**INTERNATIONAL CIVIL AVIATION ORGANIZATION**

**AFI PLANNING AND IMPLEMENTATION REGIONAL GROUP FIFTEENTH MEETING (APIRG/15)**

(Nairobi, Kenya, 26 – 30 September 2005)

**Agenda Item 8: Future work programme of APIRG**

## The Fuel Crisis and the Urgent Need to Implement Fuel Saving Measures

(Presented by International Air Transport Association (IATA))

**SUMMARY**

In spite of international passenger and cargo traffic growth exceeding expectations, the extraordinarily high level of oil prices threatens the industry with yet another year of airline losses. In addition, the high cost of fuel has spotlighted the existing inefficiencies in the air traffic services infrastructure. This paper highlights areas were ATS Providers and State ATS Authorities could assist in driving fuel inefficiencies out of their systems, and assist airlines in their internal fuel efficiency strategies.

Action by APIRG is in Paragraph 3

## 1. Introduction

1.1 In spite of the rising numbers of flights and passengers, the air transport industry continues to struggle with costs. The multiple crises of previous years - 11 September 2001, the war in Afghanistan, the war in Iraq, the war on terrorism, and SARS - combined to place our industry in an extremely vulnerable position. The rising price of crude oil has now become an even greater threat.

1.2 The airlines' 2004 fuel bill was US$62 billion, US$15 billion more than 2003. At $47.00 a barrel [average] in 2005, the fuel bill will be **$83BN - a staggering US$46 billion more than 2003**. Without doubt, the price of fuel is the biggest crisis facing the airspace user today.

1.3 The prospect of a return to profitability for the industry - on the premise of an oil market going back to the US$34 a barrel of crude after having peaked at USD$55.60 last October - is proving to be very grim. In fact, it appears that the **oil market forward curves are at historic highs <u>and are here to stay</u>**. Oil reached **USD$62.10 in early-July 2005 – a record price!**

1.4 In an industry that typically takes 15 to 20 years before new technologies can translate into system-wide efficiency gains, it is unlikely that switching to an alternative form of energy will be an option in the foreseeable future. Coupled with the lack of control over price, this means that the only hope of winning the battle to reduce energy costs is to achieve even greater operational efficiency.

## 2. Discussion

2.1 Fuel efficiency is a pervasive concept touching almost every aspect of the industry from aircraft design and construction through aviation regulatory requirements to airline operation and air navigation service provision. The cost of fuel, as a percentage of overall operating costs, has risen from around 10-12% in 2002, to around 20-25% now. Airlines are undertaking a number of fuel mitigation activities – both to reduce the amount of fuel burned – and to mitigate the cost of fuel as a “bottom line” item.

2.2 For those airlines with cash reserves or appropriate credit, there had been a temporary solution of fuel hedging - but increasingly, airlines are unable to muster the cash necessary to enter into long term hedging arrangements – particularly when those contracts may be at $60+ per barrel. Many airlines have implemented fuel surcharges – however, market forces make such surcharges unpopular, and can actually dissuade passengers from flying. **The key to mitigating the effect of fuel price is to increase operating efficiency – across the entire system**.

2.3 The fuel efficiency of air transport operations is influenced by many factors, not all of which are under the airlines direct control. Many areas, such as route structure, air traffic control and airport capacity and layout are beyond airlines’ control - but **directly** impact their fuel consumption.

2.4 In 2004, IATA launched a Fuel Action Campaign, aimed at reviewing every aspect of air transport operations. The campaign was structured in four parts:

a. Identification of fuel conservation best practices in air transport operations – supported by an assistance program to put these practices into place;
b. Enhancement of the current commercial fuel activities;
c. Identification and remediation of ATM infrastructure deficiencies; and
d. Identification and remediation of ATS effectiveness issues – engaging the ANS providers in a “Save One Minute” campaign.

2.5 In September 2004 – and again in March 2005 **-** IATA wrote to every one of the 188 Air Traffic Service providers in the world with an urgent plea to review specific areas that could bring fuel savings to airlines and asked for feedback on actions that could be considered by States. Regrettably, the response from ANSPs has been less than satisfactory, with only around 45 responses from 188 States.

2.6 The core of the IATA’s request to States on fuel conservation measures hinges in the following areas:

a. Airspace and air route design;
b. ATC techniques that take advantage of aircraft navigation capabilities rather than vectoring or assigned speed restrictions;
c. Review of Noise Abatement Procedures;
d. Closer coordination and cooperation with military authorities to facilitate transit of military restricted airspace;
e. Reviewing opportunities that would allow aircraft to operate closer to preferred flight levels; and
f. Discussing fuel conservation with local airlines and seek their assistance in better understanding fuel conversation target areas.

