuration (AOM 20.1.2)

<i>Number of seats in cabin</i>	<i>A319</i>	<i>A320</i>	<i>A321K & R (Oasis)</i>	<i>A321T (Transcon)</i>	<i>A321NX</i>	<i>A321NA</i>
<i>First Class</i>	–	–		10		
<i>Business</i>	8	12	20	20	20	16
<i>Coach</i>	120	138	170	72	176	174
Seats:	128	150	190	102	196	190

Loading Last Minute Baggage/Passengers (AOM 4.1.3)

Baggage - Right engine must be shut down. Left engine at idle. Load forward and aft compartments. (report “Shutting down right engine, left engine at idle” on intercom)

Passengers – If portable stairs or stand will be used instead of jetway use following. Left engine must be shut down. Right engine at idle. (report “Shutting down left engine, right engine at idle” on intercom)

American Airlines Airbus A319, A320, A321 Notes

Taxiing

The captain is NOT required to stop only because a passenger leaves seat during taxi. Use judgment to determine if stopping will create a greater possible hazard. When able stop and re-seat passenger.

The captain may decide when visibility is sufficient. During low visibility operations only run checklists when aircraft stopped or on straight taxiway with no "complex" intersections. If low visibility use SMGCS if published for below RVR 1200. The lowest reporting RVR on the airport is the controlling RVR for taxi out.

Headsets / Boom Mikes (AOM 1.4.4)

Headsets and Boom Mikes must be worn below 18,000 ft.

Oxygen (FOM 1g.5.5)

Both pilots must wear oxygen anytime cabin altitude exceeds 10,000'.

Max Holding Speeds and Leg Timing (FOM 8g.3.3, 8g.3.4, 8g.3.5)

FAA holding speeds

Through 6000 ft.	200 KIAS, 1 min.
Above 6,000 through 14,000 ft.	230 KIAS (210 KIAS where published), 1 min.
Above 14,000 ft.	265 KIAS, 1 min. and 30 secs.

ICAO holding speeds

Through 14,000 ft.	230
Above 14,000 through 20,000	240
Above 20,000 through 34,000	265
Above 34,000	0.83 M

Standard pattern – right hand turns

Non-Standard pattern – left hand turns

American Airlines Airbus A319, A320, A321 Notes

Minimum Safe Altitudes (FOM 1g.6.4)

In terminal area: MSA, within 25 nm of defined nav aid: On approach chart, SID/STAR

Enroute: MEA, Airway centerline, number on airway: 10,000

Enroute: MOCA, 4 nm of airway centerline, number with "T": 4,000T

Off Route: Route MORA, 10 nm of airway centerline, number with "a": 3200a

Off Route: Grid MORA, within defined grid sector, number near center of grid

Alternates (FOM 2.5.x)

OK, unless you are lawyer or accountant material stand by for your eyes to glaze over on this next little bit. But hang in there, I will try to break it down for you!

- This part determines if you need an alternate for your destination:

Domestic destination alternate is required unless weather for destination at ETA \pm 1 hr. is at least:

- Ceiling: 2000 ft. above airport elevation
- Visibility: 3 sm.

An alternate is also required if there are winds in excess of FM Chapter 10.7 Landing Limitations, Icy or slippery runways, snow or slush exceeding the maximum allowed or Volcanic ash.

Still with me? OK, this part is to help you decide if you need an alternate for your departure airport.

American Airlines Airbus A319, A320, A321 Notes

Takeoff Alternate (FM 6.3.1)

Declare a takeoff alternate anytime weather conditions at the departure airport are below CAT I landing minimum. Airbus is allowed exception down to CAT IIIA minimums if available and useable at departure airport and aircraft must be at or below max landing weight. Takeoff alternate must be within 1 hr. from departure airport with one-engine inoperative. For planning purposes use:

Type Aircraft	Ave. KIAS	Distance NM	Fuel Flow lbs./hr.	Assumed Altitude
A319	320	373	6,900	11,000
A320	320	368	6,900	10,000
A321	320	368	8,200	11,000

Takeoff Alternate is required anytime weather at departure airport is below CAT I minimums except Airbus when CAT II/III is available, then Takeoff Alternate not required until weather minimums below CAT IIIA (single). This assumes that the aircraft will be at or below Max Landing weight for return and can use the CAT II or CAT III approach. The idea here is that you need an alternate if you cannot return immediately to your departure airport if you have a problem.

American Airlines Airbus A319, A320, A321 Notes

- This part shows whether you have good enough weather to depart.

Standard Takeoff Minimums (FOM 5.g.4)

1 statute mile or RVR 5000

Note: If published Takeoff minimums are higher than standard you must use the higher published minimums. If Standard Takeoff Minimums are published you may use the Lower Than Standard Minimums.

