International Civil Aviation Organization
CAR/SAM Regional Planning and Implementation Group (GREPECAS)
Fifteenth Meeting of the CAR/SAM Regional Planning and Implementation Group (GREPECAS/15)
Río de Janeiro, Brasil, 13 – 17 October 2008

Agenda Item 6: **Any other business**

MANAGING THE ENVIRONMENTAL ISSUES OF AIR TRANSPORTATION

(Presented by IATA)

SUMMARY

This paper highlights the increased importance of CNS/ATM activities in the management of aviation's environmental impacts. Against the background of the ICAO goal of limiting or reducing the impact of aviation emissions on the global climate, it discusses responsibility in environmental matters. Air Navigation Service Providers need to consider environmental benefits when defining systems for air traffic services, including the environmental savings of new routes, terminal procedures and ground movements.

This paper calls for all stakeholders to take a more proactive approach to environmental management and pursue the use of operational measures that can limit or reduce the environmental impact of aircraft engine emissions.

1. Introduction

1.1 Scientific research, political activity and media attention have familiarized the world with the issue of climate change and its apparent cause and effect. Consequently aviation continues to be questioned and criticized of its contribution to greenhouse gas emissions. Currently, aviation contributes about 2% to total CO2 emissions worldwide – as compared to:

- 18% for road transport
- 35% for electricity/heating, and about
- 23% for industry.

1.2 Aviation is one of the most efficient means of mass transportation. Modern aircraft transport passengers at about 3.5 litres per 100 kilometres, and as an industry aviation has improved its fuel efficiency performance by about 70% over the last 40 years.

2. Discussion

2.1 The ICAO 36th General Assembly requested the Council to encourage Contracting States to improve air traffic efficiency, which leads to emissions savings, to report on progress in this area, and requests the States to accelerate the development and implementation of fuel efficient routings and procedures to reduce aviation emissions..

2.2 The ICAO Committee on Aviation Environmental Protection (CAEP) developed the Operational Opportunities to Minimize Fuel Use and Reduce Emissions (Circular 303/AN/176).

2.3 The fourth meeting of the ALLPIRG/Advisory Group (ALLPIRG/4) addressed environmental issues and concluded that "ICAO Regional Offices and PIRGs support ICAO/CAEP efforts to expand the methodology for the quantification of CNS/ATM environmental benefits to each region by collecting data"

2.4 The March 2006 meeting of ALLPIRG/5 adopted the following Conclusions related to Environmental Benefits:

Conclusion 5/7 — Environmental benefits of CNS/ATM systems.
That PIRGs and States:

a) use the Committee on Aviation Environmental Protection (CAEP) provided CO2 conversion factor in the analysis of environmental benefits of implementing CNS/ATM systems;
b) prioritize the implementation of voluntary, operationally-based improvements in their air traffic management systems, with emphasis on fuel savings, emissions reductions and noise benefits, and also to mitigate costs to the industry;
c) provide feedback to ICAO on studies conducted on the environmental benefits of implementing CNS/ATM systems; and
d) share air traffic data to improve future CAEP assessments, in line with State letter AN 1/17-03/86.

Conclusion 5/8 — Globally coordinated air traffic services (ATS) routes.
That PIRGs:

a) establish a global consolidated, prioritized list of routes and terminal area (TMA) improvements in close coordination with airspace users; and
b) work with neighboring PIRGs/States/air navigation service providers (ANSPs) to accelerate international route improvements

Conclusion 5/9 — Terminal area (TMA) structure and area navigation.
That States:

a) employ area navigation in all TMAs, including appropriate arrival and departure procedures, to improve efficiency and reduce emissions in the vicinity of airports; and that, in special cases where there are particularly challenging obstacles and where air traffic density is very high and additional approach paths are possible, the more precise and contained required navigation performance (RNP) procedures be employed; and
b) review operations, procedures and training of controllers to ensure the optimum management of air traffic services

2.5 The ICAO air navigation planning and implementation regional groups (PIRGs) are tasked to monitor implementation of air navigation facilities and services, taking into account environmental matters. It is clear that ICAO, the formal and informal airspace planning groups, international organizations and contracting States have a valuable role to play to address and minimize the use of fuel and its associated gaseous emissions.

