International Civil Aviation Organization

AIR NAVIGATION SYSTEMS IMPLEMENTATION GROUP

Third Meeting (ANSIG/3)
(Cairo, Egypt, 2 – 4 July 2018)

Agenda Item 5: Environmental Issues

ESTIMATION OF ENVIRONMENTAL BENEFITS ACCRUED FROM IMPLEMENTATION OF ASBU MODULES

(Presented by the Secretariat)

SUMMARY

This paper proposes a methodology for estimation of environmental benefits accrued from Block 0 Modules in the MID Region.

Action by the meeting is at paragraph 3.

REFERENCES

– CAEP/10-WP/39

1. INTRODUCTION

1.1 Environmental Protection, to minimize the adverse environmental effects of civil aviation activities, is one of the five strategic objectives of ICAO. With a view to minimizing the adverse effects of international civil aviation on the environment, ICAO formulates policies, develops and updates Standards and Recommended Practices (SARPs) on aircraft noise and aircraft engine emissions, and conducts outreach activities. Information related to the ICAO activities on environmental protection is available on the ICAO website at: *https://www.icao.int/environmental-protection/Pages/default.aspx*

2. DISCUSSION

ASBU Block 0 Analysis and the Rules of thumb (RoT)

2.1 CAEP/10 conducted Task O.05 (ASBU Analysis) originated from the CAEP/9 ASBU Analysis Terms of Reference. The purpose of this task was to carry out an assessment of the potential environmental benefits (fuel savings / CO_2) between the current implementation of ASBU Block 0 modules in 2013 and the planned implementation of such modules in 2018 (end of Block 0).

2.2 In order to accomplish this task, CAEP developed sets of Rules-of-Thumb for each studied module with the overall intent to provide a conservative estimate of ASBU Block 0 fuel saving benefits. Rules-of-Thumb were developed using existing, publically available data, literature, and assumptions, together with the professional judgment of the analysts. A total of twenty three (23) rules of thumb have been developed for thirteen (13) ASBU Block 0 Modules, as at **Appendix A**.

B0 Module[1]	Environmental benefits in OI (Y/N)	RoT defined
APTA	Y	■ ■
ACDM	Y	■ ■
AMET	Y	■
ASUR	Y	■
CCO	Y	■ ■
CDO	Y	■ ■
FRTO	Y	■ ■
NOPS	Y	■ ■ ■
OPFL	Y	■
RSEQ	Y	■
SURF	Y	■ ■ ■
TBO	Y	■
WAKE	Y	■ ■
DATM	Y	-
FICE	Y	-
ACAS	N	-
ASEP	N	-
SNET	N	-
	Total rules of thumb:	23

Table 1. ASBU Block 0 Modules potential environmental benefits and Rules of thumb

2.3 The results of the ASBU Block 0 analysis conducted by CAEP highlight a potential reduction in fuel consumption by 2018 due to the implementation of ASBU Block 0 modules when compared to the 2013 baseline. The results presented are not intended to represent absolute reductions in fuel consumption.