Lower Than Standard Takeoff Minimums (QRH pg.OD-1, FOM table 5g.4.1)

This information is available on Jepp charts (back of airport taxi chart, usually 10-9) for airport and in QRH OPS DATA. You must use the higher of the two for given situation. For example, Jepp lists ¼ mile for KLAS but Ops Specs show 500 RVR, you are limited to ¼ mile. Also, note required lighting and runway markings for specified RVR. Currently down to as low as 500 RVR

Note: Captain must make takeoff if less than 1600 RVR or ¼ mi. visibility (due to lack of reference if reject and change of control from Capt. to F/O) (FOM 5.7.1)

- You are still awake? All right then, this section tells you what the criteria is to allow an airport to be an alternate for either takeoff or destination.

Alternate weather minima (AWM) apply for both destination and takeoff alternates. Minima is based on straight in precision or non-precision approaches. For airports with at least two appropriate approaches the approaches must be to separate, suitable runways (can be opposite ends of same physical runway).

Alternate Airport Requirements

Facility	Ceiling	Visibility
1 nav aid	CAT I HAT + 400 ft.	CAT I visibility min. + 1 sm or 1600 meters
2 or more nav aids	CAT I HAT of highest of the two approaches +200 ft.	CAT I vis. mins. to highest app. mins. + 1/2 sm or 800 meters
Only applies to aircraft capable of engine out CAT 2/3: At least one CAT II or III approach	CAT II – 300 ft CAT III – 200 ft	CAT II – RVR 4000 or ¾ sm CAT III – RVR 1800 or ½ sm

Note: IFR alternate weather minima are restrictive for dispatch (filing) purposes. Once committed to an alternate airport, standard approach minima apply.

Exemption 3585 allows domestic flights to be released based on the “main body” of the forecast for a destination. Conditional portions of the forecast are minimized. Conditional means the parts of a forecast that are “probable,

American Airlines Airbus A319, A320, A321 Notes

temporary or becoming". The standard minimums apply for the main body of the forecast but for the conditional portion the following apply:

Destination: Visibility at or above half of landing minimum.

First Alternate: Visibility and ceiling at or above half of landing minimums.

Second Alternate: Visibility and ceiling at or above landing minimums.

Note: Two alternates must be used for exemption 3585.

Must be able to fly to destination, fly to alternate and then fly 45 minutes at normal cruise consumption rate.

Domestic ILS Approach Exemption 10,000 (FOM 2.5)

In contiguous US no alternate required if for at least 1 hour prior to 1 hour after ETA the weather reports or forecasts indicate at least 1,000' ceiling and at least 3 sm visibility at airports with ILS CAT I, II or III approaches. No thunderstorms may be reported or forecast for the time period.

Authorized Instrument Approaches (AOM 10.1.2)

ILS – ILS CAT I, ILS CAT II, SA CAT II, ILS CAT III, ILS/DME, ILS/PRM

Non-ILS – LOC, LDA, LDA/DME, LDA without GS, LDA DME without glideslope, LDA/PRM, RNAV GPS, RNAV GPS PRM, RNAV GNSS, RNP, VOR (with VNAV), VOR/DME (with VNAV), NDB with VNAV, SDF

NOTE: Check SEL list to ensure aircraft is equipped for specific approach.

Approach Minima

See QRH OPS DATA for actual required visibility minimums.

CAT I, decision altitude (DA), uses barometric altimeter

CAT II, decision height (DH), uses radar altimeter

CAT IIIA (Single, Fail-Passive), decision height (DH), uses radar altimeter

CAT IIIA (Dual, Fail-Operational), alert height (AH), uses radar altimeter

CAT IIIB (Dual, Fail-Operational), alert height (AH), uses radar altimeter

Use CAT C for straight in approaches (A321 CAT D), CAT C for circling unless app. speed is greater than 140 KIAS, then use CAT D (AOM 10.1.3)

American Airlines Airbus A319, A320, A321 Notes

ATC Clearance (FOM 5.1.2)

Request clearance no earlier than 20 mins. prior to departure time. Departure clearance is good for 2 hrs. past scheduled departure time. Call Clearance Control to extend valid clearance time if necessary.

If ATC changes the routing from what is filed the changed routing is shown as:

*****REVISED SEGMENT*****

on the PDC printout. The revised segment is what should be programmed into the FMGC.

Hot Brakes – (AOM 6.4.6) AML entry and maintenance action is required if there is:

- 150° C difference in brake temps on the same strut *and* one brake 600° or greater *or* 60° or less
- a mean 200° C difference between different trucks
- fuse plug melted
- brake temp exceeds 900° C (800° - A321)