2.7 IATA also suggested that a “Fuel Champion” be appointed in each ANSP – not as an additional position, but as an add-on function that is focused on delivering fuel conservation benefits.

2.8 Attachment A describes how these areas can be applied in the AFI Region. Attachment B provides general background on fuel conservation activities.

*Cultural Issues*

2.9 While airlines and air traffic service providers invest in safety with their safety management systems and departments that are devoted to the safety culture of the workforce, many airlines have a similar investment in fuel efficiency as well and employ a full time Fuel Programme Manager who is responsible for monitoring the airline's fuel use as well as ensuring that procedures and practices are in place for maximising fuel efficiency. If Civil Aviation Authorities were to have a policy or programme that reviews system efficiency and a department responsible for maintaining and promoting the efficiency of the air traffic system, significant efficiency gains could be realised in the air traffic system.

## 3. Action by the Meeting

3.1 Considering the critical nature of the fuel crisis, the meeting is asked to urgently consider areas in their respective airspace and ATS operations where fuel efficiencies can be gained. No matter how small they are, if implemented quickly, these changes can have a significant effect on airline fuel consumption. Specifically, States are requested to:

a. **Identify** – with IATA and local airlines - actions that would provide fuel efficiency;

b. **Establish and promulgate** a program to implement fuel efficiency measures; and

c. **Nominate** a Fuel Champion who would liaise with IATA, airlines and other ANSPs to ensure all possible fuel conservation strategies are evaluated and if safe and cost effective, implemented.

3.2 The meeting is requested to **recommend that a Fuel Action Task Force be established** to oversight the fuel conservation activities amongst Member States.

**Regional Fuel Efficiency Actions: Africa Indian Ocean Region**

1. **Airspace and air route design.** This area alone has multi-million USD per annum potential for fuel savings in AFI. Some examples include:

    a) New or straighter routes. Routes defined by navigating from navaid to navaid are usually the most inefficient means of navigation. Area navigation (RNAV) and RNP represent greater savings in a fixed route environment. In areas of low-density traffic flexible tracks and user preferred tracks represent the most in fuel savings.

    b) RNAV SIDs and STARs. Routes on climb out and descent are a critical phase of flight in terms of fuel consumption. Consequently SIDs and STARs that are designed based on aircraft operational performance and ATC separation criteria offer significant fuel savings.

    c) Continuous descent profiles for arrivals and approaches offer significant fuel savings, quieter operations, as well as safety benefits. A Continuous Descent Approach can save 450-900 lbs fuel per flight.

    d) Collaborative Decision Making (CDM). Collaborative Decision Making for route and departure times can significantly reduce ground delays, congestion at bottlenecks and unanticipated reroutes. Allowing CDM for airlines to see the big air traffic picture and self manage slots is a simple program to both the airline and ATS Provider. While savings of such a programme is obvious, it is also difficult to measure. However, as example, the first 8 months of operations in 2004 from two airlines OPERATING IN THE Asia Pacific Region resulted in 35 reroutes to circumnavigate Afghanistan. Because this was so devastating to their operations, one of these airlines adopted a policy of taking off 4 tonnes of payload cargo and in its place was adding an additional 3 tonnes of contingency fuel for every flight that is flight planned to fly over Afghanistan during the midnight rush to Europe– which is about 10 flights per evening for that particular airline.

2. **ATC techniques that take advantage of aircraft navigation capabilities rather than vectoring or assigned speed restrictions.** Some examples include:

    a) Asking RNAV equipped aircraft to fly parallel offsets to routes in lieu of radar vectors if traffic is a factor on a fix track

    b) Assigning a time based crossing restriction to aircraft as far in advance as possible in lieu of assigning a speed restriction

    c) Allowing an aircraft to fly a visual approach in lieu of executing an instrument approach in VMC conditions

    d) Reduced separation minimums increase the opportunities to save fuel. An example would be applying the 50 nm minimum longitudinal separation rule on RNP-10 oceanic tracks for climbs or cruise climbs.

3. **Review of Noise Abatement and Departure Procedures.**

3.1. Noise abatement procedures were first developed in the late 60's during the era of noisy aircraft engine performance. Since then there has been considerable reduction in noise due to modern engine design. The noise footprint of a modern jet is significantly less than that of the earlier jet aircraft it replaces.

3.2. Noise abatement procedures come at the expense of excess fuel burned. The ICAO Standard for noise abatement is Annex 16, Vol 1, Part V and clearly states that "a*ircraft operating procedures for noise abatement shall not be introduced unless the regulatory authority, based on appropriate studies and consultation, determines that a noise problem exists*". The recommendation that follows states that "a*ircraft operating procedures for noise abatement should be developed in consultation with the operators which use the aerodrome concerned*".

