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Summary

Airlines are increasingly portrayed in the press as "sustainability villains", who are untaxed and unaffected by any current agreement on emissions. Current emissions levels are forecast to grow in absolute tonnes and even more so as a proportion of total emissions. However when talking to airline executives, there is real enthusiasm to be greener. So what is the true picture?

Top-down solutions: National/regional emissions initiatives impose a competitive disadvantage on this most global of industries. This has deterred unilateral action by governments on important issues throughout the industry's history, and the established mechanisms for resolution (United Nations, etc.) move slowly. In simple terms, airline executives see their hands as tied until governments can agree on common and equitable solutions.

Bottom-up solutions: Short-term actions available to airlines are already widely adopted. They have reduced fuel use and therefore both cost and emissions at the same time. Medium-term solutions such as bio-fuel and the corresponding engine modifications are not yet out of the laboratory, however. This could still leave five or more years of substantial and important safety regulation hurdles and production planning before an airline can deploy the new, greener technology. Then, global refleeting would normally take approximately 30 years. Longer term zero-emissions solutions are even further away with deterrent-scale investment required on a very high risk business case.

Short, medium and long-term action by airlines all require substantial safety regulation, but the single biggest hurdle is the competitive deterrent of being a "prime mover." So we are back to seeking intergovernmental agreement on industry standards.

Executive Bites[1]

Aviation & sustainability

Appetizer

Airlines are increasingly portrayed in the press as "sustainability villains", who are untaxed and unaffected by any current agreement on emissions. Current emissions levels are forecast to grow in absolute tonnes and even more so as a proportion of total emissions. However when talking to airline executives, there is real enthusiasm to be greener. So what is the true picture?

Background

Global initiatives to limit carbon emissions, and so global warming, are centered around the Kyoto agreement (negotiated in 1997, in force 2005), from which aviation is specifically excluded. As other industries plan to cut their emissions and as passenger numbers grow, airlines could become one of the larger contributors to global warming as soon as 2020. Expert forecasts suggest a doubling of the global commercial jet fleet to over 35,000 by 2025. Yet there remains scepticism about reduction of aviation emissions, even after inclusion in the European Emissions Trading Scheme in 2008.

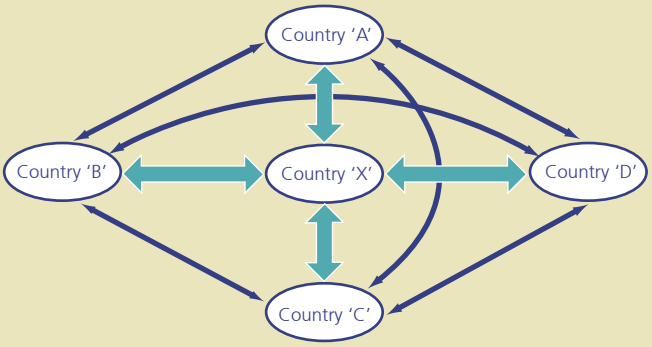
The broad spectrum of the above "sustainability" figures defy the well-intentioned executive. However, statistics from the highly respected IPCC (International Panel on Climate Change) and the UK's Stern Report offer a clearer picture:

- Aviation contributes around six percent of GHG (greenhouse gases).
- These emissions may cause as much as nine percent of the greenhouse effect (with much of the emission at altitude and therefore unable to be absorbed by trees and plants, nature's carbon "scrubbers").
- Some analysts forecast that by 2050, these figures could quadruple.

So why is aviation not included in Kyoto and other environmental initiatives? The usual and somewhat imperfect answer is exemplified by one major European country—let's call it Country X. Country X is determined to be greener and is strongly supported by its "flag carrier," its national airline—XAir. But then a new minister for green affairs proposed a "green tax" on any flight entering or leaving Country X's airspace. In response, XAir's management quietly pointed out that (see figure 1):

- Our international airline competes with other international airlines.
- Those competitors will incur the new tax, on typically 0.1 percent of their flights to and from Country X.
- Ninety-nine percent of XAir flights will attract the green tax and so XAir will carry a major competitive burden in an already low-profit industry.

Figure 1: Impact of unilateral action on aviation emissions



Simplified image: For airlines A, B, C and D, only the "green" routes incur the extra tax. For AirX, all their flights incur the extra tax adding up to a significant competitive burden. X may be greener but may also soon go out of business with the extra tax burden.

The green tax proposal was abandoned. So it follows that for any government or airline, the "first mover" always risks going out of business.

