

Familiarization Folder

Simulator SE-BOH

Version 2012-03-18

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Simulator Overview

The simulator is driven by 6 computers interconnected in a 100 Mbit LA

FS Computer

Drives a BENQ 762ST projector with a 220 cm wide screen (100")

FS9

FS9 support programs – airport scenery, UT Europe

B737 Radio stack

ENVIRONMENT Sounds

Project Magenta MCP interface.

Dual CP Flight EFIS Controllers, CP Flight MCP, CP Flight MIP controller

SHUTTLE 1 17" Widescreen (PFD, ND, EICAS, SBY)

Project Magenta B737NG Glass Cockpit – CPT PFD/ND

SA_WXR – Collins 2100 - Weather Radar

PM EGPWS system (with Terrain display)

PM Upper EICAS

SHUTTLE 2 10.4 and 17" Touch screens

Project Magenta Systems (B737 Overhead Panel / Glare Shield Warning Panels)

Electronic Flight Bag with moving maps

VATSIM client and AUDIO

Intercom system, FIRE Suppression system, Flight deck Warning sounds, EGPWS sounds.

SHUTTLE 3 CDU screen 7" Color TFT

Project Magenta B737NG FMS

Flight Deck Solution hardware CDU

SHUTTLE 4

InterfaceT – Overhead interface

SIOC – instrument (MIP/Overhead) interface

PM F/O PFD/ND 17" Widescreen

PM Lower EICAS 10" TFT screen

INSTRUCTOR 2 x 20" TFT

Instructor Station (Louis Gordo), FSDS Fire Suppression Control Program

SA-WXR Radar, TR Autobrake Pro, TSR Fuel Handle (for APU),

Active Sky, Top Cat Dispatch with Fuelling program

B737NG Simulator Flight Systems

FMS Flight Managing System

All Smiths FMS modes and CDU pages are simulated.
The FMS System is controlled via a single Flight Illusions hardware CDU mounted in the CDU bay.
The database is recent AIRAC each cycle is updated every 21 days

In addition the CDU has special pages for Pushback and Simulator controls. In the ACARS page there is a METAR download function.

MCP Mode Control Panel

All functionality of the B737NG MCP
SPD Intervention and ALT Intervention by depressing SPD/ALT for 1 sec

EFIS Controller

All functionality of the B737NG EFIS Controller.
All modes are supported in ND and PFD

TQ Throttle Quadrant

All functionality of the B737 TQ except:
There are **no servomotors** for the A/T, Speed Brakes or Trim.

Center Pedestal

COM, 2 x NAV, 2 x ADF, TCAS II Transponder,
Engine Fire Panel (fully working), Cargo Fire Panel, Collins WXR2100 Radar Fully working with TILT, RANGE, GCS, OFF, PAC / PAC Alert)
Takes its data direct from FS9 weather.
Rudder Trim Panel, Stab Trim Panel.
Plus one non-B737 control panel for: Sim Push-Back, Electronic Checklist and PTT button.

MIP Main Instrument Panel

All **essential** functions, auto brake panel, gear system, flap indicator, brake press indicator as well as all warning annunciators are operative.
All dimmers for backlight and floodlights are functional.

FWD Overhead Panel

Fully working with all gauges - exception are the Electrical Power Monitor and Cabin Controller which are "cosmetics"

Auto brake

Enhanced simulation with TSR Autobrake Pro.
Correct T/O and stopping distances in WET, DRY, SLUSH rwy conditions.
Correct auto brake logics.

Glare Shield

All fully functional except the DU and SYS/ENG switches

Ground Steering Tiller

Fully functional - limited to 60 Kts

Rudder Pedals and Yoke

Working on CPT side only at the moment.

Audio

Online ATC via separate speakers and headsets.
Three MIC/BOOM headset connections on the CDU Bay and Center Pedestal.
Full intercom between CPT-F/O
Engine / System / Environment sounds via separate 5.1 speakers

Electronic Checklist

Full automated electronic checklist system in the Navigation Display.
Controlled from Center Pedestal

Navigation Systems Overview

IRS Inertial Reference System

There are two IRS systems installed in a B737NG. Each IRS computes its own position independently; consequently they will diverge slightly during the course of the flight. After the alignment process is complete, there is no updating of either IRS positions from any external sources. Therefore it is important to set the IRS position accurately in [POS INIT](#).