3.3. IATA requests that the State of the airport and the airport authorities that have noise abatement procedures to review the conditions dictating such a procedure and if practical either:

a) Discontinue noise abatement procedures where they are not justified, if for example the climb out occurs over water and there is no community below

b) Allow airlines to choose runways and SIDs that support the direction of flight towards its destination airport,

c) Publish information identifying the noise sensitive areas and allow airlines to choose between the most appropriate of the two ICAO recommended noise abatement departure procedures (NADP). The difference between NADP 1 and NADP 2 could equate to 100-200 kg fuel saving per departure, and

d) Allowing clean airspeed on departures where noise is not an issue, i.e. departures that immediately route the aircraft over water. The rule of thumb for clean airspeed is V2 + 10-20 kts below 3,000 ft and V2 + 100 kts in the continuing climb to 10,000 ft.

4. **Engage in closer coordination and cooperation with military authorities to facilitate transit of military restricted airspace.** In domestic airspace and even near international airports it is difficult to navigate off a fix track without infringing upon military airspace. In addition there are military restricted areas over international waters that prohibit more efficient flight paths. Significant fuel savings could be achieved if ATC were allowed to clear aircraft on more direct routings during the times when military airspace is not being used for military activities.

5. **Reviewing opportunities that would allow aircraft to operate closer to preferred flight levels.** In particular, unrestricted climbs and descents carry significant fuel savings. Also, providing options to pilots, such as offering a small departure delay or alternate routing as an alternative to a penalising en route altitude provides significant savings, especially to long haul flights that may be stuck for hours at an unfavourable cruising altitude. In the en route environment, RVSM provides greater opportunities to operate at fuel saving altitudes.

6. **Discussing fuel conservation with local airlines and seek their assistance in better understanding fuel conversation target areas.** Areas that could be explored includes:

a) Programmes that allow minimum use of APU's and maximum use of Ground Support equipment. For example, a B747-400 APU burns 6 times as much fuel per hour as mobile ground support equipment.

b) Allowing departures in direction of flight. Airborne fuel flow is 6 times higher than ground idle, i.e. 18 minutes taxi equals 3 minutes of airborne operation.

c) Allowing visual separation in approach controlled airspace and visual approaches

d) Allowing early arriving flights to slow down to prevent gate holds and ramp congestion

e) Providing opportunities for rolling take offs

f) Allowing cruise climbs or step climbs in oceanic and remote airspace

g) Allowing flexible flight planning so that airlines can flight plan routes and entry/exit points based on the best operational conditions, such as upper wind conditions.

# Fuel Efficiency - A Business Imperative for the Air Transport Industry

## Introduction

The high price of jet fuel is wreaking havoc in the airlines' financial fortunes.

In an industry that typically takes 15 to 20 years before new technologies can translate into system-wide efficiency gains, it is unlikely that switching to an alternative form of energy will be an option in the foreseeable future. Coupled with the lack of control over price, this means that the only hope of winning the battle to reduce energy costs is to achieve even greater operational efficiency.

Fuel efficiency is a pervasive concept touching almost every aspect of the industry from aircraft design and construction through aviation regulatory requirements to airline operation and air navigation service provision. This paper will attempt to explore the current and potential contribution from all of these areas.

The environmental factor as a driver of fuel efficiency is also discussed, as well as the battery of measures that airlines in particular are deploying in their attempt to mitigate the impact of high fuel prices on their operations.

Last but not least, this article will highlight the initiatives and measures taken by IATA in the context of the recently launched industry-wide 'Fuel Action Campaign'.

## Aircraft design and fuel efficiency

The trend in fuel efficiency of jet aircraft over time has been one of almost continuous and incremental improvement; fuel burned per seat in today's new aircraft is 70% less than that of early jets. About 40% of the improvement has come from engine efficiency improvements and 30% from airframe efficiency improvements (Figure 1).

Historically, these improvements have averaged 1–2% per year for new production aircraft (Koff, 1991; Albritton et al., 1996; Condit, 1996). The relatively steady and continuous rate of improvement observed over several decades is likely to continue in the future. In the longer term (2050) compared to 1997, a total aircraft production average fuel-efficiency improvement of 40–50% is considered feasible (ICCAIA, 1997g).