The way forward

Regulation – top down
Although imperfect, the "first mover" argument has discouraged governments and airlines from unilateral action. Both are waiting for industry-wide global solutions to be agreed upon. Their primary focus is on the ICAO (International Civil Aviation Organization), a subcommittee of the United Nations. But intergovernmental agreements are hard to reach and offer at best, only guidance. Airlines are governed by other, usually national, agencies. So the effect could be slow and insignificant.

Industry – bottom up
Despite the combined challenges of "first mover" disadvantage and cumbersome regulations, there is a genuine desire among airline executives to be greener. So what action can the industry take to reduce its contribution to climate change? The options fall into operational, tactical and strategic categories.

Operational: These are short-term actions that tend to be limited in effect but are better than doing nothing. They are well known and openly shared across airlines in a true attempt to contribute to a solution. IATA reports that from 2000 to 2005, operational steps achieved a 12.1 percent improvement in ASMs/gallon[2], from 52.8 percent to 59.0 percent.

Note:

[1] The Executive Bites series is intended to summarize insights from executives and pundits on important transport issues. These short notes cannot offer a comprehensive industry review.

[2] ASM - Actual Seat Miles, number of seats multiplied by number of miles flown.

Immediately deployable operational steps

- Single-engine taxiing: less fuel is burned with one engine.
- Shutting down of engines during delays: such as taxi queuing and standing at the jetway.
- Better measurement and reduction of weight: lifting more weight burns more fuel. Airlines have always off-loaded spare meals, etc., but are now more rigorous than ever.
- Redistribution of belly cargo: an unbalanced aircraft needs correction during flight which burns more fuel.
- Higher cruising, shorter/steeper approaches: high altitude has lower air resistance so needs less fuel.
- Ticket premium options that the airline then invests in a carbon offset scheme.
- Tankering: carrying enough fuel for a return trip. This avoids refuelling at high-cost airports (not really a "sustainability" issue as lifting the weight of the extra fuel actually burns more fuel and so increases emissions).[3]

Operations deployment - needs planning

- Fly on routes and at altitudes to achieve minimum emissions.
- Renegotiate en-route fuel reserve regulations.
- Reduce airborne holding (stacking).
- Install winglets at the end of wings to reduce drag.
- Redesign hubs/schedules for less congestion—in the air and on the ground.
- Campaign for expanded/improved airfield capacity to reduce congestion—in the air and on the ground.
- Plug in to airport power when at gates instead of using aircraft engines.
- Low drag paint schemes, e.g. chrome, combination or no paint.
- Changing where fuel is purchased.
- Changing purchasing fuel alliances.

Operations actions for sustainability

Immediately deployable:

- Single-engine taxiing
- Shut down engines during delays
- Better measurement and reduction of weight
- Redistribution of belly cargo
- Higher cruising, shorter/steeper approaches
- Passenger paid off-setting
- Tankering

Planning required:

- Better routes and altitudes
- Better enroute fuel reserves
- Improved stacking
- Winglets
- Redesign hubs/schedules
- Expanded/improved airfield capacity
- Plug in to airport power
- Better/no paint schemes

Tactical: This involves fuel/engine modification in the medium term (5 to 10 years). The impact is greater than with operational steps, but overall is still limited.

Aircraft fuel is a complex issue with a difficult price-based history. Following the swing in value of commodity oil prices, jet fuel can run from 15 percent of an airline's operating costs to as much as 60 percent. This makes it a controversial component of any business plan.

With aircraft fuel, quality is also a key issue. Failure involves more than coasting to the hard shoulder and waiting for the rescue truck. Whole consignments of jet fuel can be rejected on quality grounds, e.g., bacteria found in a tanker.

Bio jet, a sustainable version of jet fuel, does not yet exist, although there is some activity in this area. Isolated pockets of interest are emerging, but claims that such a solution could be available within five years will require much greater government and industry support to become a reality. The challenge of new fuel is that any change to the fuel specification has to clear commercial, regulatory, and technical hurdles.

Commercial hurdles

- Developing such a fuel at the laboratory stage is a long and expensive process. A business case for such investment is troublesome while there is no demand nor regulatory support.
- Developing production capacity for industrial volumes is also a long process. A business case would need to include the opportunity cost of the lost product and refinery capacity so bio jet can be produced.
- Current engines are designed to run on the current fuel specification. If the fuel specification changes, the engine specification may also need to change. The design/build/test production cycle of aircraft engines is a long and expensive process dwarfing that of the fuel cycle.
- Bio jet is even more corrosive than conventional jet fuel, which may add further cost in terms of MRO (maintenance, repair, and overhaul).

Regulatory hurdles:

- Aviation regulators are very strict and rightly so.
- A change in fuel specification and deployment of new specification engines would require a major regulatory review around the world.

