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Agenda Item 2: WATRS Plus Project Implementation Issues

Preliminary Cost-Benefit Analysis for the Western Atlantic Route System (WATRS) Plus Separation Reduction Initiative

(Presented by the United States)

SUMMARY

This paper presents the findings of a preliminary cost-benefit analysis to determine the estimated operator fuel savings and forecasted aircraft upgrade costs for operators to achieve RNP 10 or RNP 4 authorization for the WATRS Plus Project.

ICAO Strategic Objective:
A: Safety – Enhance global civil aviation safety
D: Efficiency – Enhance the efficiency of aviation operations
E: Continuity – Maintain the continuity of aviation operations

Global Performance Indicators:
GPI-5 Performance Based Navigation
GPI-6 Air Traffic Flow Management
GPI-7 Dynamic and flexible ATS route management
GPI-8 Collaborative airspace design and management

1. Introduction

1.1 This paper presents the findings of a preliminary cost-benefit analysis to determine the estimated operator fuel savings and forecasted aircraft upgrade costs for operators to achieve RNP 10 or RNP 4 authorization for the WATRS Plus Separation Reduction Initiative.

1.2 The U.S. FAA has previously announced its intention to propose, on a date to be determined, that RNP 10 or RNP 4 authorization be required for cruise operations between flight levels 290 – 410 (inclusive). This cost-benefit analysis was developed to estimate the costs and benefits associated with that scenario. The fuel-burn simulations discussed in this paper, therefore, assumed that all operations within the airspace would possess RNP 10 or RNP 4 authorization. Likewise, the costs were estimated on the assumption that operators that frequently fly in the WATRS Plus control areas would upgrade their aircraft to meet RNP 10 or RNP 4 standards.

1.3 The effect of reduced fuel consumption in terms of reduced emissions will be estimated as part of future efforts.

2. Fuel Savings

2.1.1 The U.S. FAA William J. Hughes Technical Center Simulation and Analysis Team (ACB-330) conducted fuel-burn simulations to determine the potential fuel savings through reducing the lateral separation minimum from 90 nautical miles to 50 nautical miles. This activity was based on a 3-day sample of traffic movement data. It was taken from a 1 December 2005 to 15 March 2006 105-day sample of Enhanced Traffic Management System (ETMS) data collected from the airspace.

2.1.2 The fuel-burn modeling was conducted by using the three-day sample and the current lateral separation requirement of 90 nautical miles to generate a baseline for the daily pounds of fuel burnt by all aircraft within the airspace. The same traffic sample was then modeled by using a lateral separation of 50 nautical miles for all aircraft to determine the total fuel burn for the aircraft within the airspace. The results of the simulation are presented in Table One.

WATRS Plus Simulation Results			
WATRS (lbs.)	**WATRS Plus (lbs.)**	**Savings**	**% Reduction**
23,423,500	23,111,700	311,800	1.33%
25,119,100	24,777,400	341,700	1.36%
21,453,000	21,178,700	274,300	1.28%
69,995,600	69,067,800	927,800	1.33%

Table One: WATRS Plus Simulation Results

2.1.3 The simulation results show the average operator fuel savings from implementing 50 nautical mile lateral separation would be 1.33%. These savings are due to shorter route distances and greater availability of fuel-efficient flight levels. The fuel savings in pounds was converted to gallons through using the conversion factor for Jet-A fuel of 6.84 lbs. per gallon. An estimated Jet-A fuel price of $1.98 per gallon was obtained from *FAA Aerospace Forecasts 2007-2020* and used to calculate the total estimated fuel savings. Please note that this fuel price estimate is a conservative long term forecast and does not reflect current market conditions. The 19 October 2007 IATA Jet Fuel Price Monitor presents a current price of $2.43 per gallon as the average price paid at the refinery for aviation jet fuel.

2.1.4 A 3-day fuel savings of $268,600.00, or $32.7 million annually was calculated for this proposed initiative. These values were then used to estimate the potential 15-year fuel savings. The fuel savings are estimated to increase 5.9% per annum in accordance with current traffic growth forecasts provided by the U.S. FAA Office of Policy and Plans and this number was factored into the calculation. An estimated 15-year fuel savings of $741.2 million, or $414.0 million discounted was calculated for this initiative and is presented in Table Two.