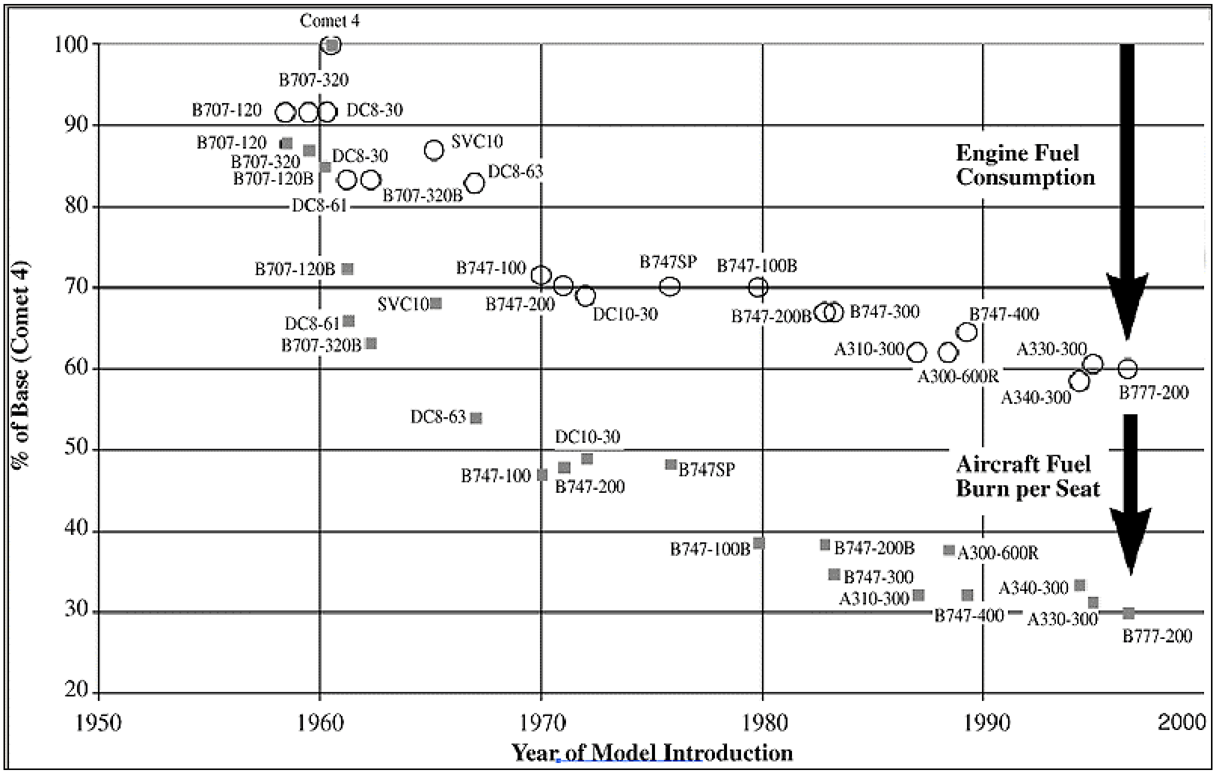
Improvement in engine fuel efficiency has come mainly from the increasing use of modern high-bypass engine technology that relies on increasing engine pressure ratios and higher temperature combustors as a means to increase engine efficiency.

Recent aerodynamic technologies such as supercritical airfoils and winglets have already provided substantial increases in aerodynamic efficiency over first-generation jet transports, and there are many emerging aerodynamics technologies worthy of development and implementation. One of the most promising, especially for improving efficiency in jet transports, is laminar flow control.

The new planes also rely on a greater use of the lighter composite materials rather than conventional aluminium. The A380 is evidence of Airbus' faith in the increasing use of composites. Some 25 per cent of the aircraft is built using composite material – 22 per cent carbon fibre reinforced plastic and three per cent GLARE fibre-metal laminate, which is being used for the first time on a civilian airliner.

Also for the first time the aircraft has a composite centre wing-box, a crucial primary structure that connects the wings to the fuselage. Another first is the composite rear fuselage section behind the rear pressure bulkhead. As well as these composites the A380 has a significant proportion of advanced metallic materials, which also offer advantages such as operational reliability, and ease of repair and maintenance. However, weight saving is one of the greatest advantages of composites, leading to less fuel burn, fewer emissions and lower operating costs.