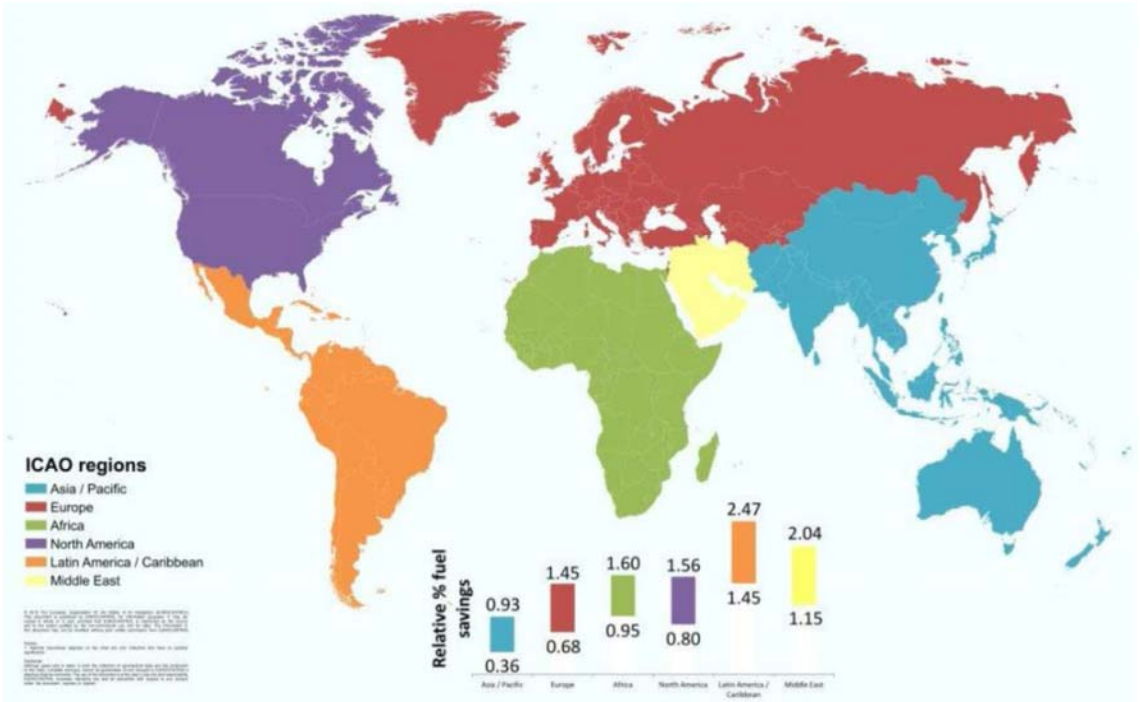


Figure 1. Range of fuel saving 2013 to 2018 (%)

2.4 The relative contribution to the 2018 global fuel burn savings (by-module), comparing 2013 to 2018 implementation levels, is shown in Table 2. The results show that four Modules (five operational improvements / RoTs) contributed a cumulative 94 per cent of the total fuel burn savings: B0-CCO, B0-ASUR, B0-CDO and B0-ACDM.

Module	Operational Improvement	Fuel Saved (high) MT	Fuel Saved (high) %
B0-ASUR	ADS-B	1,43	34,46
B0-CCO	CCO	0,81	19,52
B0-ACDM	A-CDM	0,68	16,39
B0-CDOb	PBN STARs	0,6	14,46
B0-CDOa	CDO	0,4	9,64
B0-FRTOb	FUA	0,09	2,17
B0-NOPS	ATFM	0,07	1,69
B0-FRTOa	FUA	0,04	0,96
B0-WAKEa	RECAT	0,02	0,48
B0-RSEQ	AMAN/DMAN	0,01	0,24
B0-WAKEb	CSPRs	0	0,00
B0-OPFL	ADS-B	0	0,00
	Total:	6.71	100%

Table 2. Contribution of Block 0 Modules to the global fuel saving

Estimation of environmental benefits accrued from Block 0 Modules in the MID Region

2.5 The ASBU analysis carried out by CAEP shows that the following Block 0 Modules (operational improvements) would have the biggest contribution to fuel saving in the MID Region (by order):

- **CCO 1 (CCO)**
- **CDO 1 (CDO)**
- ACDM
- **CDO 2 (PBN STARs)**
- ASUR (ADS-B Surveillance)
- **CCO 2 (PBN SIDs)**
- **APTA 1 (Radius to Fix)**

2.6 As the status of implementation of B0-ACDM and B0-ASUR is still low in the MID Region, a Draft Methodology for the Estimation of environmental benefits accrued from the implementation of priority 1 Block 0 Modules in the MID Region has been developed by the Secretariat for B0-APTA, CCO and CDO based on the Rules of Thumb and the traffic data available on the ICAO iSTARS, as at **Appendix B**.

2.7 In order to complete the results of the analysis and improve its accuracy, the meeting is invited to encourage States to fill the Questionnaire for the assessment of environmental benefits accrued from the implementation of ASBU Block 0, at **Appendix C**.

2.8 Based on the above, the meeting in invited to agree to the following Draft Conclusion:

DRAFT CONCLUSION 3/X: ***ESTIMATION OF ENVIRONMENTAL BENEFITS ACCRUED FROM THE IMPLEMENTATION OF BLOCK 0 MODULES IN THE MID REGION***

That,

*a) the Draft Methodology for the Estimation of environmental benefits accrued from the implementation of priority 1 Block 0 Modules in the MID Region at **Appendix B**, be used for the estimation and reporting of environmental benefits in the second edition of the MID Air Navigation Report (2017-2018); and*

*b) States be urged to report on annual basis (by 31 March) to the ICAO MID Office the required data for the assessment of environmental benefits accrued from the implementation of ASBU Block 0, using the Questionnaire at **Appendix C**.*

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information provided in this Working Paper;

b) review and support the Draft Methodology for the Estimation of environmental benefits accrued from the implementation of priority 1 Block 0 Modules in the MID Region, at **Appendix B**; and

c) endorse, as appropriate, the proposed Draft Conclusion.

