Aviation and sustainability

Engineering, Aviation

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Introduction

Sustainability generally refers to the preservation of the planet that is our only home and resources inherent in it ensuring continued function of our ecosystem and therefore the maintenance of productivity in the long term (Sachs, et al, 2009; Zakhem, et al, 2007). It is a moralresponsibilityto provide for the needs of the present (current) generation without compromising the ability of theenvironmentto provide for future generations in bounty and diversity (Werbach, 2009). The aviation sector in its offer of an efficient and safe means of transport across the globe is universally recognized as an essential component of the global economy and universal social progress (Deloitte, 2013). Conversely, human activity in general, including operations in the aviation industry, continue to have a huge impact on the environment and its ecosystems (Friends of Earth, 2013). In the aviation industry, sustainable development is perceived to encompass securing the well-being of the present and future generations by striving for a balance among three pillars: social, economic and environmental objectives (ICAO, 2012).

This paper explores the significance and implication of the pursuit of sustainability in the context of global airlines and airports. Issues of unconstrained aviation growth versus the call for global constraints of aviation for environmental reasons as well as challenges faced by management in the maintenance of corporategoalsinvolving the sustainable development of aviation operations are evaluated. Towards this goal, the benefits and drawbacks of the pursuit of sustainability from a management perspective are explored evaluating practical environmental activities that now encompass the management of airlines and airports. Finally, this paper assesses the capacity of the aviation industry to achieve dramatic improvements required to enhance environmental performance through innovations in aircraft design and in airline and airport operations. Following is an overview of the industry in light of environmental concerns.

Industry overview

In the modern global society, air transport has become essential and has significantly changed how people travel, interact with others and do business. Aviation has become a driver of economic, social and cultural development (ICAO, 2012). The democratization of international air travel has led to the reduction in the cost of flying and with real cost falling 60% over the last 40 years (Deloitte, 2013). This has made aviation more accessible to a greater number of people. Alongside this, developments in technologies and designs over the same period have enhanced energy efficiency of aircraft and achieved noise reductions of 70% and 75% respectively (Deloitte, 2013).

Such positive developments are nonetheless inadequate in the face of significant growth projections. It is estimated that passengers will reach six billion requiring 50 million flights (ICAO, 2012; Welsh, 2010). This is roughly double the current capacity. Statistics from the International Panel onClimate Change(IPCC) and the UK's Stern Report present the following grim picture regarding the environmental impact of the aviation industry. They advance the view that aviation contributes around 6% of greenhouse gases (GHG) further exacerbated by the high altitudes of flights which limits the effectiveness of nature's carbon ' scrubbers'- the trees and plants which absorb greenhouse gas (Carbon dioxide) – to undo these emissions. Emission of GHG in aviation is estimated to cause as much as 9% of the greenhouse effect (COM, 2012; ICAO, 2012; Deloitte, 2013; Friends of Earth, 2013).

Concern over these estimated adverse effects is heightened by expert forecasts of growth in passenger numbers and therefore a doubling of global commercial jet fleet to over 35, 000 by 2025. This heightens scepticism about reduction in aviation emissions with analysts forecasting that by 2050, current emission figures could quadruple (Welsh, 2010; Friends of Earth, 2013). In the view of IPCC, industry and stakeholder initiatives are and will not be adequate to achieve true sustainability and in its opinion, uncontrolled growth of the industry should be constrained given the challenges in mitigation of impact (Friends of Earth, 2013; ICAO, 2012; Seabury, 2012).

Demand and growth of the aviation industry though important for society and the economy is however a significant contributor to global climate

change. Constraint of growth is however not feasible given the growing demand and import of the industry globally. In this regard, a lot needs to be done by industry players and various stakeholders to ensure safety, security and environmental conservation. Industry players face myriad challenges in the pursuit of sustainability.

Dilemma of sustainability in the aviation sector

The aviation industry is increasingly portrayed and perceived as a villain in the pursuit of sustainability around the world. This stems from the fact that they are untaxed and are unaffected by any current agreements on emissions (Welsh, 2010). Global initiatives aimed at limiting carbon emissions, and thereforeglobal warming, are centred around the Kyoto agreement negotiated in 1997 and coming into force in 2005. The aviation industry is specifically excluded in this agreement and its negotiations despite it being a major contributor to global warming (COM, 2012; Welsh, 2010). The ‘ well-intentioned’ executives and organizations in the industry are often hindered in the green pursuits by the business risk of being the ‘ first mover’ in this pursuit (Deloitte, 2013).