***Figure 1:*** *Trend in transport aircraft fuel efficiency*



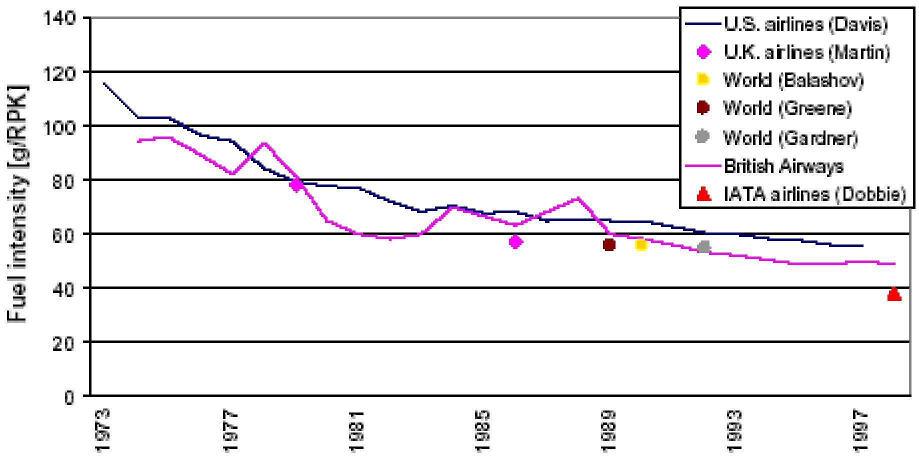

*Source: Albritton et. al, 1997*

**Fuel efficiency on a passenger kilometre basis**

The fuel intensity per passenger kilometre of commercial civil air transport has been reduced by approximately 50% since the early 1970s. The use of more fuel-efficient aircraft engines and the introduction of bigger aircraft accommodating more seats per aircraft in combination with an increase in the average stage distances have reduced the fuel use per available seat kilometre (ASK).

The improvement in the specific fuel consumption has furthermore reduced the necessary amount of fuel that has to be carried on flights of comparable distances leading to additional fuel savings. In addition, the operation at higher passenger load factors has contributed to reduce the fuel use per revenue passenger kilometer (RPK).

***Figure 2****: Fuel intensity per revenue passenger kilometre (RPK) of passenger air travel*




*Sources*: *[Davis 1999], [Martin and shock 1989], [Balashov and Smith 1992], [Greene 1990], [Gardner et. al. 1998], [British Airways 1999a] and [Dobbie 2001].*

**Competing for fuel efficiency!**

More than ever before, fuel efficiency has become a key determinant in an airline's choice of aircraft type. It is interesting to note that Boeing's advertises the B787 Dreamliner as the 'Chief Efficiency Officer'. Scheduled to come in operation in 2008, it will, according to Boeing, "…revolutionise the economics of airplane operations..."

Boeing has emphasized the flexibility and fuel efficiency of the B787, which seats 217 to 289 passengers with a range of up to 8,500 nautical miles. Boeing says the jet will be 20% more fuel-efficient than comparable planes now on the market. The new airplane will provide airlines with unmatched fuel efficiency, resulting in exceptional environmental performance. It will also travel at speeds similar to today's fastest wide bodies, about Mach 0.85.

At the recent inauguration of the Airbus A380, the Airbus officials claimed an advantage in capacity, range and fuel efficiency that drops the cost per passenger 20 percent compared to the 747-400. Airbus says the A380 offers a gain in fuel use of some 15 percent when compared with Boeing's top-of-the-range 747-400. At a cruising speed of 900 kilometers (550 miles) per hour, the A380 delivers a consumption of three litres (5.4 pints) of fuel per passenger per 100 kilometres (62 miles) traveled, according to Airbus. It cites a figure of 3.4 litres (6.2 pints) for the 747-400.

As air traffic recovers to pre 9/11 levels, high fuel costs and fuel efficiency remain key considerations in the airline's choice of new aircraft. It helps that Boeing's B787 is 20 percent more fuel-efficient than older models, while the A380 has the advantage of carrying more people.

**Air Traffic Management (ATM)**

The urgent need for radical improvement of the air traffic management system to accommodate the continuing growth of aviation and to promote efficient airspace use is recognised by all. The current system and its subsystems suffer from deficiencies in the technical, operational, political, procedural, economic, social, and implementation areas.

Much of the enroute and terminal area air traffic management (ATM) system and airport infrastructure used by the air transport industry today, closely resembles the systems that were used in the 1950's. Expensive, energy guzzling

RADAR's for surveillance, zigzag routes based on old very high frequency (VHF) omni-directional radios (VOR's) and Distance Measuring Equipment (DME), and analogue radios slaved to dedicated radio frequencies.

Today's modern air transport aircraft can be tracked using low cost automatic dependent surveillance – contract or broadcast, (ADS-C or B). They can navigate accurately anywhere around the globe with the basic GPS signal and communicate routine messages efficiently using datalink.

Although much has been done to modernize existing Air Traffic Management systems in specific jurisdictions with the resulting benefits of reduced operating costs and handling, the industry is still short of a modern, efficient, harmonized and seamless ATM system.

The all-too fragmented air traffic management system in place today needs complete redesign and a new architecture. Fundamentally, the solution is the ICAO Global Operational Concept aiming at a "Single Sky over a Single Market".