Appendix A - Rules of Thumb (RoT)

Block/ Module	Title	Phase of Flight	Modelling benefit envelope	Rule-of-thumb	Implementation 2013	Implementation 2018	Theoretical achievable upper bound implementation
B0-CDO (1)	CDO	Arrival	TOD – surface	CDO: 60kg fuel saved per arrival	CDO: Percentage of arrivals by ICAO region1	CDO: Percentage of arrivals by ICAO region	N/A
B0-CDO (2)	PBN STARs	Arrival	TOD-surface	PBN: Low – 20kg High – 50kg (range)	PBN: Percentage of arrivals by ICAO region1.	PBN: Percentage of arrivals by ICAO region1.	N/A
B0-FRTO (1)	Improved operations through enhanced en-route trajectories (FUA) FUA	All	Above 3k	Savings (kg) per movement per region	Individual implementations prior to 2013	Individual implementations post 2013	Insufficient data to determine the theoretical upper bound.
B0-FRTO (2)	Improved operations through enhanced en-route trajectories (FUA) Flex routes	All	Above 10K	1% cruise fuel burn saving (no range)	Individual implementations prior to 2013	Individual implementations post 2013	N/A
B0-RSEQ	Improve traffic through runway sequencing (AMAN/DMAN)	Arrival	Below 10,000,	50-100kg fuel savings (range) For 35%	35% arrivals	35% arrivals	Global airports with >200,000 movements +airports in previous column

[1] NA – North America, E – Europe, AP – Asia Pacific, ME – Middle East, A – Africa, LA – Latin America

				arrivals			35% arrivals
B0-CCO (1)	CCO	Departure	Surface - TOC	90-150kg fuel saved per departure (range)	Percentage of departures by ICAO region:	Percentage of departures by ICAO region:	N/A
B0-CCO (2)	PBN SIDs	Departure	Surface - TOC	0-30kg fuel saved per departure (range)	PBN: Percentage of departures by ICAO region1.	PBN: Percentage of departures by ICAO region1.	N/A
B0-NOPS (1)	ATFM- reduction in arrival delay	Arrival	Below 10k	1kg fuel saving per flight	Percentage of departures by ICAO region:	Percentage of departures by ICAO region:	NA: 100% E: 100% AP: 100% ME: 100% A: 100% LA: 100%
B0-NOPS (2)	ATFM-reduction in en-route delay	cruise	Above 10k	3.5kg fuel saving per flight	Percentage of departures by ICAO region:	Percentage of departures by ICAO region:	NA: 100% E: 100% AP: 100% ME: 100% A: 100% LA: 100%
B0-NOPS (3)	ATFM- flight efficiency improvement	cruise	Above 10k	0.25kg fuel saving per flight	Percentage of departures by ICAO region:	Percentage of departures by ICAO region:	N/A
B0-TBO	Improved safety and efficiency through the initial application of data link en-route	Cruise	Above 10k	12-34kg fuel savings (range) This is not a low high	Benefits to be applied to flights that fly at and above FL290	Benefits to be applied to flights that fly at and above FL290	23kg fuel saving to be a applied to all flights over FL290 in States where CPDLC is planned to be implemented prior to 2018

				range but a range depending upon datalink implementation			
B0-WAKE (1)	Optimised Wake Turbulence-RECAT	Ground	Below 3k	21-32 seconds reduced taxi time (range) For 35% departures	N/A		35% departure AT Global airports with >200,000 movements +airports in previous column
B0-WAKE (2)	Optimised Wake Turbulence-RECAT	Arrival	Below 10k	7-12kg fuel savings For 35% arrivals	N/A		35% arrivals AT Global airports with >200,000 movements +airports in previous column
B0-ACDM (1)	A-CDM (outside US)	Departure	Below 3k	1-3 minutes taxi time savings** (range)	See attached excel file	See attached excel file	Global airports (non-US) with >100,000 movements +airports in previous column
B0-ACDM (2)	A-CDM (US)			1-2 minutes taxi time savings ** (range)	See attached excel file	See attached excel file	All US airports with >100,000 movements +airports in previous column
B0-ASUR	ADS-B initial capability and ground/satellite surveillance	Cruise	Above 10k	Number of flights * % equipped * average duration of flight in unsurveilled airspace * kg		To be applied to a % of flights in each region specified in note three with a RFL above FL290 2 scenarios low and	Same as 2018 implementation