The deregulation and democratization of the aviation industry has resulted in intense competition among airlines which has led to significant reductions in air fares which have consistently declined over time (ICAO, 2012; Driver, 2006). Living standards and wages have inversely increased overall increasing the number of people accessing air travel (ICAO, 2012; Hill, 2006). This, in addition to substantial taxes by states, as well as fees, charges and surcharges on many international routes often surpass the ticket price

impacting net profit margins which are at levels less than 2% on global scheduled airlines and are falling (AAG, 2012; Deloitte, 2013).

Additional levies such as ‘ green tax’ and climatefinanceif not applied across the entire industry creates a ‘ first mover’ disadvantage which discourages governments and airlines from unilateral action, as well as impeding the pace of established mechanisms for resolution such as the United Nations programs. National and/or regional emissions initiatives impose a competitive disadvantage on the industry tying the hands of airline executives until governments can agree on common and equitable solutions covering the entire industry (ICAO, 2012; Zakhem, et al, 2007).

Good intention and regard for the environment is hindered by intense competition and the slim margins characteristic of the industry. There is therefore need for greater concerted effort so as to undo the ‘ first mover’ disadvantage which hinders the competitiveness of players that pursue sustainability. Such efforts are considered in the proceeding section.

Way forward for sustainable development in the industry

What is required is an agreement on intergovernmental and industry-wide global solutions, a top-down regulatory approach, which are however hard to reach and are at best, advisory guidelines. The consequent result would be slow and insignificant given that airlines are governed by nations and/or agencies (Seabury, 2012). In spite of these cumbersome regulations and ‘ first mover’ disadvantage, there is genuine desire among executives and across the industry for the pursuit of sustainable development and reduction

of environmental impact, particularly the reduction of the industry's contribution to climate change (ICAO, 2012). The options available for this endeavour, characterized as bottom-up solutions undertaken by industry, fall into three categories: operational, tactical, and strategic initiatives.

Bottom-up solutions

Operational initiatives

Operational approaches involve short-term actions which despite their limitation in overall effect are better than no initiatives at all. In an attempt to enhance its contribution overall, these approaches are well known and openly shared across the industry. They comprise the following steps aimed at reducing fuel consumption: single-engine taxiing; engine shutdowns during delays; better measurement and reduction of weight; distribution and balancing of belly cargo; higher cruising and shorter/steeper approaches; as well as ticket premium options for investment in carbon offset schemes; and tankering-carrying enough fuel for return trip. These initiatives are immediately deployable (Welsh, 2010; AAG, 2012).

Other operational initiatives that need planning consist of: better routes and altitudes; better enroute fuel reserve; reduction in airborne holding (stacking); installation of winglets at wing tips to reduce drag; redesign of hubs/schedules for greater efficiency; improved/expanded airfield capacity; low drag paint schemes; as well as improved fuel purchasing and supplies (Welsh, 2010; AAG, 2012).

Tactical initiatives

These are generally medium term approaches covering 5 to 10 years which have greater impact than operational initiatives though still limited in overall effect. The involve fuel and engine modifications. Aircraft fuel is a controversial component of business mired by complexity and a difficult price-based history. Swings in commodity prices impact airlines' operating costs running from 15% to as much as 60% of costs (Deloitte, 2013). Quality is also a significant concern with regard to jet fuel as it is directly linked to flight safety. Whole consignments of jet fuel can be rejected on grounds of quality such as the finding of bacteria in tankers (Welsh, 2010).

Though there is some activity in the area of sustainable versions of jet fuel (Bio jet) with isolated pockets of interest, there is yet to be success and may not be in the short term. Faster pace of progress would require greater support from the industry and government. This approach is also challenged by commercial, regulatory and technical hurdles governing fuel specifications (ICAO, 2012; Seabury, 2012).

Commercial hurdles include long and expensive laboratory stage processes without demand and/or regulatory support and subsequent lengthy processes of developing production capacity for industrial volumes. Changes in fuel specifications may also require engine modifications which would need to pass the long and expensive design/build/test production cycle dwarfing that of the fuel cycle. In addition to these hurdles, Bio jet is considerably more corrosive than conventional jet fuel and may increase maintenance, repair and overhaul costs (MRO) (Welsh, 2010; ICAO, 2012).

Regulatory hurdles comprise the very strict aviation regulators which is appropriate for the industry. Change in specifications of fuel and engines would necessitate a major review of the regulatory framework around the world (ICAO, 2012).

Technical hurdles encompass the drawn out periods of uptake of modifications and new specifications with customers (major airlines) typically renewing their fleet about every 15 years. After the extensive research, design, build, test, production cycle, and regulatory approval, this additional period need be factored as well. In addition to these 15 years, major airlines would sell their airplanes into the second hand market which would also last a further 15 years of flight (ICAO, 2012). This makes the adoption of new engine/modifications and fuel technologies may take upwards of three to five decades to achieve a complete shift and transformation.

