MINISTÈRE
CHARGÉ
DES TRANSPORTS

Liberté
Égalité
Fraternité

Quality Assurance Workshop

Whole process for IFP design and related validation

5-6 July 2022
Virtual meeting room

MINISTÈRE CHARGÉ DES TRANSPORTS
Liberté Égalité Fraternité

INTERNATIONAL CIVIL AVIATION ORGANIZATION
A United Nations Specialized Agency

Use of thorough flight simulation in a sustainable IFP validation process

Laurent Guitard
DSNA/DTI
laurent.guitard@aviation-civile.gouv.fr

Validation (extract from Doc 9906 Vol 5)

The purpose of validation is to obtain a qualitative assessment of the procedure design including obstacle, terrain and navigation data,
and provide an assessment of the flyability of the procedure.(Doc 9906 vol 5§1.1.1)

Flight validation consists of flight simulator evaluation
and evaluation flown in an aircraft .(Doc 9906 vol 5§1.2.3)

If a flight validation is performed, a printed graphic and/or electronic file
of sufficient detail that depicts the flight track flown must be included in the report.
Type of simulator or aircraft, any findings and
flight validation pilot comments and operational recommendations should be recorded.

1. When using FMS and pilots expertise in procedure design?

Flight validation in FPD process

A need for the procedure designer to complete and consolidate the IFP design study based on aeronautical data, obstacles data and use of well-known design criteria

A requirement by the National Safety Authority to investigate specific elements of the design in order to issue the approval of the IFP

Need for flight validation

1. **Obstacles** : to compensate for a low awareness of nearby obstacles
   (final and early missed approach)

2. **Flyablity** : to assess final axis not aligned with runway,
   final slope and outside visual references, segments length,
   link between two segments (angle of turn, or change of nav mode PBN to ILS),
   use of special functions such as RF leg, FASDB...
3. **Flyablity** : to check the use of a design criteria not compliant with Doc 8168

4. **Charting and coding** : assess display of information for the crew
   and coded data for navigation system

Flight validation using aircraft or flight simulator?

1. Flight simulation based on crew and aircraft

- Is more expensive and limited in terms of explored topics
- Does not reflect any meteorological conditions
- Procedure designer may not be on board the aircraft during the flight

2. Flight simulation based on flight simulator and crew

- Is more flexible in terms of explored topics (the full flight is not required)
- Can reflect many different meteorological situations
- Procedure designer can be on board with the crew
- Is more sustainable

2. Flight simulation from a procedure designer point of view offers more feedback but need preparation to guaranty benefit of the financial input...

What is expected from the flight simulation?

Thorough and extensive analysis of the topics that shall be checked during the simulation :

- What is expected from the crew and from the aircraft system (points to be assessed)

Important work to conduct before the flight :

- What is provided to the crew (charts and information before the flight)
- What is provided to the navigation system (coding of the required statics data and navigation data)

Choice of the aircraft

Based on the local traffic

Discussed and agreed with ATCOs and main Airlines

Based on local or remote simulators

Meteorological frame

Panel of selected meteorological situations :

- representatives of the area
- that may create difficulties in achieving the trajectory
- discussed and agreed with local ATCO

	Type of model	ATM Model	QNH	Temperature at LFXX	Wind		
					Ground	4000ft	7000ft
1W		ISA-10	987	4°	250°/20kt	260°/25kt	275°/30kt
2W		ISA-5	998	9°	180°/10kt	190°/25kt	200°/35kt
3W		ISA-12	1002	2°	330°/10kt	350°/15kt	360°/20kt
4W		ISA+20	1035	34°	330°/5kt	320°/10kt	330°/15kt
1E		ISA	1023	14°	160°/15kt	170°/20kt	180°/30kt
2E W	Winter	ISA-15	1042	-1°	030°/10kt	040°/15kt	050°/20kt
2E S	Summer	ISA+15	1030	29°	030°/10kt	040°/15kt	050°/20kt
3 E		ISA-5	1016	9°	120°/04kt	210°/20kt	210°/30kt