GPS Global Positioning System

There are two independent satellite GPS receivers installed. Their main purpose is to feed the FMS. The FMC uses GPS position as first priority for FMC position updates. Note this allows the FMC to position update accurately on the ground, eg if no stand position is entered in POS INIT. This practically eliminates the need to enter a take-off shift in the [TAKE-OFF REF](#) page.

Radio Position

This is computed automatically by the FMC thus allowing the FMC to select the optimum DME or VOR stations required for the position fix. NG's have two extra dedicated DME interrogators (hidden) for this purpose. Radio position is found from either a pair of DME stations that have the best range and geometry or from DME/VOR or even DME/LOC.

The NAV STATUS page in the CDU shows the current status of the nav aids being tuned. Nav aids being used for navigation (ie radio position) are highlighted.

FMC Position

The FMC uses GPS position as first priority for FMC position updates, it will even position update on the ground. If GPS is not available, FMC position is biased approximately 80:20 toward radio position and IRS L. When radio updating is not available, an IRS NAV ONLY message appears. The FMC will then use a "most probable" position based on the IRS position error as found during previous monitoring when a radio position was available. The FMC position should be closely monitored if IRS NAV ONLY is in use for long periods.

Note:

*The simulator as well as the real aircraft **can** be flown with raw navdata only and without the FMS or IRS system operative.*

Primary Flight Displays

Here are only shown systems that are actually installed and operative in the simulator.

PFD Primary Flight Display

ND Navigation Display



The speed tape shows minimum and maximum operating speeds. Flap speeds, Vref speeds. The maximum operating speed provides a 0.3g maneuver margin to high speed buffet.

A PFD options is the analogue/digital angle of attack display. The red line is the angle for stick shaker activation; the green band is the range of approach AoA.

The PFD can show correct **Traffic Advisory** from the TCAS II system when activated on the EFIS controller. The NAV display modes are also selected on the EFIS Controller.

MCP Mode Control Panel

The MCP (in the center) on the Glare Shield is the B737 “autopilot” control panel.



EFIS Controllers left and right of the MCP – Master Warnings in the ends with the “six-pack” warning annunciators. Those warnings refer to the Overhead Panel.

EFIS Control Panel

To the left and right of the MCP you have this panel that controls all EFIS modes in the ND and PFD independently for CPT and F/O PFD/ND displays.



WXR displays the COLLINS 2100 weather radar display super imposed on the ND.

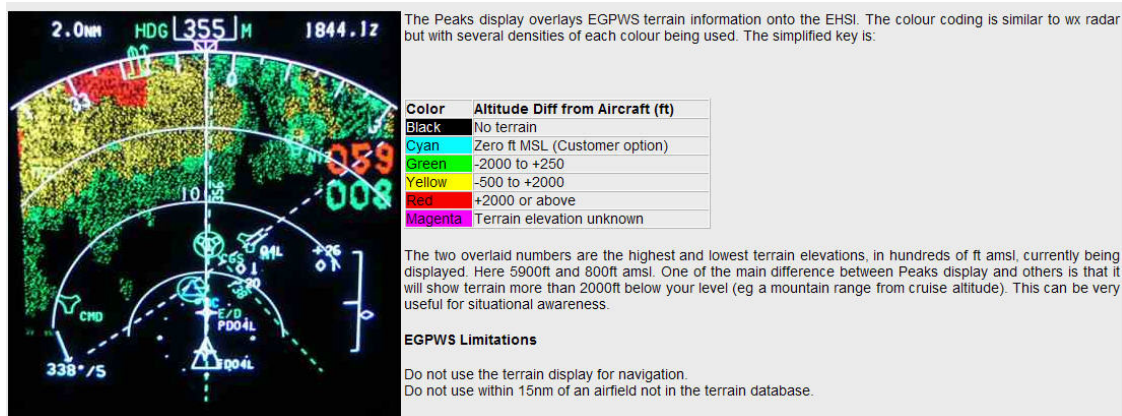
Range on the radar follows selected ND range.