2.6 Therefore, it is important that States and Air Navigation Service Providers (ANSP) take on a proactive role on implementation programmes that are "pro-environment". The ICAO airspace planning forums need to aggressively promote awareness of environment issues, pursue environmental saving initiatives, document environment benefits, promote environmental saving programmes and implement measures to reduce emissions.

2.7 Although much has been done, there is room for significant improvement in the management of aircraft operations. The UN Intergovernmental Panel on Climate Change (IPCC) estimates 6-12% inefficiency in the management of air traffic by air traffic control (ATC). Operational improvements that should be more vigorously pursued include:

a) Shortening air routes,
b) Promoting flexible flight planning,
c) Promoting RNAV and RNP over continental airspace,
d) Complete expansion of RVSM,
e) Pursuing reduced separation minimums,
f) Promote dynamic sharing of airspace between civil and military (when not being used by military),
g) Promoting flex-tracks, dynamic reroutes and user preferred routes (UPRs) in oceanic airspace
h) Promoting RNAV and RNP procedures in TMAs,
i) Promoting Continuous Descent Arrivals (which can save 50-200 kg fuel per flight),
j) Promoting Collaborative Decision Making to reduce ground delays and reroutes,
k) Promoting cruise climbs and oceanic step climbs.

2.8 In order to promote awareness, environmental savings of CNS/ATM should be addressed and environmental benefits documented. Where simple formulas or tables exist, environmental savings should be quantified to routes in the air navigation plan, proposals to airspace planning forums and in report documentation. IATA will do its part in documenting environmental savings to its proposals. Common methodology and standardization of benefit analysis is important and the determination of environment benefits should not be a costly exercise but to the greatest extent possible it should be a simple and cost effective methodology to assess environmental benefits.

2.9 In summary, it is important for the ICAO Regional Offices, States, ANSP, the airspace planning forums and other associated bodies assess the environmental impact of specific implementation plans and promote those benefits to the government policy makers faced with making the necessary commitments to CNS/ATM systems implementation.

3. Action by the Meeting

3.1 The meeting is requested to:

a) recognize the mandate for ICAO to address the adverse environmental impacts that may be related to civil aviation activity and acknowledges its responsibility and that of its Contracting States to achieve maximum compatibility between the safe and orderly development of civil aviation and the quality of the environment;

b) recognize the mandate for PIRG’s to address environmental matters, and therefore the need to consider the environmental issues when defining CNS/ATM systems, including the environment savings of new routes, terminal procedures and ground movements;

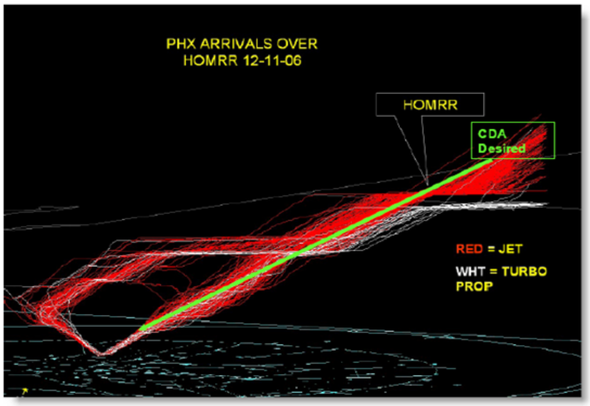
c) note the need to establish and maintain a simple and cost effective common methodology to assess and document environmental benefits to airspace and CNS/ATM planning initiatives; and

d) commit to a proactive approach by promoting the use of operational measures that can limit or reduce the environmental impact of aircraft engine emissions.

'Dive & Drive' vs. Continuous Descent Arrival (CDA)

Introduction
Aircraft should burn the least amount of fuel during the descent phase of flight. This is due to the smooth and unimpeded descent profile that the aircraft is capable of flying with engines running at an idle or near-idle speed. The ideal descent also starts at the highest possible altitude (top-of-descent) where the less dense and colder air helps with fuel efficiency.

Reduced engine and airframe drag through Continuous Descent Arrival (CDA) also reduces the noise footprint anywhere from 4-6 decibels from a conventional approach. An MIT study found that "a three-decibel difference is appreciably noticeable to the human ear while a 10-decibel reduction equates to 50 percent less noise".