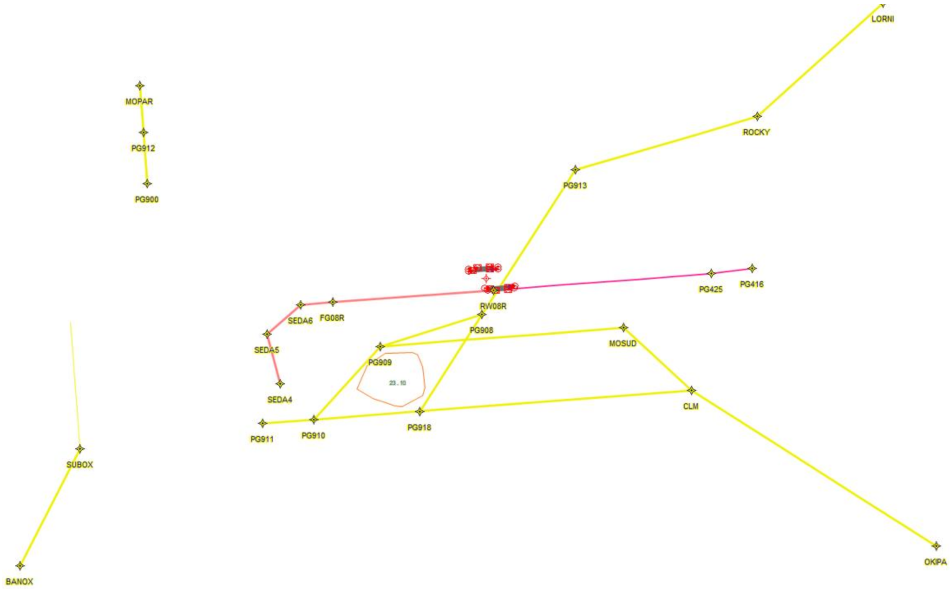
Aircraft types and conditions

Average aircraft weight configurations are provided

BCS3 CDG LANDING WEIGHT DOF 100222			
ARCID	*DEP*	*ALTN*	*LW (T)*
AFR59UM	LIPZ	LFPO	49,8
AFR11VA	LEMD	LFPO	53
BTI8GJ	EVRA		
AFR14XT	LIPE	LFPO	51,4
AFR47YX	EKCH	LFPO	50,1
SWR49P	LSZH		
AFR79RZ	EDDB	LFPO	50,7
AFR86SA	LIRF	LFPO	52,7
AFR82QX	LIPZ	LFPO	48
BTI3FL	EYVI		
AFR54YC	LEMD	LFPO	50,3
AFR56SE	LIPE	LFPO	50,1
		AVERAGE	***50,7***