				fuel burn saving *fuel efficiency gain * No of 1000’ climbs (dependent upon region)		high low- 70kg saving, 1% fuel efficiency gain high- 110kg saving, 2% fuel efficiency gain	
B0-OPFL	Improved access to optimum flight level through climb and descent with ADS-B	Cruise	Above 10k	Range: Low: 0.7% fuel savings for 23% traffic High:0.8% fuel savings for 30% traffic	18% of flights between US and AUS / NZ (closest route group-Americas-other Asia Pacific?)	N/A	N/A
B0-APTA (1)	PBN enabled radius to fix approaches	Arrival	Below 3k	11kg saving per SMALL, 62kg saving per MEDIUM, 95kg saving per HEAVY*	See attached excel file	See attached excel file	N/A
B0-APTA (2)	Improved access through improved minima	Arrival	Below 10k	381-471kg/flight To be applied to 0.5% operations	See attached excel file	See attached excel file	N/A
B0-SURF	Reduced taxi time during peak hours	Ground	Below 3k	1-2 minutes**	See attached excel file	See attached excel file	35% of movements AT Global airports with

(1)				reduced taxi time (range) To be applied to 35% movements at specified airports			>150,000 movements +airports in previous column
B0-SURF (2)	Reduced taxi time during LVPs	Ground	Below 3k	1-2 minutes** reduced taxi time (range) To be applied to 0.4% movements at specified airports	See attached excel file	See attached excel file	0.4% movements AT Global airports with >150,000 movements +airports in previous column
B0-SURF (3)	Reduced taxi time during night	Ground	Below 3k	23-46 seconds** reduced taxi time (range) To be applied to 10% of movements at specified airports	See attached excel file	See attached excel file	10% movements AT Global airports with >150,000 movements +airports in previous column
B0-AMET	Wind updates	All	Full flight	5.1-6.6kg fuel saving per hour of flight (range)	None	To be applied to 7.5% of all flights per region	To be applied to 7.5% of all flights per region

* If flights cannot be broken down into aircraft weight categories then we have another RoT
** Need to confirm whether MDG has different FB rates for taxi-in and taxi-out

NB: Modules B0-CDO (1), B0-CDO (2), B0-RSEQ, B0-CCO (1), B0-CCO (2), B0-WAKE (1), B0-ACDM (1), B0-ACDM (2), B0-ASUR, B0-OPFL, B0-SURF (1), B0-SURF (2), B0-SURF (3), B0-APTA (1), B0-APTA (2) and B0-AMET have low and high values for the RoT. Therefore benefits for Block 0 in 2013 and 2018 should be a range of values.

IATA fuel burn assumptions:

Additional fuel burn savings to be added on top (expressed separately):
B0-FRTO (2): for all flights with a flight time > 3 hours, an additional saving of 3% per hour per 100kg fuel used (i.e. difference between fuel used in normal flight and fuel used with 1% saving (from RoT)
B0-ASUR: for all flights with a flight time > 3 hours, an additional saving of 3% per hour per 100kg fuel used (i.e. difference between fuel used in normal flight and fuel used with RoT applied (from RoT)
B0-AMET: for all flights with a flight time > 3 hours, an additional saving of 3% per hour per 100kg fuel used (i.e. difference between fuel used in normal flight and fuel used with RoT applied (from RoT)
B0-APTA (2): for all flights with a flight time > 3 hours, an additional saving of 3% per hour per 100kg fuel used (i.e. difference between fuel used in normal flight and fuel used with RoT applied (from RoT)?
B0-RSEQ: for all flights with a flight time > 3 hours, an additional saving of 3% per hour per 100kg fuel used (i.e. difference between fuel used in normal flight and fuel used with RoT applied (from RoT)

APPENDIX B

Description of the Methodology for the Estimation of environmental benefits accrued from the implementation of priority 1 Block 0 Modules in the MID Region

1 The methodology was developed based on the studies carried out by the Committee on Aviation Environmental Protection (CAEP) and the defined Rules of Thumb (RoTs) agreed and endorsed by CAEP.

