Twenty Seventh Meeting of the
Informal South Pacific ATS Co-ordinating Group
(ISPACG/27)

Auckland, New Zealand
27 February – 01 March 2013

Agenda Item 4 - Review Open Action Items (AI 25-1)

LOST FUEL SAVINGS DUE TO LACK OF RNP 4 & FANS-1A EQUIPAGE

Presented by Federal Aviation Administration

SUMMARY

This paper identifies denied aircraft requests for climb to optimum altitudes and places a value on the increased fuel burn due to lack of Future Air Navigation System (FANS) equipment and RNP certification.

1. INTRODUCTION

1.1. Currently in the Oakland Oceanic Flight Information Region (FIR), approximately 57 percent of the flights are FANS equipped. However, only around 44 percent of aircraft flight plan Required Navigation Performance 4 (RNP 4) equipage. When aircraft are FANS equipped and RNP 4 certified, Oakland Oceanic controllers can apply Automatic Dependent Surveillance – Contract (ADS-C) separation rules between pairs of like equipped aircraft. Smaller separation standards allow aircraft to operate at more fuel efficient routes and altitudes. This paper focuses on extra fuel burn due to denied requests because of lack of aircraft FANS and RNP 4 equipage.

2. DISCUSSION

2.1. FANS equipped aircraft are able to qualify for RNP 4 certification. Since the fuel burn savings metrics in this paper were first developed, there has been a significant closure in the gap between the percentages of RNP 4 and FANS-1A equipped aircraft in the Oakland Oceanic Control Area (CTA). In May of 2012, 55 percent of aircraft in the Oakland CTA were FAN-1A equipped, but only 30 percent of aircraft flight planned RNP 4 equipage. That was a gap of 25 percent of aircraft capable of being certified as RNP 4 but weren't flight planning the equipage. Currently, about 57 percent of flights in the Oakland Oceanic FIR are FANS equipped and 44 percent flight plan RNP 4. There is still a gap of 13 percent of flights that are capable of RNP 4 but that do not flight plan with RNP 4 equipage. Over the last 8 months the gap has closed 12 percent between RNP 4 and FANS-1A equipped aircraft.

2.2. Some operators do not flight plan RNP 4 because of the extra cost associated with more frequent ADS-C reports. A FANS, RNP 4 flight planned aircraft in the Oakland Oceanic FIR receives an ADS-C reporting rate of 832 seconds (13 minutes 52 seconds). A FANS, RNP 10 aircraft receives an ADS-C reporting rate of 1600 seconds (26 minutes 40 seconds). So it is true that a FANS, RNP 4 aircraft will have more ADS-C reports operating on the same routes in the Oakland FIR. However, when you examine the overall costs, it is more efficient to flight plan with RNP 4 equipage. Over an 8 hour flight, an RNP 4 aircraft will send 35 ADS-C periodic reports. Over the same 8 hour flight, an RNP 10 aircraft will send 18 ADS-C periodic reports. The difference is 17 extra ADS-C reports for an RNP 4 aircraft. Assuming an average cost for an ADS-C periodic position report of 0.25 US dollars ($0.25), the extra cost in ADS-C reports add up to $4.25. Consider that a gallon of fuel weighs 6.65 pounds (lbs) and costs a conservative $3.25 a gallon. A B744 held 1000 feet below its optimum altitude burns approximately 288 pounds per hour of fuel more than at their optimum altitude. That means that the B744 will burn up that $4.25 in fuel in only 1.81 minutes by operating only 1000 feet below its optimum altitude. RNP 4 and FANS will greatly increase the likelihood that the aircraft will be able to operate at its optimum altitude.

2.3. States need to work with their operators to help them certify their aircraft as RNP 4 capable. RNP 4, FANS equipped aircraft operate at more fuel efficient altitudes and reduce carbon dioxide ($CO_{2)}$ emissions. Reductions in CO_2 emissions lessen the impact of global aviation on the environment.