Data and trajectories to be validated

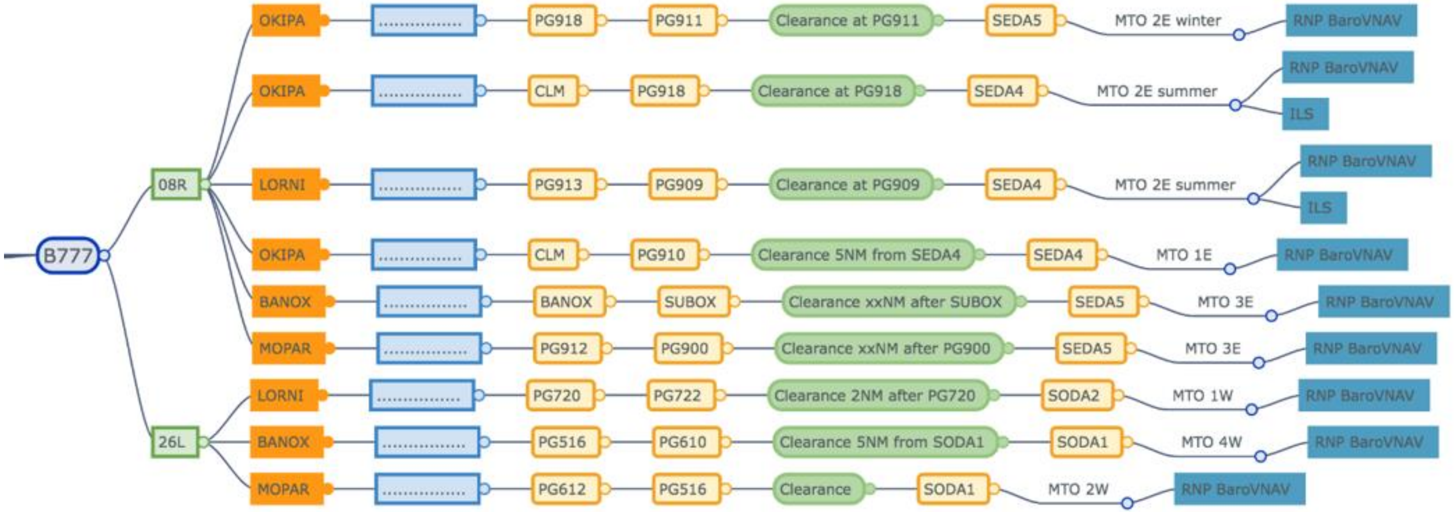
Draft of charts and draft of coded data



INA RNP BANOX, LORNI, ROCKY, MOPAR, OKIPA, COLOM, SEDA4 RWY 08R													
RMK	Lié à/*Linked to* FNA ILS/LOC RWY 08R et/*and* FNA RNP RWY 08R (1) Réacteur / *Jets* = (R) - Hélices / *Propellers* = (H)							MAG VAR 2020 1,1°E			REF NAVAID : BT		
Leg sequence	Path Terminator	Waypoint Identification	Fly Over	Direction MAG (°)	Direction True (°)	Distance (NM)	Turn direction	MNM Altitude (FL or AMSL ft)	MAX Altitude (FL or AMSL ft)	MAX IAS (kt)	Vertical angle (°) / TCH (m)	NAV Spec	
HLDG		BANOX	-	-	-	-	-	-	-	-	-	-	
		LORNI	-	-	-	-	-	-	-	-	-	-	
		MOPAR	-	-	-	-	-	-	-	-	-	-	
		OKIPA	-	-	-	-	-	-	-	-	-	-	
INA BANOX	IF	BANOX	-	-	-	-	-	FL090	FL110	250	-	RNP1	
	TF	SUBOX	Yes	025	026.0	11.7	-	-	-	-	-	RNP1	
	FM	SUBOX	-	354	355.0		-	-	-	-	-	RNP1	
	DF	SEDA4	-	-	-	-	-	FL080	-	230	-	RNP1	
	TF	SEDA5	-	344	344.8	4.6	-	-	-	230	-	RNP1	
	TF	SEDA6	-	047	048.0	4.0	-	5000	-	210	-	RNP1	
INA LORN1	IF	LORNI	-	-	-	-	-	*FL110 (R) (1)* *FL110 (H) (1)*	*FL150 (R) (1)* *FL120 (H) (1)*	300	-	RNP1	
	TF	ROCKY	-	227	228.3	15.1	-	-	-	-	-	RNP1	
	TF	PG913	-	253	254.0	17.0	-	-	-	-	-	RNP1	
	TF	PG908	-	212	212.7	15.4	-	-	-	-	-	RNP1	
	TF	PG909	-	251	252.2	9.6	-	-	-	-	-	RNP1	
	TF	PG910	-	221	221.7	8.8	-	-	-	-	-	RNP1	
	TF	PG911	Yes	264	265.0	4.6	-	-	-	-	-	RNP1	
	FM	PG911	-	264	265.0		-	-	-	-	-	RNP1	
	DF	SEDA4	-	-	-	-	-	FL080	-	230	-	RNP1	
	TF	SEDA5	-	344	344.8	4.6	-	-	-	230	-	RNP1	
	TF	SEDA6	-	047	048.0	4.0	-	5000	-	210	-	RNP1	