Further radar adjustments can be made from the Radar Panel on the Center Pedestal.

TERR displays the EGPWS terrain information superimposed on the ND.

Only selected airports have terrain info – mainly ones that have mountainous surroundings.

The radar modes is controlled from a Radar Panel in the Center Pedestal.



TCAS II is integrated into the [EFIS displays](#).

The PFD/EADI will display advisories for climb, descend whenever there is a collision risk. The ND/EHSI in map view show all targets within 80 nm included their altitudes/vertical movements. TCASII aural warnings are implemented.

TCAS II works with either the simulated enhanced “AI Traffic” or the actual traffic online (VATSIM)

Aural Warnings

Cockpit aural warnings include the (fire bell), take-off configuration warning, cabin altitude, landing gear configuration warning, mach/airspeed over speed, stall warning, EGPWS/ TCAS II and Windshear. Only certain warnings can be silenced whilst the condition exists. All EGPWS/TCAS II warnings are functional in the sim – even those in PFD and ND. All standard GPWS aural warnings are functional.

Auto Radio Altimeter Callouts at 2500, 1000, 100, 50, 40, 30, 20 and 10 feet plus the following:

"Minimums"
 "Plus Hundred" when 100ft above DH
 "Approaching Minimums" when 80ft above DH
 "Approaching Decision Height"
 "Decision Height"

EFB Electronic Flight Bag

A Class 3 EFB is installed in SE-BOH on CPT side on a 10.4" Touch screen with a remote 17" touch screen on F/O side.:

The EFB map system constantly show updated (GPS) position on a moving map. Full set of charts updated every month.



Real B737NG EFB

Dispatch and Instructor Station

A separate computer with LAN access for Instructor and service use.

Actual Weather Download or specific weather setting such as CAT I, II or III weather, Day, Night, crosswinds, turbulence, windshear , A/C system malfunctions,
 Flight planning and Dispatch tools (Loadsheets, Wx briefing, Company Flight Plan)

Flight planning can also be performed from the EFB (Electronic Flight Bag) at CPT left side.

Training Flights

All types of flight can be made – there are high definition scenery installed for most major and medium airfields within EU.

All roads, rivers lakes, urban areas and coastlines are visible when weather conditions permits.

All NAV data is kept updated with the actual AIRAC 21 day navdata cycle..

The software allows you to make **all** kinds of approaches in **all** kinds of weather/wind.

CAT I / II / IIIA approaches with full AUTOLAND or manual approaches.

Simulation of dry/wet/slush/snow/ice contaminated runways is implemented and affects takeoff and landing distances accordingly.

The FMS has all capabilities of the real 737NG including VNAV/LNAV.

Normal Line flight preparation include:

1. TopCat Dispatch Program (*at Instructor Computer Station*)
 - Calculates Block Fuel / Flight Time estimate with real online upper winds.
 - Auto Loads the simulator with Load sheet Fuel/Payload.
 - Calculates Derates, flap setting, runway requirements, auto brake settings.
 - Prints Load sheet, runway computations, METAR/TAF and various other reports.
2. Compute a Flight Plan or use a CO Flight Plan stored (or downloaded) in the CDU. For an EFB Computed flight plan the ATC routing is validated via EUROCONTROL automatically.
3. Program the FMS system via the CDU – routing, SID/STAR, takeoff data, derates ...
4. *File ATC plan on Vatsim (if ATC is preferred)*
Instructor sets the Simulator WX / RWY conditions if not actual WX is preferred.

Compared with a full flight B737NG simulator

You can not compare those as this sim is “fixed” e.g. not moving; have no flight deck enclosure and a somewhat limited forward view.

In essence it is a system simulator with full MIP, Glare shield, Center Pedestal, FWD Overhead Panel, Ground Steering Tiller, B737TQ and Flight Controls.
Flight deck front view is generated by a projector on a 220 m wide screen.

There are obvious things that can not be implemented due to space limitations and/or economy reasons. Among those – a full flight deck enclosure.

The systems are simulated as far as possible and are true to the real B737NG.
A few, very complex systems, are simplified in the software to some degree.
This means there exist pitfalls that may give unexpected erratic behavior which are not tolerated in a full motion industry standard simulator.
Some systems of minor importance cannot be simulated due to restrictions in FS9 which serves as the operating base.

