ATM and climate change
Targeting airspace efficiency

2009 promises to be a very significant year for aviation and the environment. The world is preparing for an agreement on global greenhouse gas emissions cuts, to be concluded in Copenhagen this December. The agreement has been dubbed 'Kyoto 2', as it will supersede the 1997 Kyoto Protocol which set the first round of emissions reductions, to 2012, but which was never ratified by the United States, or many of the larger developing states.

What would success for 'Kyoto 2' look like? Analysts suggest that three elements will be important: meaningful cuts in CO_2 agreed by the major industrialized countries; an agreement from the major developing countries that they cannot expand on a 'business as usual' basis; and thirdly the richer countries will need to agree on how to mitigate the effects of the climate change, especially for poorer countries. The targets and timescales for the lifespan of Kyoto 2 are unclear. However, it is likely to reflect the 2007 G8 declaration that it would seek to halve global CO_2 emissions by 2050.

For some time, it has been assumed that aviation emissions – which were exempt from the Kyoto Protocol – would be included in Kyoto 2. However, it is not expected that binding reductions on the absolute level of aviation emissions will be set. More likely is that aviation emissions will be part of the total emissions levels that will have to be cut, and it will be left to individual states or regions to decide how best to achieve those reductions. It is also expected that Kyoto 2 will make continued use of emissions trading mechanisms. Aviation is likely therefore to be under increased pressure to create a global emissions trading scheme along the lines of the system already operating in Europe.

As part of the industry input into the pre-Copenhagen discussions, ATAG (the Air Transport Action Group, of which CANSO is a member) was invited to submit a number of papers to ICAO to help guide its policy input. The Organisation has found itself under increasing pressure to create more momentum for aviation CO2 reductions, and in response it created a new committee, GIACC (group on International Aviation and Climate Change) charged with setting targets for emissions reductions. GIACC has called on the aviation industry to outline its emissions reduction strategies, and ATAG has worked with each aviation sector to agree realistic targets. CANSO Environment Manager Adam Phelan notes that the timing was ideal. "CANSO was already working on benchmarking its members' current airspace fuel efficiency," he says, "and based on that work, it has been able to set targets for improvements in airspace efficiency (and thus, reductions in fuel burn) up to 2050."

CANSO launches new environment Webhub

As part of its commitment to promoting its 'Imagine 2010' programme, CANSO has completely overhauled its website to enable it to focus more easily on its priority work projects. Environment has been given its own 'Webhub' where the latest information and output from the CANSO ATM Environment Workgroup, will be displayed. The Webhub can be visited at www.canso.org/environment

	Year	Global ATM Efficiency
Baseline	2005	between 92% & 94%
Goal 1	2012	between 92% & 95%
Goal 2	2020	between 93% & 95%
Goal 3	2050	between 95% & 98%

Table 1: CANSO ATM Efficiency Aspirational Goals

Adam J. Phelan – CANSO environment workgroup has benchmarked airspace fuel efficiency

CANSO's work, which was lead by Phil Stollery and the ATM Environment Workgroup, identified that on average ATM is 92-94% efficient. Stollery explains that efficiency in this sense is the difference between the exact point-to-point distance of a flight at the most fuel efficient altitude and speed, and the actual flight mileage flown. CANSO aims to increase that efficiency over the coming decades to reach approximately 96% efficiency by 2050 (see figure 1). 100% efficiency is not possible due to numerous interdependencies and trade-offs which are noted in the box on page 14.