Scenarios to be flown

Thorough description of the various scenarios



Scenarios to be flown

Thorough description of each scenario

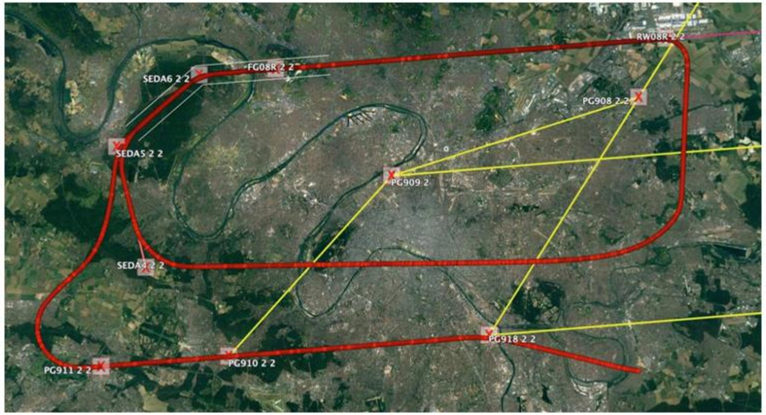
Landing weight 215T	RWY	Final	Approximate length	METEO	INA	First WP	« Direct to » Clearance	Vertical Clearance	To	OK/NOK
B777-1	08R	RNP Baro VNAV	43NM	2EW	OKIP2	PG918	PG911		SEDA5	
Altitude						FL100	FL080	To 5000	Min 5000	
IAS						250kt	220kt		Max 230kt	
Temp				-1°						
QNH				1042						
Wind				GND/030°/10kt 4000/040°/15kt 7000ft/050°/20kt						
Missed approach	HDG 180 passing 2000 then a heading westbound allowing aircraft to join 270° SEDA4 radial in then a direct to SEDA4 to join the SEDA4 RNP 08R approach. Phraseology: “Expect SEDA4 RNP RWY 08R approach.”									
Main objective	Is it flyable to join SEDA5 from PG911? Is the SEDA5 SEDA6 segment long enough to correctly perform the interception of the final axis? How is SEDA6 sequenced? Is the SEDA6 -FG08R segment long enough to prepare aircraft to final (final configuration).									
Secondary objective	Crew workload to fly SEDA5 SEDA6 FG08R compared to radar vectoring? Is it possible to keep the aircraft along the prescribed vertical path at associated speeds (provided by the altitude constraints)? Checking the position of the TOD. (CDO). Maximum Offset of the trajectory along each segment (for a later assessment of the Normal Operation Zone around the nominal segment).									

3. After the simulation

MINISTÈRE CHARGÉ DES TRANSPORTS

Answers and comments based on the assumptions

A flight simulation report is provided as requested by Doc 9906 Vol5 based on the scenarios proposed



Main Objectives

Figure 2 shows a smooth lateral path from PG911 to SEDA5. Waypoint SEDA5 is correctly flown-by and the subsequent lateral path to SEDA6 and the final approach is as expected since it remains within the NOZ as shown in Figure 3. The SEDA5 to SEDA6 segment is sufficiently long to allow for a stable lateral path between these waypoints. Waypoint SEDA6 is sequenced with the aircraft close to the centre of the NOZ. The smooth intercept of the final approach course demonstrates that the SEDA6 to FG08R segment is sufficiently long to configure the aircraft for the approach. This is demonstrated in video sequence scenario B777-1_08:45-14:25.

Secondary objectives

The workload between SEDA5 and FG08R is low. The FL100 restriction at waypoint PG918 is adequate. Aside from the expected offset during the turn after the "direct to" clearance, no remarkable offset can be observed on the navigation display.

Additional observations

None.

Possibility of video sequence

4. Conclusions

The simulation flight validation report **shall be well documented**

Extremely useful solution to assess **specific IPD**

The flight validation is very **useful for the State Safety Authority**

It increases the **knowledge and the practice of procedure designer**
(they are able to see and assess what they design)

Expensive and **sustainable solution**
but very rich of experiences and communication