As an IFR Procedure Training and B737NG familiarization tool it works very well.

Especially so with ATC online via VATSIM who usually have a very good ATC coverage in Central EU airspace.

That feature is not available on a “real” simulator, nor are the extremely detailed airports.
In a VATSIM session the simulator uses Real Weather as well as Upper winds.

Wx at departure, destination and enroute is downloaded every 5 min from MET Office.
For other training purposes we can via the “Instructor Station” manually set time, season, and weather down to **CAT IIIc** conditions. Also a multitude of failures can be set.

- **FMS computer** can simulate all normal workflow with the B737 Smiths ECDU.
- **Radios** are true to life working replicas.
- **MCP and EFIS** controller’s works exactly like its real life counterparts.
- **Autobrake** system is fully simulated – even with DRY/WET/SLUSH/ICE contaminated runway conditions.
- **Full Overhead** systems are all there and working
- **TQ** is a 1/1 replica of the B737 TQ. A/T, SPD BRK and Trim wheels are not motorized.
- **Engine Fire Suppression Panel** will be fully simulated for APU and both engines.
- **Weather Radar** (Collins WXR2100) is simulated within FS9 limitations with all radar modes. Controlled from the Radar Panel.


Manual flying is “OK” within the limits of FS9 but the handling feeling is in no way like a real sim which purpose is to reduce the cost of training flights in the real a/c.

However manual flight is rare in real life – mostly only performed in t/o and late approach/landing.

Some “feel” like bumps, vibrations etc is generated in the CPT position via a “Buttkicker” system in the left pilot chair.

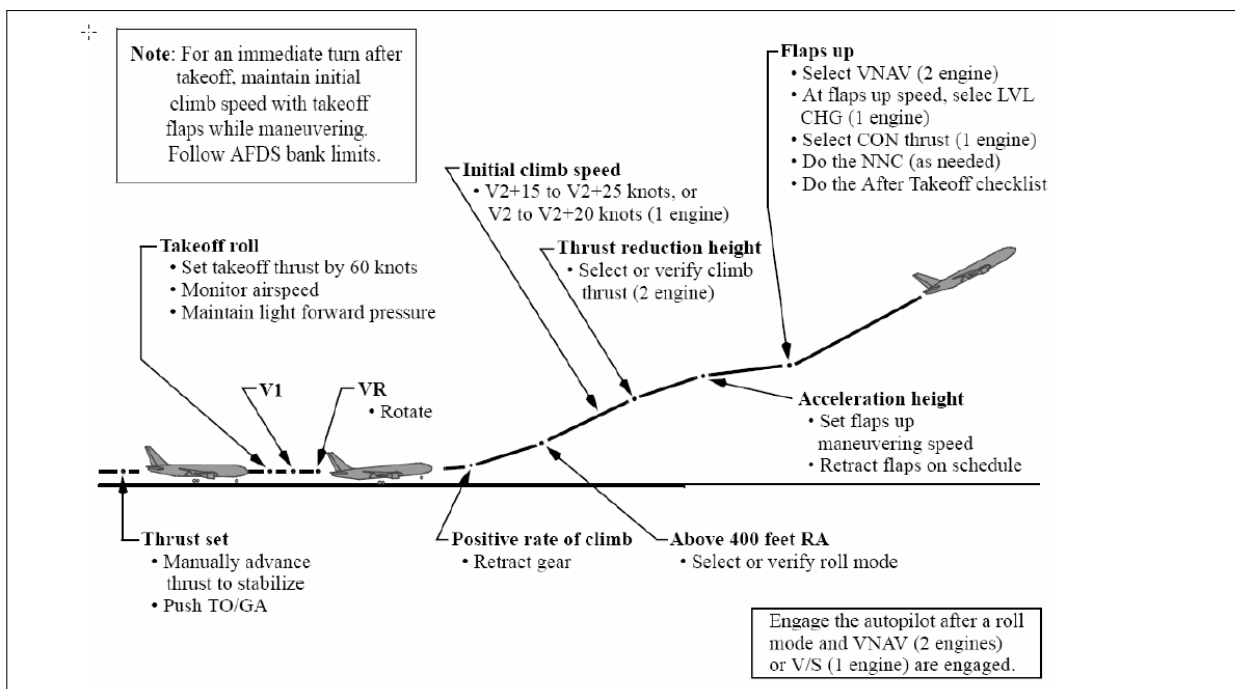
B738 Checklist

The checklist used is the real life Boeing 737 latest Normal Checklist.
The grayed out items are not applicable with the simulator.