IATA has fully embraced the concept and in concert with a range of industry partners, including the major airframe manufacturers, major avionics manufacturers, and a number of service providers, has developed an ATM Implementation Roadmap.

That Roadmap was delivered to ICAO on the 15th October 2004 to assist the aviation community in its transition from the 'air traffic control environment of the 20th century to the integrated collaborative air traffic management system needed to meet aviation's needs in the 21st century." The ultimate goal is a "One Sky vision of a future integrated global air navigation system, with no inefficiencies resulting form national borders and better use of global airspace resources."

The new concept for air traffic management - with enhanced communications, navigation, and surveillance/air traffic management (CNS/ATM) systems - would benefit the air transportation sector by reducing delays, increasing the capacity of existing infrastructure, and improving operational efficiency.

The implementation of the new CNS/ATM system is underway and is resulting in fuel savings as well as reduced emissions. Several studies conducted on the implementation of the CNS/ATM suggest that improvements in air traffic management could help to improve overall fuel efficiency by 6-12%.

In the mean time various initiatives are underway in the industry to enhance ATM capabilities and efficiency. One such example is the Boeing's air traffic management (ATM) unit, which is an ambitious transatlantic trial of new satellite navigation technology, involving airlines and airports from North America and Europe.

Boeing officials say flight trials have shown that a concept called "tailored arrivals" or continuous descent approaches can improve efficiency and reduce noise and emissions when aircraft land. Under this system, electronic data guide the aircraft on its descent with "the most efficient path to its destination," according to Kevin Brown, Boeing's vice president and general manager of Advanced Air Traffic Management. Also, clearance instructions are transmitted electronically to arriving aircraft so that pilots and air traffic controllers don't require multiple voice transmissions. Such arrivals could save between 400 and 800 pounds of fuel per flight, which adds up to more than $100,000 in annual costs for each aircraft, Boeing officials say.

Early tests of the system -- using an Airbus A330 and a Boeing 747-400 done in Australia showed that tailored arrivals can save airlines fuel, reduce noise and cut controller workload and frequency congestion.

**Reduced Vertical Separation Minimum (RVSM)**

In a move that is expected to save airlines at least $5 billion in jet fuel costs over the next decade, the Federal Aviation Administration recently doubled the airspace routes between 29,000 feet and 41,000 feet by spacing aircraft a thousand feet apart instead of 2,000 feet. Increasing available high altitude routes gives pilots and air traffic controllers more choices so that aircraft can fly more direct routes at the most fuel-efficient altitudes, saving time and money for airlines and travellers alike.

"When you save fuel, you save money: it's that simple and more efficient routes save the passenger time," said FAA Administrator Marion C. Blakey. "We're adding airspace routes, increasing capacity and maintaining the same high level of safety all at the same time." The procedure is called Reduced Vertical Separation Minimum (RVSM) and can add capacity safely because most aircraft are now equipped with advanced, more precise dual altimeter systems and autopilots, FAA said.

The horizontal separation of aircraft in high altitude airspace remains at five-plus miles. RVSM has been implemented safely over the last seven years in less complex airspace from Europe to Australia and over most of the North Atlantic and Pacific Oceans. In Europe the successful implementation of RVSM and associated airspace reorganisation has enabled considerable delay reduction.

**Departure Spacing Program**

In 2000, the FAA in an effort to improve air traffic departure flow while maintaining a safe and orderly operating environment installed a new flight planning and coordination control tool, called the Departure Spacing Program (DSP). This helps the FAA "deliver uninterrupted, safe service to its clients while reducing communication inefficiencies and increasing air traffic control flexibility."

The DSP enables air traffic controllers to work more efficiently with traffic management coordinators to better use existing capacity for departing aircraft. The system reduces departure-sequencing delays and minimizes terminal-area ground, airspace and telephone congestion.

**Regulatory Requirements - Fuel Reserves**

Last summer, the FAA relaxed a long-standing requirement that aircraft on international flights carry 10% extra fuel to cover detours because of weather, navigational problems or the need to extend the flight to an alternate airport. Regulators are letting some airlines carry smaller reserves of fuel on international flights to reduce weight and save money.

Russ Chew, the FAA's senior air traffic official, said the FAA, among other things, was working on more efficient air traffic management, improved navigation technology and procedures to permit more direct routing and simpler flight plans. FAA plans to help airlines reduce fuel costs by 1% through 2008. The FAA said because of safety concerns, waivers on fuel requirements for international routes are granted on a case-by-case basis.