2 The objective of the Methodology is to carry out estimation of the environmental benefits (fuel savings/CO_2) accrued from the implementation of priority 1 ASBU Block 0 Modules in in the MID Region.

3 The Methodology is focused on the Block 0 Priority 1 Modules that have shown the biggest contribution to the environmental benefits in the MID Region and the implementation data for them is available. Accordingly, three (3) Modules (five RoTs) have been selected: B0-APTA, B0-CDO and B0-CCO.

Note 1 – CAEP studies have determined the contribution of each studied Block 0 Module at the Global and Regional Level, including those of the MID Region.

Note 2 – additional information on CAEP studies could be found in CAEP/10-WP/39. A summary of the studies is reflected in the ANSIG/3-WP/14.

4 Number of Departures were collected from the traffic data available on iSTARS. However, the required traffic data for some International Airports is not available on iSTARS. States should report their annual traffic data for the accuracy of the estimation, which will also increase their figures in terms of fuel saving for those airports for which no data is available.

5 Percentage of traffic using APTA, CDO and CCO procedures represents percentage of the implementation of those procedures. For a more accurate estimation, States should report the average percentage of traffic in an airport using these PBN procedures.

6 For the estimation of APTA fuel saving, fleet size in the MID Region has been assumed as follows for the estimation. However, provision of a more accurate percentage of States' fleet will improve the estimation.

- Light Airplane: 10%
- Medium Airplane: 30%
- Heavy Airplane: 60%

Note 3 –collection of the above mentioned required data will be carried out by the Questionnaire for the assessment of environmental benefits accrued from the implementation of ASBU Block 0.

7 Fuel saving for each of the RoTs (elements) is based on a minimum and maximum estimate of the fuel saving (low to high). The following ranges have been applied, based on the CAEP studies on RoTs:

- APTA (APTA 1 – PBN-enabled Radius to Fix approach)
  - Light/Small Airplanes (7000kg or less): 11kg/flight
  - Medium Airplanes (7000kg to 136000kg): 62kg/flight

  - Heavy Airplanes (136000kg or more): 95kg/flight
- CCO (CCO1 – CCO)
  - Minimum saving (Low): 90kg/Departure
  - Maximum saving (High): 150kg/Departure
- CCO (CCO2 – PBN SIDs)
  - Minimum saving (Low): 0kg/Departure
  - Maximum saving (High): 30kg/Departure
- CDO (CDO1 – CDO)
  - Saving (Low): 60kg/Arrival
- CDO (CDO2 – PBN STARs)
  - Minimum saving (Low): 20kg/Arrival
  - Maximum saving (High): 50kg/Arrival