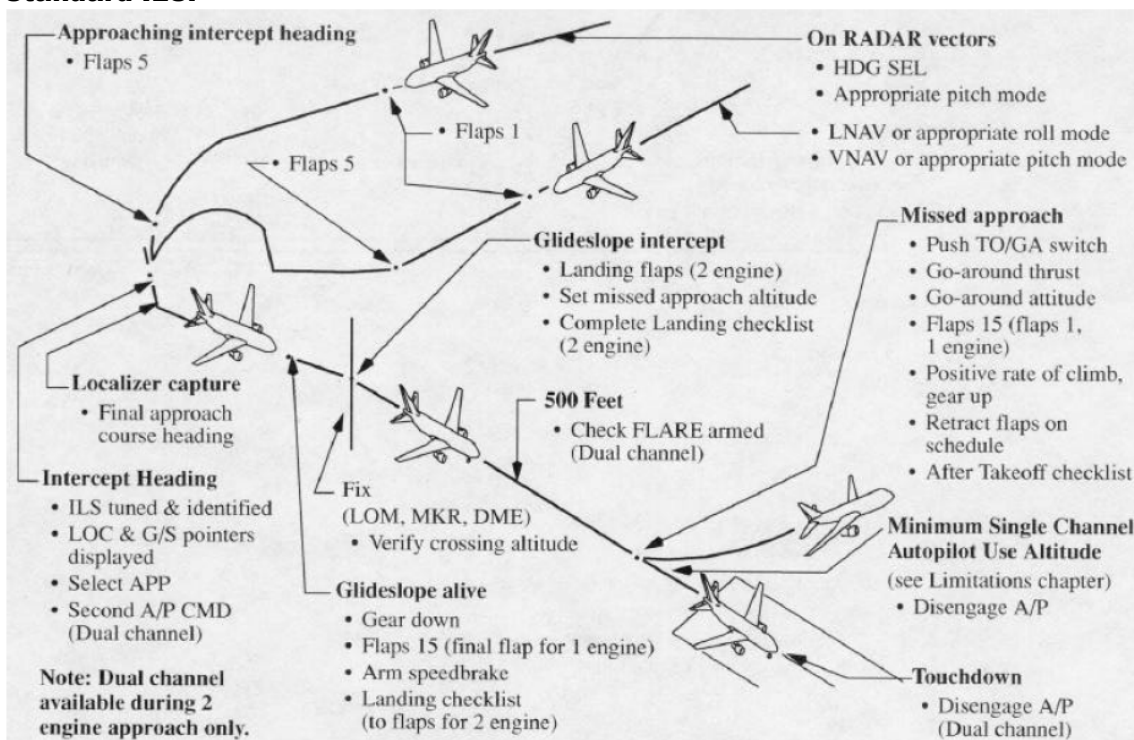
 B737-800 Normal Checklist <small>Effective 2009-04-10 Issue No. 01</small>	
PREFLIGHT	
Oxygen	Tested 100%
NAVIGATION transfer and DISPLAY switches	Normal, AUTO
Window Heat	On
Pressurization mode selector	AUTO
Flight instruments	Heading __, Altimeter __
Parking brake	Set
Engine start levers	CUTOFF
BEFORE START	
Flight deck door	Closed and locked
Fuel	__ KGS, PUMPS ON
Passenger signs	
Windows	Locked
MCP	V2 __, HDG __, ALT __
Takeoff speeds	V1 __, VR __, V2 __
CDU Preflight	Completed
Rudder and aileron trim	Free and 0
Taxi and takeoff briefing	Completed
ANTI COLLISION light	ON
----- Ready for pushback / start / taxi -----	
BEFORE TAKEOFF	
Flaps	__, Green Light
Stabilizer trim	__ Units
AFTER TAKEOFF	
Engine bleeds	ON
Packs	AUTO
Landing gear	UP and OFF
Flaps	UP, no lights
DESCENT	
Pressurisation	LAND ALT __
Recall	Checked
Autobrake	
Landing data	VREF __, Minimums __
Approach briefing	Completed
APPROACH	
Altimeters	__
SHUTDOWN	
Fuel pumps	OFF
Probe heat	OFF
Hydraulic panel	Set
Flaps	UP
Parking brake	
Engine start levers	CUTOFF
Weather Radar	OFF