So far, American Airlines and Continental Airlines are the only two carriers that have been permitted to carry less fuel, the FAA said. American Airlines claims to reduce its fuel bill by US$10.5 million a year through this new policy on fuel reserve levels.

The potential for savings through reduced fuel reserves is much less for European carriers as they already operate with contingency fuel less than half that of their US counterparts. In any case more airlines should take advantage of the regulatory flexibility that allows them to streamline their fuel reserves by leveraging technological advancement in sophisticated navigation and communications systems, accurate flight planning systems, the ability to update the flight plan through data link en-route, and CAT III B landing capabilities with limits between 200 to 75 meters provided on many aircraft types.

**Airports**

Airports can also have quite a large impact on fuel and environment effects. Congested airports are the main culprits. Much can be done to reduce the noise and improve local air quality at such airports. One of IATA's service offerings in the consulting area is aircraft flow simulation at airports. Using a simulation model IATA is able to determine delays considering 1) the existing rules and procedures and 2) best practices and facility improvements required to remove limitations. Comparing before and after delays is used to estimate fuel cost savings to justify improvements.

Good apron management techniques on the part of airport authorities can contribute to reduce bottlenecks and contribute to better fuel management. Areas would include effective and coordinated gate allocation, to prevent stand-offs and stop/start taxiing, use of ground power instead of APUs, which are used to run the air-conditioning system of an aircraft parked at the gate. Fuel-powered APUs are eight times more costly to operate than electricity. There is a need to raise the awareness of the airports authorities to fuel crisis and to encourage them to look for every opportunity to assist airlines in reducing fuel burn.

**Fuel Efficiency – the environmental dimension**

A 1% saving in fuel for an A320 or B737-300 aircraft will result in a yearly reduction of fuel consumption by**100 metric tons** (32,835 US Gal) and save airlines approximately USD$50,000 per aircraft. It will also decrease the emission of pollutants by the following amounts:

**318.7 tons of $CO_2$;**
**123.9 tons of $H_2O$;**
**2.112 tons of $NO_x$;**
**98 kg of $SO_2$; and**
**56 kg of CO**

Considering there are more than 40 million flights per year (27million scheduled, 13 million freight), the cut in emissions would run in the millions of tons.

A particular challenge for manufacturers and operators lies in the *tradeoffs* that exist between emissions, noise and other design requirements. In many cases, aircraft tend to become less fuel-efficient when design criteria for meeting more stringent noise requirements are considered. Similarly, higher combustion temperatures to improve fuel efficiency typically result in increased levels of nitrogen oxides.

IATA Members plan to achieve an additional 10% fuel efficiency improvement in their total fleet by 2010. This could reduce the total release of carbon dioxide emissions into the atmosphere in this period by almost 350 million tons compared to a scenario in which year 2000 efficiency levels would be "frozen".

Emissions trading

Until now, aviation has been the ‘sacred cow’ of the transport sector excluded from all legislation to minimise environmental impact and damage. But, this is likely to change in the foreseeable future.

There is increased awareness of the aviation’s impact on the environment both in terms of global warming, noise and local air quality. It is estimated that the projected growth in air traffic “may be responsible for up to a quarter of greenhouse emissions by 2030.”

With this increased awareness, airlines face the inevitable prospect of the inclusion of aviation in the EU’s emission trading scheme as of year 2008. Emissions trading involve the government setting carbon dioxide emission limits for individual industries. Emissions trading allow companies to emit in excess of their allocation of allowances by purchasing allowances from the market. Similarly, a company that emits less than its allocation of allowances can sell its surplus allowances.

British Airways has taken the lead in this area and is already a member of the voluntary UK emissions trading scheme currently in place. At this stage, the scheme only covers BA’s domestic operation and UK properties. Nonetheless, BA claims to have achieved an impressive 17% reduction in emissions compared to the scheme 1998-2000 baseline level. But, political consensus on the issue, even within Europe, will be difficult to achieve.

Most airlines prefer emissions trading to environmental taxes as the most effective and efficient instrument to combat greenhouse gas emissions from aviation. ICAO has concluded, “ emissions trading is a far more cost-effective mechanism for limiting international aviation emissions relative to taxes and charges. It is committed to continue its study of emissions trading for international aviation.

The cost implications of emissions trading for individual airlines are still unknown. But, as the industry prepares for its implementation in the next three years, it is likely that emissions trading will be a major driver of fuel efficiency for the industry.