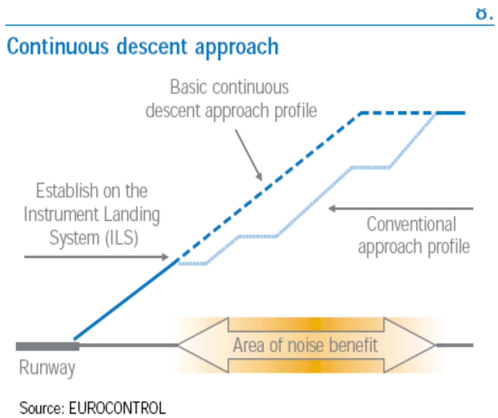


CDA's also reduce nitrogen oxides (NOx) pollutants by 30% at 3000 feet and below.

Arrivals Today
In today's arrival procedures, it is not unusual for a pilot to receive anywhere between 4 - 10 step-down altitude assignments by air traffic control (ATC). In busy airspace, these step down clearances allow controllers to manually sequence and space flights at relatively low altitudes and slower speeds. Each time the aircraft levels off at its altitude assignment, there is the noisy "spooling up" of engines to maintain level flight – resulting in additional fuel burn.

Benefits
CDA's save 50-200 kg fuel per flight - for a Boeing B767 around 165 kg fuel or 525 kilos CO_2 per arrival. The noise footprint is reduced anywhere by 3 to 6 decibels and the pilot workload decreases significantly.

For safety reasons, the NTSB actively recommends that all airlines incorporate a constant-rate-of-descent technique in flying non-precision approaches (NPA's).



Recommendation
There is an easy way to implement CDA's today – it's a simple clearance by ATC instructing individual flights to at "pilot's discretion descend and maintain [assigned altitude]" in a way that does not force the aircraft to level off at an interim altitude assignment. This will allow the pilot to start descent at the profile that is optimum for fuel savings.

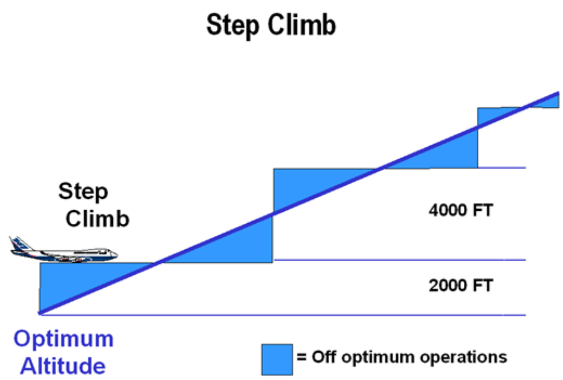
CDA's as a standard instrument arrival procedure for all aircraft is somewhat more complicated to develop. However, IATA recommends that ANSP's start developing CDA procedures where they can be relatively easy to accomplish – at low-density airports or after hours at the more busy airports. The communities below would be most grateful - as implementing CDA's over their homes will significantly reduce aircraft noise.

Flying at Optimum Altitude

Flying at optimum altitude is critical for saving fuel. For example, an Airbus A340-5?00 or a Boeing B747-400 flying 4000ft below optimum altitude would incur about 440kg additional fuel burn per hour. That spread over a flight of 5 hours or longer could easily result in normal route reserves being exceeded and an en-route diversion for fuel.

STEP CLIMBS

Flight planning calculations which dictate the minimum legal fuel requirement are predicated on achieving the lowest fuel burn while factoring all known or foreseen contingencies. Care is also taken to allow for unforeseen contingencies, such as Contingency or Route Reserve fuel. The rules of flight usually prohibit a smooth linear upward (or downward) flight profile and instead change altitude by 'step-climbs'.



Air Traffic Control (ATC) Separation Minimums affect Altitude Availability

There are several instances when optimum altitudes by step climbs are not always available. This happens primarily when ''demand' outstrips ''supply'' (or airspace capacity), which penalizes the flight to a lower altitude. These penalties are more pronounced in areas of ''procedural separation'' where deficiencies in communication, navigation or surveillance require expanded separation standards on the horizontal plane on the order of 10 to 15 times greater than those used by radar control. The resulting safe separation minimums mean fewer opportunities for access to an optimum altitude.