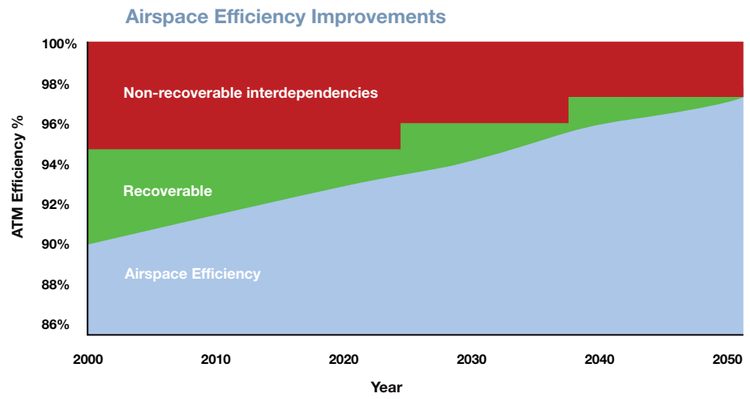

Figure 1: Interdependencies and recoverable efficiency

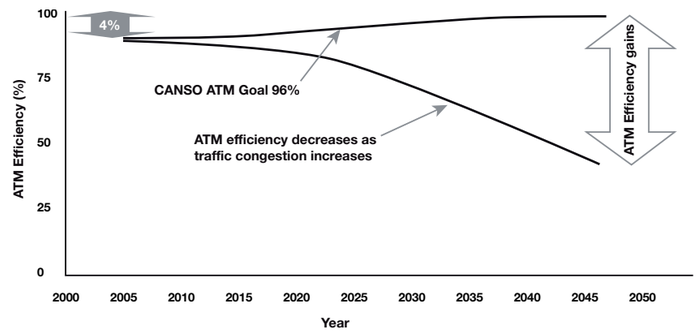

Figure 2: Effect of increased congestion on ATM fuel efficiency (conceptual only)

"While a 4% improvement in ATM efficiency over the next 40 years may seem a modest target, it is essential to remember that this will be in the context of an expected tripling of passenger numbers" notes Stollery. "Historically, aircraft fuel efficiency declines as congestion increases. Preventing this kind of 'capacity crunch' remains the key driving force behind projects such as NextGen and the Single European Sky: environmental benefits are a secondary gain from these reforms. Therefore the CANSO targets are a stretch.

		System efficiency	
Region	% global aviation activity	Lower bound	Upper bound
Australia	3%	98%	99%
Europe	28%	89%	93%
United States	35%	92%	93%
Subtotal	66%	91%	94%
Rest of the world	34%	94%	96%
Total	100%	92%	94%

Table 2: ATM system efficiency baseline 2005

On a 'business as usual' case we would expect to see emissions increase as more and more aircraft are forced to take longer routes or are placed in Holds in order to cope with increased traffic numbers."

Another important aspect of the CANSO average figure masks the fact that some parts of the world – due to airspace fragmentation, traffic numbers, airport capacity and any number of other factors – are less efficient than others. For example Europe is estimated to be only 89% efficient in lower airspace, leaving much more room for improvement than Australia, which is estimated at up to 98% efficient (see table 2). The very gradual improvement in efficiency to 2050 may also not be a smooth curve; depending on demand levels, efficiency will vary over the short-medium term, especially in areas where significant regional and civil-military cooperation is lacking.
A number of key procedures and technological improvements are planned which are expected to deliver the savings looked for in the CANSO targets. The SESAR joint undertaking has identified the need for a 10% environmental improvement over the next 20 or so years, and the NextGen project has a similar aim. Projects such as ASPIRE in the far east (see box overleaf) and AIRE across the Atlantic show that it is possible to deliver a fully optimised flight, which indeed does create an efficiency improvement in the region of 4%. The huge job now for ANSPs and ATM regulators is to create

Phil Stollery: "Historically, aircraft fuel efficiency declines as congestion increases".

Finding the 4%: ASPIRE

CANSO's aim of a 4% increase in airspace fuel efficiency over the coming decades looks achievable when put in the context of the fuel-optimised flights currently being trialed in Oceanic airspace.

ASPIRE (Asia and South Pacific Initiative to Reduce Emissions) is a project jointly run by the FAA, Airways New Zealand and Airservices Australia, to run flights at maximum efficiency across their airspace, to and from the Pacific seaboard of the US. So far three flights have been conducted: from Auckland to San Francisco, from Los Angeles to Melbourne, and from Sydney to San Francisco. Each flight investigated the latest in 'free flight' techniques, routing aircraft to take advantage of prevailing winds, as well as other techniques such as tailored arrivals.