15-Year Fuel Savings			
2008	$19,061,271.20	0.9346	$17,814,664.06
2009	$34,604,376.34	0.8734	$30,223,462.30
2010	$36,646,034.55	0.8163	$29,914,158.00
2011	$38,808,150.58	0.7629	$29,606,738.08
2012	$41,097,831.47	0.713	$29,302,753.84
2013	$43,522,603.53	0.6663	$28,999,110.73
2014	$46,090,437.13	0.6227	$28,700,515.20
2015	$48,809,772.92	0.582	$28,407,287.84
2016	$51,689,549.53	0.5439	$28,113,945.99
2017	$54,739,232.95	0.5083	$27,823,952.11
2018	$57,968,847.69	0.4751	$27,540,999.54
2019	$61,389,009.71	0.444	$27,256,720.31
2020	$65,010,961.28	0.415	$26,979,548.93
2021	$68,846,608.00	0.3878	$26,698,714.58
2022	$72,908,557.87	0.3624	$26,422,061.37
Total	**$741,193,244.74**		**$413,804,632.88**

Table Two: Estimated 15-Year Fuel Savings from WATRS Plus Separation Reduction Initiative.

3. Aircraft Upgrade Costs

3.1.1 Aircraft engineering costs for the addition of a second long-range navigation system to achieve at least RNP10 capability were researched. The traffic sample was analyzed to yield a list of the aircraft types that may require equipment upgrades to achieve RNP10 capability. This research found that 91.5% of the aircraft observed in the traffic sample currently possessed the capability to navigate to the RNP10 or RNP4 navigation specification. Upgrade costs for aircraft types comprising the remaining 8.5% of operations within the airspace were further researched by interviewing representatives of commercial and general aviation operators, airframe manufacturers, avionics manufacturers, service centers and industry associations. The aircraft engineering cost estimates for these types is presented in Table Three: Estimated Aircraft Engineering Costs for RNP10 Eligibility.

Aircraft Engineering Costs for RNP-10 Eligibility[1]		
Type	**Estimate**	**Source**
A124	$300,000.00	Engineering Analysis
B701, B703	$250,000.00	Manufacturer
B721, B722	$250,000.00	Manufacturer
B732, B733	$250,000.00	Manufacturer
DC86, DC87	$300,000.00	Manufacturer
DC91, DC93	$250,000.00	Manufacturer
IL62, iL96	$300,000.00	Engineering Analysis
MD81, MD82, MD83, MD87, MD88	$250,000.00	Manufacturer

Aircraft Engineering Costs for RNP-10 Eligibility[1]		
Type	**Estimate**	**Source**
YK42	$300,000.00	Engineering Analysis
AC95	$100,000.00	Engineering Analysis
ASTR	$75,000.00	Service Center Estimate
AT72	$100,000.00	Engineering Analysis
BE10, BE20, BE30	$100,000.00	Engineering Analysis
BE40	$75,000.00	Service Center Estimate
C25A	$75,000.00	Service Center Estimate
C25B	$75,000.00	Service Center Estimate
C500	$75,000.00	Service Center Estimate
C501	$75,000.00	Service Center Estimate
C525	$75,000.00	Service Center Estimate
C56X	$75,000.00	Service Center Estimate
CL60	$75,000.00	Service Center Estimate
CRJ1, CRJ7	$75,000.00	Service Center Estimate
D228	$100,000.00	Engineering Analysis
DH8A, DH8B, DH8C	$100,000.00	Engineering Analysis
E110	$100,000.00	Engineering Analysis
E135, E135	$75,000.00	Service Center Estimate
FA10, FA20	$75,000.00	Service Center Estimate
GFL2, GLF3	$75,000.00	Service Center Estimate
H25A, H25B	$75,000.00	Service Center Estimate
JS32	$100,000.00	Engineering Analysis
L29B	$100,000.00	Service Center Estimate
LJ24, LJ25	$75,000.00	Service Center Estimate
LJ31, LJ35, LJ36	$75,000.00	Service Center Estimate
LJ40, LJ45	$75,000.00	Service Center Estimate
LJ60	$75,000.00	Service Center Estimate
MU30	$100,000.00	Engineering Analysis
P180	$100,000.00	Engineering Analysis
PAY4	$100,000.00	Engineering Analysis
PC12	$100,000.00	Engineering Analysis
PRM1	$100,000.00	Service Center Estimate
SBR1, SBR2	$75,000.00	Service Center Estimate

Aircraft Engineering Costs for RNP-10 Eligibility[1]		
Type	**Estimate**	**Source**
SW4	$100,000.00	Engineering Analysis
WW23, WW24	$75,000.00	Service Center Estimate

[1] These estimates assume the presence of a single long-range navigation system (LRNS) and present the estimated cost to add an additional LRNS to make the aircraft eligible for RNP-10 authorization.