**No savings is too small for the airlines!**

Airlines in response to the high fuel costs are deploying a battery of measures designed to economise on the fuel burn of their fleet. While some of these practices have been in use for years in an unsystematic manner, they are now implemented with renewed urgency across the industry as airlines cope with high fuel costs and cutthroat competition. A non-exhaustive list of such measures is provided below:

- Maximise load factors and optimise the position of the centre of gravity when loading aircraft
- Use of flight simulators to replace test and training flights and reduce non-revenue flights wherever possible
- Reduce taxi time an taxiing with fewer engines between the airport gate and the runway
- Use electrically driven ground support equipment as against the use of on-board power generators
- Improve fuel performance of aircraft through maintenance programme and action in the areas of aerodynamic efficiency and engine performance
- Fly slower at cruise altitudes while sacrificing "very little" on its on-time performance
- Carry less weight by pulling heavy ovens and serving trays off of flights where no hot food is served, and by reducing the amount of water and ice they carry
- Retrofit winglets to the end of a wing to improve aerodynamic efficiency.
- Take advantage of price differentials between destinations and ‘tankering’ fuel
- Swap turboprops for small jets
- Match fuel load closer to actual payload

Better and more sophisticated flight planning through plotting "optimum trajectories"--ways to make routes as direct as possible and shorten approach paths whilst factoring in the effects of wind and weather patterns.

Increase use of onboard flight management systems to calculate optimum fuel use.

Train pilots and dispatchers to learn how to cut back on refuelling to lower the weight of the aircraft, thereby decreasing the amount of fuel burned.

Engine water wash to remove contaminants that build up and can alter the airflow across the turbine blades causing a loss in efficiency
Fly in a straight line as much as possible between certain city pairs results in shorter distances travelled and a reduction in the amount of fuel used
Sensitise ground crews and fuel vendors to prevent aircraft over-fuelling

**IATA Fuel Action Campaign**

As indicated previously, there are more than 40 million air transport flights per year (27million scheduled, 13 million freight) with annual operating costs for our industry of about **USD 375 Billion -** of which USD 70 billion is attributable to fuel. An improvement of just 1% in total system efficiency could realise USD$3.75BN in benefits on an annual basis. A reduction in fuel cost - or fuel use – of just 1% would save the airspace users USD$ 700 Million per year.

Market forces drive fuel cost but fuel use or consumption is strongly affected by airline fuel management and air traffic management. Leading the efforts in this area, IATA initiated a Fuel Action Plan in September 2004. The estimated benefit for since launch of Fuel Action Plan is **USD 85.3 million [September – December 2004]**.

Estimated benefits for 2005 from other route improvements are expected to be in excess of **USD 700 million**. Major achievements include flexible flight planning and transpolar route access in China, new and realigned routes in Middle East, non-ECAC route improvements in Europe and North American random routes off North Atlantic Tracks to West Coast USA.

IATA has stated that these savings should be easily achieved if States and Air Navigation Service Providers (ANSP's) were cognizant of the concerns of their customers, the airspace users. To this end, IATA has initiated a **"Save a Minute" Campaign,** asking ANSP's to save just one minute through better design and/or management of their airspace. Its sounds simple and - even the ANSP's agree.

This action alone would save airspace users a staggering USD1 billion a year in total operating cost.

IATA has contacted all ANSP's and many have responded positively. IATA is also working with the most senior levels with the International Civil Aviation Organization (ICAO). The ICAO Regional Planning and Implementation Groups (known as PIRGS) have agreed to place the appropriate priority and emphasis on environment and fuel saving. It is important that all stakeholders recognize this issue as THEIR priority and not just the airspace users.

Working closely with Members and industry fuel experts, IATA has developed a best practices fuel guide for airlines and ANSP's entitled "Guidance Material and Best Practices for Fuel & Environmental Management". This material is available on the IATA WEB Site at www.iata.org/fuelaction

The guidance material identifies areas of potential fuel saving and compiles best industry practices in fuel efficiency from an airline and an ANSP perspective. It includes a comprehensive checklist to allow airline management to audit their current fuel management system and ensure that they are taking full advantage of all generally available avenues to reduce fuel expenditure, within the bounds of safety.

**Drop by drop, every saving count!**

Barring a sudden slump in the world economy, the high price of oil and petroleum products is likely to prevail. There are indications that the various industries dependent on fossil energy are adjusting to the new price levels. Against this backdrop, the pressure for greater fuel efficiency will remain, if not accentuate further, as airlines try to survive in the cut-throat competitive environment of this industry.

The compounded effect of the technological 'push' through technological advancement discussed above and the environmental 'pull' from the coming environmental legislation will contribute to make fuel efficiency a primary goal for the industry.

As the airlines exhaust every single avenue within their control for saving fuel, they need to look beyond and actively engage other stakeholders like the airports and Air Navigation Service Providers where further optimisation can be achieved. It takes a community-wide engagement to reach the next level of fuel efficiency.

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