En Route Consequences

Specific Range Penalty for not flying at Optimum Altitude

Aircraft	+2000ft	-2000ft	-4000ft	-6000ft
A300B4-605	2.0%	0.9%	3.4%	9.3%
A310-324	1.9%	1.4%	4.4%	9.3%
A318-111	0.7%	1.6%	5.0%	10.0%
A319-132	1.0%	3.0%	7.2%	12.2%
A320-211	**	1.1%	4.7%	9.5%
A320-232	1.4%	2.1%	6.2%	12.0%
A321-112	2.3%	1.4%	4.6%	15.2%
A330-203	1.8%	1.3%	4.2%	8.4%
A330-343	3.0%	1.0%	3.2%	7.2%
A340-212	1.4%	1.5%	4.0%	8.0%
A340-313E	1.5%	1.6%	5.2%	9.5%
A340-642	1.6%	0.6%	2.2%	5.1%

** Above Maximum Altitude

In-flight re-clearances, e.g. reroutes by ATC, must be limited to the least-impact solution on the aircraft. The lateral (route) profile is generally optimized for both fuel burn and costs. Re-clearances should therefore be first limited to level changes. If an alternative flight level along the same route is not available, only then should a reroute or a lateral track deviation be considered. A suboptimum flight level, either above or below, will penalise the range of the aircraft by as much as 15% as illustrated in the Airbus Specific Range Penalty chart. The penalties are more evident in non-RVSM airspace found in Russia, Central Asia and Africa.

EXAMPLE

An Airbus A340-600 operating a Johannesburg-London route of around 11 hours at a 4000' level penalty (which would be the normal next available altitude on a non-RVSM bidirectional route) would burn 5000kg more fuel than planned. Although contingency fuel is catered for such eventualities, it however does erode on the options available at destination, such as holding for bad weather or traffic. Flight time is generally not affected in a major way.

Clean Airspeed Departures

250kts/10,000ft restrictions.

BACKGROUND

The vast majority of airports around the world continue to impose a speed restriction of 250kts IAS (indicated airspeed) until reaching 10,000ft ASL (above sea level). This is an old regulation dating back to the days of 'see-and-be seen' where a large majority of turbo-fans and turbo-props prevailed in the traffic mix. Flying VFR (visual flight rules) required pilots to see - and at speeds low enough to avoid each other in case of conflict. In class A, B and C airspace, and assisted by radar surveillance, this condition is not necessarily true in today's environment of controlled flight. All traffic operate in a ''known'' environment, i.e. following an air traffic control (ATC) clearance and under ATC surveillance.

Another reason for the slower speed was bird strikes, the risk being greater below 10,000 feet. It is believed that the structural design of aircraft allows for impacts in proportions to speed.

The performance profiles of today's modern and larger aircraft cannot in most cases efficiently meet these speed requirements. It costs fuel. Additionally, the slow flying at drag-speed cause added radio congestion with requests from pilots for waivers – resulting in increased controller workload. Unless a site-specific safety risk is identified, there should be no reason to impose this restriction at every airport.

EXAMPLES

With optimized takeoff and climb speeds, fuel consumption can be minimized, especially on larger jet category aircraft. This optimum speed range for modern turbo-jet aircraft is usually from 270-300kts IAS. At todays fuel costs, an Airbus 340-500 for example, assigned 280kt for climb would spend 135kg in additional burn or 428kg CO_2- per flight. One airline analyzed and implemented fuel savings of 800kg per B744, 120kg per B777 departure when the 250kt IAS speed restriction was waived. Every kg of CO_2 savings counts. As a secondary benefit, the higher speed flows can also result in increased capacity flows at busy airports.

RECOMMENDATION

IATA believes that this speed restriction should be imposed only on a site-specific basis, e.g. on a clearly established bird-strike avoidance mitigation strategy. Except where noise abatement procedures do not allow, flaps should be retracted starting at 1,000ft allowing for less drag from the wing surface - hence the notion of a 'clean' wing. A fully extended flap on a B747 means an increase of 1320 sq.ft of exposed wing surface[1], causing higher resistance to the aerodynamic flow and increased fuel flow rates.

- END-

1 B747-400 Leading-edge flaps (total) 43.85 m2 (472.00 sq ft), Trailing-edge flaps (total) 78.69 m2 (847.00 sq ft)