Table Three: Estimated Aircraft Engineering Costs for RNP10 Eligibility

4. WATRS Plus Implementation Costs

4.1.1 The costs for operators to upgrade aircraft to realize benefits from this initiative were determined by using the estimated aircraft engineering costs from Table Three along with the forecasted aircraft totals that would be upgraded to RNP10 capability. These estimates are based on the following assumptions:

- Criteria for determining the aircraft population upgrade estimates considered industry association data on fleet navigation capabilities, engineering analysis, fleet size, operator perspectives, observed frequency within the traffic sample, and geographic proximity of the operator's base to the WATRS airspace.
- A significant percentage of small commercial/general aviation aircraft operators utilizing aircraft not capable of navigation to the RNP10 navigation specification may not upgrade due to their low frequency of operations within the airspace.
- State aircraft are not considered in this cost estimation.
- Pilot training costs are not considered in this analysis.
- System upgrade costs to ATS providers are not considered in this analysis.

4.1.2 The ETMS traffic sample was further analyzed and reduced to yield the aircraft types and quantity forecasted to upgrade for RNP10 capability within each respective State. Table Four presents the results for this activity and includes both commercial and small commercial/general aviation aircraft types. The results of this analysis show that approximately 247 aircraft will be upgraded by operators to realize the fuel savings from this initiative at a total cost of $29.3 million.

Forecasted Aircraft Upgrade Activity			
A/C Type		**Cost Per Airframe**	**Upgrade Cost**
A124	3	$300,000.00	$900,000.00
ASTR	1	$75,000.00	$75,000.00
B350	1	$100,000.00	$100,000.00
B721	2	$250,000.00	$500,000.00
B722	32	$250,000.00	$8,000,000.00
B732	2	$250,000.00	$500,000.00
B733	4	$250,000.00	$1,000,000.00
BE40	16	$75,000.00	$1,200,000.00

Forecasted Aircraft Upgrade Activity			
A/C Type		**Cost Per Airframe**	**Upgrade Cost**
C25	1	$75,000.00	$75,000.00
C25A	4	$75,000.00	$300,000.00
C25B	1	$75,000.00	$75,000.00
C500	2	$75,000.00	$150,000.00
C501	2	$75,000.00	$150,000.00
C56X	20	$75,000.00	$1,500,000.00
CRJ1	1	$75,000.00	$75,000.00
DC86	5	$300,000.00	$1,500,000.00
DC87	4	$300,000.00	$1,200,000.00
DC9	1	$250,000.00	$250,000.00
E135	4	$75,000.00	$300,000.00
E145	2	$75,000.00	$150,000.00
FA10	1	$75,000.00	$75,000.00
FA20	6	$75,000.00	$450,000.00
GLF2	2	$75,000.00	$150,000.00
H25B	54	$75,000.00	$4,050,000.00
LJ25	2	$75,000.00	$150,000.00
LJ31	5	$75,000.00	$375,000.00
LJ35	28	$75,000.00	$2,100,000.00
LJ36	1	$75,000.00	$75,000.00
LJ40	4	$75,000.00	$300,000.00
LJ45	13	$75,000.00	$975,000.00
MD82	3	$250,000.00	$750,000.00
MD87	1	$250,000.00	$250,000.00
MU30	1	$100,000.00	$100,000.00
P180	1	$100,000.00	$100,000.00
PRM1	4	$100,000.00	$400,000.00
SBR1	8	$75,000.00	$600,000.00
SBR2	1	$75,000.00	$75,000.00
WW24	4	$75,000.00	$300,000.00
	247		**$29,275,000.00**

Table Four: Forecasted Aircraft Upgrade Activity for RNP10 Eligibility

5. Conclusion

5.1 This cost-benefit analysis was developed to estimate the costs and benefits associated with a scenario where RNP 10 or RNP 4 authorization would be required for cruise operations between flight level 290-410 (inclusive). The fuel-burn simulations discussed in the paper, therefore, assumed that all operations within the airspace would possess RNP 10 or RNP 4 authorization. Likewise, the costs

estimations were based on the assumption that operators that frequently fly in the WATRS Plus control areas would upgrade their aircraft to meet RNP 10 or RNP 4 standards.

5.2 The analysis estimates that 247 aircraft would be upgraded to meet RNP 10 or RNP 4 standards at a cost of $29.3 million. The estimated 15-year fuel savings is estimated to be $741.2 million, or $414.0 million discounted.

6. Suggested Actions

6.1 The group is invited to consider the estimate of costs and benefits associated with the WATRS Plus Project.

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