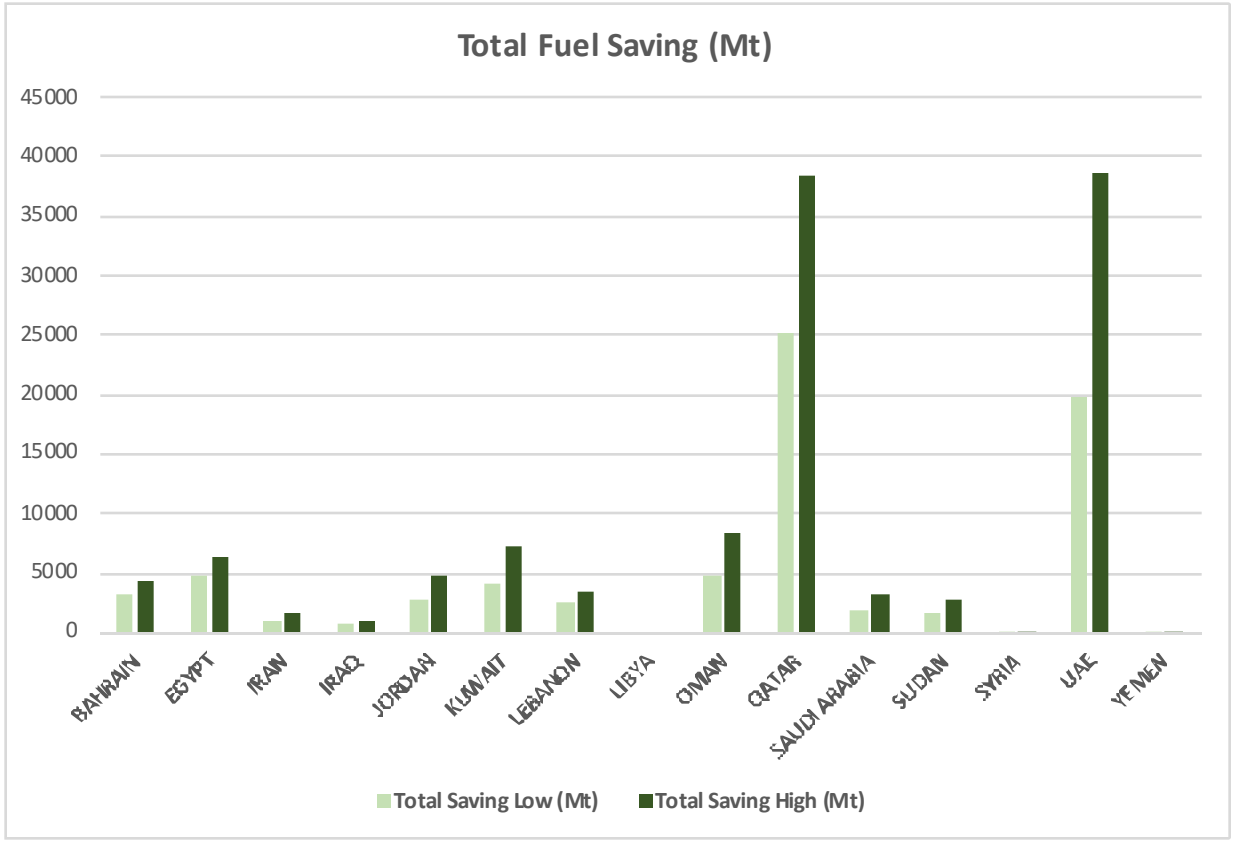
Module		B0-CCO						B0-CDO					B0-APTA			Total - low (Mt)	Total - high (Mt)
Title		CCO 1 (CCO)			CCO 2 (PBN SIDs)			CDO 1 (CDO)		CDO 2 (PBN STARs)			APTA 1 (PBN -enabled Radius to Fix approach)				
State / RoT	Depertures 2017	Impl.	Low (90kg/Dep)	High (150kg/Dep)	Impl.	Low (0kg/Dep)	High (30kg/Dep)	Impl.	60kg/Arr	Impl.	Low (20kg/Arr)	High (50kg/Arr)	APTA Impl.	RF Impl.	Fuel Saving (kg)		
BAHRAIN																	
OBBI	40803	0%	0	0	0%	0	0	0%	0	100%	816060	2040150	100%	100%	3129590.1		
Total	40803		0	0		0	0		0		816060	2040150			3129590.1	3945.7	5169.7
EGYPT																	
HEBA	10697	0%	0	0	50%	0	160455	0%	0	0%	0	0	50%	0%	0		
HESN	2781	0%	0	0	100%	0	83430	0%	0	100%	55620	139050	100%	0%	0		
HECA	69732	0%	0	0	0%	0	0	0%	0	0%	0	0	100%	33%	1764986.652		
HEGN	11031	0%	0	0	50%	0	165465	0%	0	50%	110310	275775	100%	0%	0		
HELX	3069	0%	0	0	100%	0	92070	0%	0	100%	61380	153450	100%	0%	0		
HEMA	2333	0%	0	0	100%	0	69990	0%	0	100%	46660	116650	100%	100%	178941.1		
HESH	7138	0%	0	0	100%	0	214140	0%	0	100%	142760	356900	100%	0%	0		
Total	106781		0	0		0	785550		0		416730	1041825			1943927.752	2360.7	3771.3
IRAN																	
OIKB	4460	0%	0	0	0%	0	0	0%	0	0%	0	0	0%	0%	0		
OIFM		0%	0	0	0%	0	0	0%	0	0%	0	0	0%	0%	0		
OIMM	28308	0%	0	0	0%	0	0	0%	0	0%	0	0	0%	0%	0		
OISS	13838	0%	0	0	0%	0	0	0%	0	0%	0	0	0%	0%	0		
OITT	6756	0%	0	0	0%	0	0	0%	0	0%	0	0	0%	0%	0		
OIIE	26540	0%	0	0	0%	0	0	0%	0	100%	530800	1327000	25%	0%	0		
OIII	54678	0%	0	0	0%	0	0	0%	0	0%	0	0	0%	0%	0		
OIZH	2035	0%	0	0	0%	0	0	0%	0	0%	0	0	0%	0%	0		
OIYY	2846	0%	0	0	0%	0	0	0%	0	0%	0	0	0%	0%	0		
Total	139461		0	0		0	0		0		530800	1327000			0	530.8	1327.0
IRAQ																	
ORBI		0%	0	0	0%	0	0	0%	0	0%	0	0	50%	0%	0		
ORMM	4253	0%	0	0	0%	0	0	0%	0	0%	0	0	0%	0%	0		
ORER	8137	0%	0	0	0%	0	0	0%	0	100%	162740	406850	100%	100%	624107.9		
ORSU		0%	0	0	0%	0	0	0%	0	0%	0	0	100%	0%	0		
ORNI		0%	0	0	100%	0	0	0%	0	100%	0	0	100%	100%	0		
ORBM		0%	0	0	0%	0	0	0%	0	0%	0	0	0%	0%	0		
Total	12390		0	0		0	0		0		162740	406850			624107.9	786.8	1031.0
JORDAN																	
OJAI	34454	0%	0	0	100%	0	1033620	0%	0	100%	689080	1722700	100%	0%	0		
OJAQ	684	0%	0	0	100%	0	20520	0%	0	100%	13680	34200	100%	0%	0		
Total	35138		0	0		0	1054140		0		702760	1756900			0	702.8	2811.0
KUWAIT																	
OKBK	52970	0%	0	0	100%	0	1589100	0%	0	100%	1059400	2648500	100%	0%	0		
Total	52970		0	0		0	1589100		0		1059400	2648500			0	1059.4	4237.6
LEBANON																	
OLBA	31527	0%	0	0	0%	0	0	0%	0	100%	630540	1576350	100%	0%	0		
Total	31527		0	0		0	0		0		630540	1576350			0	630.5	1576.4
LIBYA																	
HLLB	461	0%	0	0	0%	0	0	0%	0	0%	0	0	0%	0%	0		
HLLS	36	0%	0	0	0%	0	0	0%	0	0%	0	0	0%	0%	0		
HLLT	2020	0%	0	0	0%	0	0	0%	0	0%	0	0	0%	0%	0		
Total	2517		0	0		0	0		0		0	0			0	0.0	0.0
OMAN																	
OOMS	54867	0%	0	0	100%	0	1646010	0%	0	100%	1097340	2743350	100%	0%	0		
OOSA	6942	0%	0	0	100%	0	208260	0%	0	100%	138840	347100	100%	0%	0		
Total	61809		0	0		0	1854270		0		1236180	3090450			0	1236.2	4944.7
QATAR																	