BOEING 737NG

NORMAL TAKEOFF PATTERN



Standard ILS:



Example Top Cat Load Sheet, Take Off Report, and Landing Report

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L O A D S H E E T          CHECKED          APPROVED          DATE          TIME
ALL WEIGHTS IN KILOGRAMS          .....          .....

FROM/TO    FLIGHT    A/C REG    A/C TYPE          CONFIG
ESSA/EKCH  SAS807    SE-BOH    B737-800/CFM56-7B26  C12 Y148

LOAD IN COMPARTMENTS          WEIGHT DISTRIBUTION
                                7671  1/3674 2/3997

PASSENGER/CABIN BAG          10206  AD/119 C/6 I/8    TTL 125+8

TOTAL PAYLOAD          17877
DRY OPERATING WEIGHT          42991
ZERO FUEL WEIGHT ACTUAL          60868    MAX    61689 L
TAKE OFF FUEL          0
TAKE OFF WEIGHT ACTUAL          60868    MAX    78471
TRIP FUEL          0
LANDING WEIGHT ACTUAL          60868    MAX    66361
TAXI OUT FUEL          0

UNDERLOAD BEFORE L.M.C.          821    LIMITED BY ZFW          LMC TOTAL + / -

BALANCING/TRIM CONDITIONS
MACZFW 23.99%
MACTOW 23.99%    STAB TRIM: +5.4
MACLDW 23.99%

MAC LIMITS
ZFW FWD 8.00%    AFT 30.49%
TOW FWD 8.00%    AFT 30.49%
LDW FWD 8.00%    AFT 30.49%

TRIM BY CABIN AREA
A9.B116

CAPTAINS INFORMATION/NOTES
STD WEIGHTS USED  ADULT/84 CHILD/35 INFANT/0 BAGGAGE/13
BLOCK FUEL/      0 (      0 LITER)
LANDG FUEL/      0 (      0 LITER)
TAXI TIME 0 MIN

SELCAL/QL-HN

CREATED WITH TOPCAT  2.61 (17DEC09)
AIRCRAFT FILE VERSION 1.10 (15DEC09)

END LOADSHEET SAS807 ESSA-EKCH

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TAKE-OFF AND LANDING REPORT SAS807 ESSA-EKCH
 TOPCAT 2.61 29JAN10 07:33Z
 A/C SE-BOH B737-800 CFM56-7B26

ALL WEIGHTS IN KILOGRAMS

//////// AIRPORTS //////////

TAKEOFF: ESSA/ARN ARLANDA RWY 19R FLAPS 1 ELEV. 137FT (42M)
 LANDING: EKCH/CPH KASTRUP RWY 22L FLAPS 40 ELEV. 17FT (5M)

//////// TAKE-OFF //////////

APT PRWY POAT PWIND PQNH PMRTW FLP CONF THRUST V1 VR V2 PTOW
 ESSA 19R -7°C 080/05 995 61201 FLAPS 1 D-TO2 +45°C 141 142 146 60868