Technical hurdles:

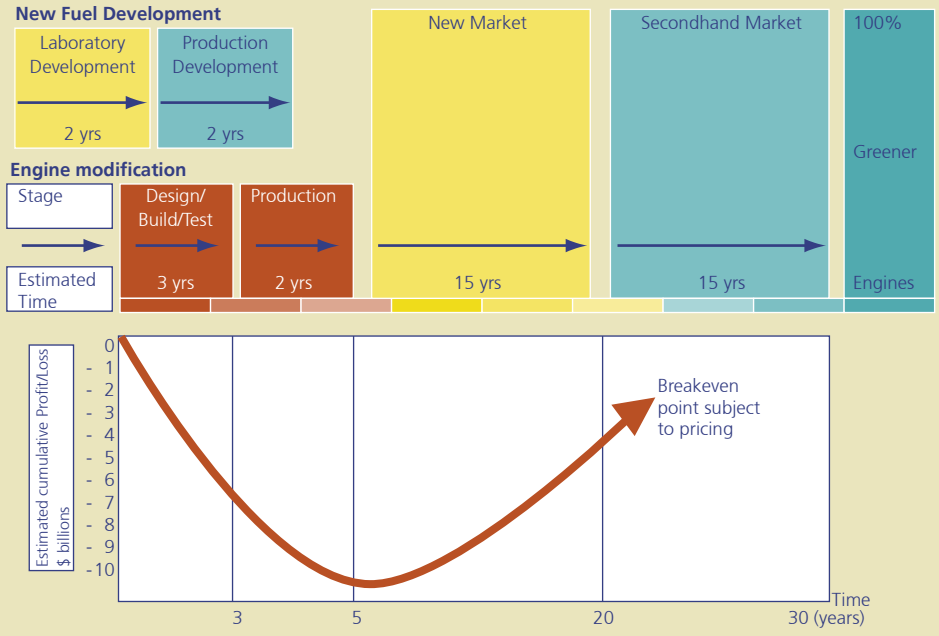
- Typically, major airlines renew their fleet about every 15 years, so a modified engine would not be fully deployed for up to 15 years after regulatory approval. This can only start after the research/design/build/test/production cycle (see figure 2).
- After 15 years, the major airlines would then sell their aircraft into the secondhand market for a possible further 15 years of flying. So we might expect at least a 30 year cycle before all aircraft are compliant with the new engine/fuel technology.

Strategic: A new generation of technology would be required in order to pursue strategic options to reduce emissions. In addition to the pockets of interest in the short-term fuel/engine programs cited above, there are also similarly isolated pockets of interest in more fundamental, technological developments, e.g. Omega—a new UK academic consortium, led by Manchester Metropolitan University, the University of Cambridge, and Cranfield University. Omega is studying how to influence the impact of aviation on the environment. This think tank includes many stakeholders in the industry, e.g. manufacturers (aircraft and engines), airlines, airports, governments (local and national), passenger groups, etc.

Note:

[3] Tankering is often included on such a list even though it works against the reduction of emissions. It does, however, help reduce fuel costs. This highlights a familiar trend linking reduction in emissions and in costs.

Figure 2: Sustainable Aviation - Industry's Fuel Tactics



Another idea being proposed is the "silent aircraft" (see figure 3). With a moulded aerodynamic shape and top-mounted engines, the silent aircraft design is a possible major step towards lower aviation emissions. This may be the closest achievable model of the aspirational "zero emission aviation in 50 years" proposed by IATA's Giovanni Bisignani. With input from all stakeholders, plus the scientists and regulators, this concept may be a great first step in the right direction. However, IATA's proposal is for within the next 50 years, and even this is ambitious.

Figure 3: Impression of the "Integrated Wing" (courtesy of Silent Aircraft Initiative, Cambridge-MIT Institute, www.silentaircraft.org).

There are many new technologies being proposed that require technological leaps far greater than the modified fuel/engine example cited above in figure 2. The business case is even more troublesome, with neither demand nor regulatory support.

Regulatory Support

Regulatory support is critical to any aviation emission solution. A simple regulatory model might be in the form of X percent emissions reduction by a fixed date, with fines and fleet grounding for non-compliance. This would help justify an airline's focus on "being green" and begin to create a future demand for bio jet. This would also allow governments of key research and manufacturing countries (e.g., United States for Boeing, Europe for Airbus) to support companies investing in the research/design/build/test/ production cycle shown in figure 2.

Conclusion

With the commercial challenges facing "first mover" governments and airlines and those facing fuel and manufacturing companies, satisfying "keen to be green" executives may take some time.

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