OTBD	111051	100%	9994590	16657650	100%	0	3331530	100%	6663060	100%	2221020	5552550	100%	0%	0		
OTHH			0	0		0	0		0		0	0	100%	0%	0		
Total	111051		9994590	16657650		0	3331530		6663060		2221020	5552550			0	18878.7	32204.8
SAUDI ARABIA																	
OEDF	39427	0%	0	0	0%	0	0	0%	0	0%	0	0	0%	0%	0		
OEJN	108676	0%	0	0	0%	0	0	0%	0	0%	0	0	0%	0%	0		
OEMA	23550	0%	0	0	100%	0	706500	0%	0	100%	471000	1177500	100%	0%	0		
OERK	92451	0%	0	0	0%	0	0	0%	0	0%	0	0	0%	0%	0		
Total	264104		0	0		0	706500		0		471000	1177500			0	471.0	1884.0
SUDAN																	
HSNN			0	0	0%	0	0	0%	0	0%	0	0	100%	0%	0		
HSOB	600		0	0	0%	0	0	0%	0	0%	0	0	100%	0%	0		
HSSS	18641		0	0	100%	0	559230	0%	0	100%	372820	932050	100%	0%	0		
HSPN	1751		0	0	0%	0	0	0%	0	0%	0	0	100%	0%	0		
Total	20992		0	0		0	559230		0		372820	932050			0	372.8	1491.3
SYRIA																	
OSAP		0%	0	0	0%	0	0	0%	0	0%	0	0	0%	0%	0		
OSLK	33	0%	0	0	0%	0	0	0%	0	0%	0	0	0%	0%	0		
OSDI	2755	0%	0	0	0%	0	0	0%	0	0%	0	0	25%	0%	0		
Total	2788		0	0		0	0		0		0	0			0	0.0	0.0
UAE																	
OMAA	71803	0%	0	0	100%	0	2154090	0%	0	100%	1436060	3590150	100%	100%	5507290.1		
OMAD		0%	0	0	100%	0	0	0%	0	100%	0	0	100%	0%	0		
OMAL	482	0%	0	0	0%	0	0	0%	0	0%	0	0	100%	0%	0		
OMDB	200954	0%	0	0	100%	0	6028620	0%	0	100%	4019080	10047700	100%	0%	0		
OMDW		0%	0	0	100%	0	0	0%	0	100%	0	0	100%	0%	0		
OMFJ		0%	0	0	100%	0	0	0%	0	100%	0	0	50%	0%	0		
OMRK	2210	0%	0	0	100%	0	66300	0%	0	100%	44200	110500	100%	0%	0		
OMSJ	37854	0%	0	0	100%	0	1135620	0%	0	100%	757080	1892700	100%	50%	1451700.9		
Total	313303		0	0		0	9384630		0		6256420	15641050			6958991	13215.4	31984.7
YEMEN																	
OYAA	107	0%	0	0	0%	0	0	0%	0	0%	0	0	0%	0%	0		
OYHD		0%	0	0	0%	0	0	0%	0	50%	0	0	50%	0%	0		
OYRN	86	0%	0	0	0%	0	0	0%	0	0%	0	0	0%	0%	0		
OYSN	615	0%	0	0	100%	0	18450	0%	0	100%	12300	30750	100%	0%	0		
OYTZ	30	0%	0	0	0%	0	0	0%	0	0%	0	0	0%	0%	0		
Total	838		0	0		0	18450		0		12300	30750			0	12.3	49.2