The results so far show an average 4% improvement in fuel efficiency over the course of the flight – in line with CANSO targets. The challenge however is to move from isolated flights across Oceanic airspace, to optimising the entire system so overland flights in congested airspace can take advantage of the same improvements. With traffic forecast to double over the next 20 years, and airport congestion expected to increase, achieving these aims will be highly challenging and both technically and politically difficult.

the conditions where these isolated test flights become the norm.

Despite these improvements, ATM remains a small part in the aviation emissions equation. The IPCC estimated in 1999 that ATM was about 12% inefficient. CANSO's work has identified that over the last 10 years ANSPs have reduced that figure by around a third – mostly due to the implementation of procedures such as RVSM (see figure 3). The low-hanging fruit has already been picked, and the next steps will be considerably more challenging.

The rest of the aviation community is well aware that ANSPs themselves will be unable to deliver all of the efficiency it seeks. States will need to accelerate reforms to the airspace system and civil-military cooperation will have to drastically improve. Some difficult political decisions, especially concerning airport capacity, will have to be taken. ATM reform will not by itself make the industry sustainable: far greater emissions reductions can be found through the improvements to engine and airframe design, or the introduction of biofuels. In the short-medium term, aviation will probably have to buy emissions permits if it wants to continue to grow. But ATM is still an important part of the total aviation package being presented to the environment ministers who will have to find a deal in Copenhagen. CANSO has been at the forefront of the industry response every step of the way – in the thoroughness of its research, in the balance between ambition and realism of its targets, in arguing its case with industry colleagues, and in the communication of its work with aviation stakeholders.

There is a great deal of work still to be done. No-one can yet be sure what will emerge prior to Copenhagen and what shape the agreement will eventually take. Two things are certain. The first is that if we are to prevent environmental catastrophe, the world must have an agreement to curb greenhouse gas emissions, and aviation must be a part of that agreement. The second is that aviation - and ATM - has faced and overcome every challenge laid before it over the last hundred years: it will undoubtedly conquer this challenge as well.

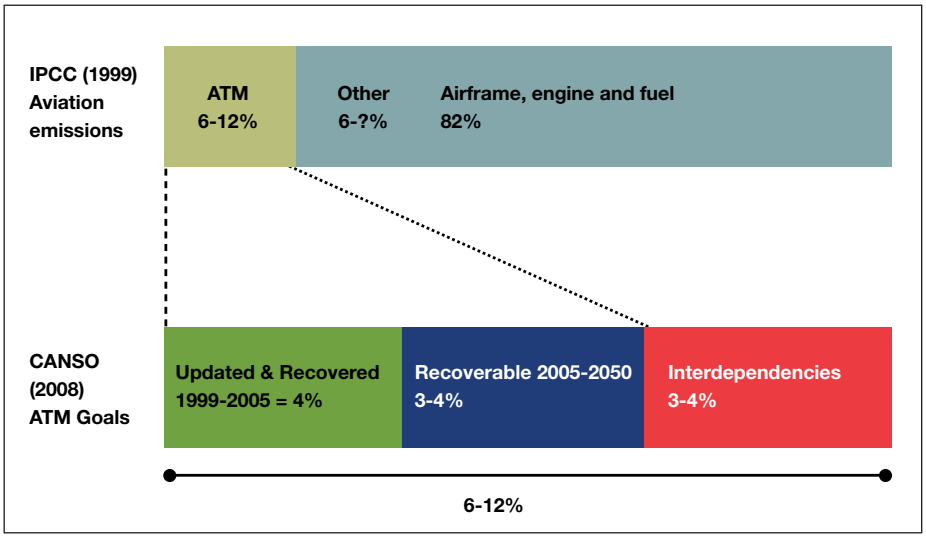

Figure 3: CANSO's work has identified that airspace efficiency improvements are in line with the IPCC estimates

Examples of unrecoverable interdependencies

- Safety
- Noise
- Capacity
- Weather
- Airline behaviour