2.4. Oakland Air Route Traffic Control Center (ARTCC) conducted a study to place a value on the extra fuel burn that is caused by aircraft operating at altitudes below their optimum altitude due to lack of RNP 4 and FANS equipment. The FAA felt this analysis would help operators recognize the potential savings with RNP 4 and FANS equipage. The following are the details on how the extra fuel burn is calculated:

a) To calculate the extra fuel burn, the FAA worked with the operators and International Air Transport Association (IATA) to develop a table of how much extra fuel each aircraft type burns when it is in thousand feet increments below the aircraft's optimum altitude. This table is provided as an attachment to this paper.

b) To determine when an aircraft is below its optimum altitude, the program tracks when an aircraft makes a request for a climb clearance and the climb is denied by air traffic control (ATC). The requested altitude is tracked as the aircraft's optimum altitude. The program examines the blocking traffic and looks to see if the conflict is same direction traffic and the distance to the traffic is 16 nautical miles (NM) or more (ADS-C Climb Descent Procedure[CDP]). If these conditions are met, the program will track the time the aircraft is below their optimum altitude.

c) The time the aircraft is below its optimum altitude is multiplied by the data in the extra fuel burn table. This allows us to calculate the extra fuel burned because an aircraft is operating below optimum altitude. The program also tracks interim step climbs and updates in requested altitude and figures this data in the calculation.

d) For this calculation, 15 days of data (6 January – 21 January, 2013) were examined in the Oakland Oceanic FIR. The results show that an extra fuel burn of 28,858 kilograms (kg) (63,487 lbs) was experienced due to lack of RNP 4 and FANS equipment. If the data are extrapolated over a 1 year time period, an annual extra burn of 702,211 kg (1,544,850 lbs) of fuel and an extra 2.2 million kg of CO_2 emissions would be realized.

e) Two other 15 day time periods were looked at over the past year with very similar results. April 1-16, 2012 showed a savings of 27,331 kg for the 15 days. September 10-24, 2012 showed a savings of 28,829 kg for those 15 days.

2.5. While this data is based on every aircraft being RNP 4 and FANS equipped, it does not capture all of the benefits that can be realized by this equipage:

a) This paper does not capture the benefits related to the application of 30 NM lateral separation for pairs of RNP 4 aircraft. It would be much more difficult to make this calculation.

b) This paper does not capture the benefits associated with the application of 30 NM longitudinal separation for opposite direction pairs of RNP 4 aircraft after the aircraft have passed. It would be much more difficult to make this calculation.

c) This paper does not capture the benefits that are lost when an aircraft is denied a request for climb due to traffic, and the aircraft does not make subsequent requests for higher optimum altitudes because of the traffic.

d) ATS Route Structures and Pacific Organized Track System (PACOTS) are developed based on a 50 NM lateral separation standard. Extra savings could be realized if route structures could be revised based on a 30 NM lateral separation standard.

e) Most of all this paper only captures the lost savings in the Oakland FIR. It does not capture the lost savings in other FIRs.

f) In the first study, there were an additional 100 RNP 4 aircraft that were denied altitude changes with a spacing of 16 NM or more. These aircraft were impacted by other non RNP 4 aircraft. A savings loss was not calculated for these 100 aircraft, but the RNP 4 savings would be significantly higher.

3. ACTION BY THE MEETING

3.1. The meeting is invited to:

a) Recognize the benefits of RNP 4 and FANS equipage; and

b) Consider certifying FANS equipped aircraft as RNP 4; and

c) Consider equipping aircraft with satellite FANS and RNP 4 certification.

Additional Fuel Burn Based on Aircraft Type								
Altitude Below Optimum	Average Additional Fuel Burn per Hour (kilograms)							
	A320[1]	A332	B737	B738	B744	B752	B763/4	B777
1000 ft below optimum	36	35[2]	13	13	131	48	52	20
2000 ft below optimum	72	71	24	24	133	81	84	139
3000 ft below optimum	118	136[2]	53	53	348	119	117	292
4000 ft below optimum	172	182	89	89	397	150	164	312
5000 ft below optimum	254	251[2]	142	142	761	214	238	595
6000 ft below optimum	336	321	272	272	800	254	327	20

[1] No data was available for the A320. B757 data was utilized.
[2] Extrapolated Data.