TOTAL FIGURES	Total Dep 2017		CCO 1 (low)	CCO 1 (high)		CCO 2 (low)	CCO 2 (high)		CDO 1		CDO 2 (low)	CDO 2 (high)			APTA1	TOTAL LOW (Mt)	TOTAL HIGH (Mt)
MID Region	1196472		99945.9	166576.5		0.0	192834.0		66630.6		148887.7	372219.3			126566.2	44203.0	92482.7

State	Total Saving Low (Mt)	Total Saving High (Mt)
BAHRAIN	3098.7	4322.8
EGYPT	4792.2	6202.9
IRAN	902	1698.2
IRAQ	618	862.1
JORDAN	2668.5	4776.8
KUWAIT	4022.8	7201
LEBANON	2394.3	3340.1
LIBYA	0	0
OMAN	4694	8402.6
QATAR	25091.3	38417.4
SAUDI ARABIA	1788.5	3201.5
SUDAN	1547.2	2665.7
SYRIA	38.5	38.5
UAE	19766.9	38536.2
YEMEN	46.7	83.6

TOTAL	71469.6	119749.4



Appendix C

Questionnaire for the assessment of environmental benefits accrued from the implementation of ASBU Block 0

STATE: …… **REPORTING YEAR: ……**									**Aircraft Weight**		
	Intl AD (Location Indicator)	**Total no. of Departures**	**% of traffic (departures) using CCO**	**% of traffic (departures) using PBN SIDs**	**Total no. of Arrivals**	**% of traffic (arrivals) using CDO**	**% of traffic (arrivals) using PBN STARs**	**% of arrivals using PBN Approach Procedures (APTA)**	**% of fleet (Light)** (7000kg or less)	**% of fleet (Medium)** (7000-136000 kg)	**% of fleet (Heavy)** (136000 kg or more)
1					*See Note*						
2											
3											
4											
5											
6											
7											
8											
9											
10											

Notes:

- Blue Cells are mandatory information (Location indicator of the international airports and annual number of departures). Without this data, estimation could not be carried out.

- White cells are those information to be used for the estimation of the amount of fuel saving using the Rules of Thumb (RoT). Providing the percentages, would make the final estimation of the total fuel saving more precise and accurate.

- Number of arrivals is considered almost equal to the number of departures.

- END -