RMKS SPEED/FLAPS SCHEDULE: VREF 40=136 F15=156 F10=166 F5=166 F1=186 CLEAN=206

 RWY/INT OAT WIND QNH RWY COND V1 VR V2 THRUST/FLAPS CONFIG

----- FULL - DRY - OPT FLAPS - OPT THRUST - A/C ON - A/I OFF -----

RWY 01L			RWY 01R			RWY 08			
3301 M			2500 M			2500 M			
TO		HW01	TO		HW01	TO		HW05	
OAT N1		FLAPS 1	OAT N1		FLAPS 1	OAT N1		FLAPS 1	
-3 95.5	77376	059-60-63	-3 95.6	78211	F60-61-64	-3 95.5	75330	057-58-61	
-5 95.2	77376	059-60-63	-5 95.2	78493	F60-61-64	-5 95.2	75330	057-58-61	
/ -7 94.9	77376	059-60-63	/ -7 94.9	78774	F60-61-64	/ -7 94.9	75330	057-58-61	
-9 94.6	77376	059-60-63	-9 94.6	79056	F60-61-64	-9 94.6	75330	057-58-61	
-11 94.3	77376	059-60-63	-11 94.3	79337	F60-61-64	-11 94.3	75330	057-58-61	
HW/10 KT	+577			+599			+352		
TW/15 KT	-7682			-10123			-8012		

RWY 19L			RWY 19R			RWY 26			
2500 M			3301 M			2500 M			
TO		TW01	TO		TW01	TO		TW05	
OAT N1		FLAPS 1	OAT N1		FLAPS 1	OAT N1		FLAPS 1	
-3 95.5	71675	053-54-58	-3 95.6	82040	O60-61-64	-3 95.6	72361	053-55-58	
-5 95.2	71675	053-54-58	-5 95.2	82040	O60-61-64	-5 95.2	72361	053-55-58	
/ -7 94.9	71675	053-54-58	/ -7 94.9	82040	O60-61-64	/ -7 94.9	72361	053-55-58	
-9 94.6	71675	053-54-58	-9 94.6	82040	O60-61-64	-9 94.6	72361	053-55-58	
-11 94.3	71675	053-54-58	-11 94.3	82040	O60-61-64	-11 94.3	72361	053-55-58	
HW/10 KT	+1441			+1285			+3231		
TW/15 KT	-7041			-6728			-5138		

 * MAX TAKE-OFF WEIGHT MUST NOT EXCEED MAX CERT TAKE-OFF WEIGHT OF 78471 KG *

//////// LANDING //////////

APT PRWY POAT PWIND PQNH PMRLW FLP CONF VREF VAPP PLDW
 EKCH 22L -1°C 220/12 983 78678 FLAPS 40 136 147 60868

RMKS NONE

////////// LANDING //////////

APT PRWY POAT PWIND PQNH PMRLW FLP CONF VREF VAPP PLDW
 EKCH 22L -1°C 220/12 983 78678 FLAPS 40 136 147 60868

RMKS NONE

 RWY/INT OAT WIND QNH RWY COND VREF VAPP FLAPS CONFIG/COND

 * MAX LANDING WEIGHT MUST NOT EXCEED MAX CERT LANDING WEIGHT OF 66361 KG *

----- REQUIRED LDG DIST - NORM VIS - FLAPS 40 - A/C ON - A/I OFF -----

*** VALID FOR ALL RWYS AT EKCH. BASED ON NO WIND ***

LDW	DRY	WET	CONTAMIN.
62600	1524M	2118M	2118M
62000	1513M	2103M	2103M
61400	1502M	2087M	2087M
/ 60868 /	1493M /	2073M /	2073M
60200	1480M	2056M	2056M
59600	1471M	2041M	2041M
59000	1462M	2026M	2026M
HW/10 KT	+4M	-7M	-7M
TW/15 KT	+275M	+478M	+478M

----- AUTOBRAKE LDG DIST - DRY - FLAPS 40 - A/C ON - A/I OFF -----

*** VALID FOR ALL RWYS AT EKCH. BASED ON NO WIND ***

LDW	AUTO MAX	AUTO 3	AUTO 2	AUTO 1
62600	1133M	1595M	2053M	2260M
62000	1126M	1583M	2037M	2240M
61400	1119M	1571M	2020M	2220M
/ 60868 /	1112M /	1560M /	2005M /	2202M
60200	1104M	1547M	1986M	2180M
59600	1097M	1535M	1970M	2161M
59000	1091M	1524M	1954M	2142M
HW/10 KT	+8M	+15M	-3M	-25M
TW/15 KT	+203M	+338M	+473M	+555M

END TAKE-OFF AND LANDING REPORT SAS807 ESSA-EKCH 29JAN10