Strategic initiatives

Initiatives in this category require new generation technologies to enable pursuit of strategic options towards the reduction of emissions. In addition to the pockets of interest in fuel and engine programs in the short term, there are also other isolated pockets of interest exploring more fundamental technological developments such as how to influence the environmental impact of aviation. This involves a think tank composed of many and varied stakeholders in the industry including airlines and airports, manufacturers, governments, passenger groups, among several other interest groups (ICAO, 2012).

There are many new technological propositions that require leaps intechnologyfar greater than the modification examples cited above. They include the integrated-wing silent aircraft with top-mounted engines and a moulded aerodynamic shape. This is a possible major step towards lower or zero aviation emissions which has been the aspiration of the industry in light of environmental concerns and climate change. IATA’s proposal is projected to within the next 50 years which is not definitive yet. This is also challenged by a lack in demand and regulatory support (ICAO, 2012; Seabury, 2012).

Regulatory support (Top-Down approach)

Critical to the development and adoption of emission solutions in the aviation industry is regulatory support including simple models like deadlines for action with consequences for non-compliance such as fines and grounding of fleet. Such actions and approaches help to enhance and to justify focus on sustainability initiatives creating demand for worthwhile ventures like Bio jet as well as engine and design reworks or modifications intended at lower emissions. This approach would also enhance the focus of governments and industry in the support of companies investing in the research/design/build/test/production cycle (ICAO, 2012; Seabury, 2012).

From a management perspective, despite the willingness and enthusiasm to ‘ go green’ focusing on sustainable development, the pursuit of high impact initiatives is impeded by the myriad hurdles and challenges in design and output of new technologies. There are several advantages that can be derived from the pursuit of sustainability and as well there are drawbacks and dis-benefits that generally impact the entire industry. However, there

are substantial gains in bold pursuits individual airlines and players giving credence to the potential in industry sustainability. The following section explores these advantages and dis-benefits employing Alaska Air Group’s environmental protection and efficiency initiatives to highlight these points and to show actions taken in this regard.

Alaska Air Group’s practical environmental activities

Alaska Air Group is the holding company for two Seattle-based subsidiaries, Alaska Airlines and Horizon Air which provide passenger and cargo transportation across 90 destinations in the United States (USA), Canada and Mexico. Alaska Airlines flies 117 Boeing 737s to 62 of these destinations while Horizon Air operates a fleet of 48 Bombardier Q400 turboprop aircraft to 39 destinations (AAG, 2012). The company has been a recipient of recognition and awards on several fronts for outstanding performance including the World’s top-performing airline in 2010, Airline TechnologyLeadershipAward in 2011, as well as industry service accolades from its customer satisfaction, on-time performance, maintenance training and public andcommunity service. As of 2012, the group has 12, 806 employees and an asset base of 5. 2 billion dollars. Their carriers serve 25 million passengers a year on 30 million seat miles and carry 114 million cargo pounds accruing cargo revenue of 108 million. The Group’s adjusted net income stands at 287. 4 million dollars. Even though Air Group flies 3% of domestic airline capacity, it has a daily consumption of a million gallons of jet fuel for its flight operations (AAG, 2012).

To the group, sustainability efforts are crucial to reductions in waste and energy costs, as well as innovation, factors which enhance value, competitiveness and overall bottom line. Air Group has a strategic commitment to reduce environmental impact through four core elements: reducing emissions from consumption of fossil fuels; reducing emissions from ground operations such as electricity and heating; reducing consumption of non-sustainable resources; and recycling of inflight and operational wastes (COM, 2012; Werbach, 2009).

The Group has admirable fuel-efficiency ratings but it continues to pursue more conservation opportunities such as fleet upgrades and modifications which have led to significant cost savings for the company; removal of unneeded weight; optimal routes, speeds and engine maintenance to ensure performance. Its practical initiatives for enhanced fuel efficiencies consist of: fleet efficiencies and transformation which lowers fuel bills, emissions and costs associated with complexities of a mixed fleet; reduction of weight of carpets and seats; better airspace efficiency through satellite navigation performance systems and streamlined landing approaches (pioneered by Alaska Airlines); use of ground power rather than the aircraft’s auxiliary power units to provide heating, cooling and electricity when planes are parked at gates; robust flight planning for optimal fuel loads; as well as a bold pursuit of sustainable fuel alternatives. In November 2011, Alaska airlines launched pioneer multiple commercial flights powered by 20% aviation biofuel blends on more than 75 flights. The biofuel blend reduced GHG emissions by 134 metric tonnes and demonstrated feasibility of biofuels (AAG, 2012; Driver, 2006; Cornelissen and Clarke, 2010).

On the ground efficiency front, the company has instituted a switch in ground support equipment from fossil-powered to electric options where feasible. This move is anticipated to eliminate 3000 metric tonnes of CO2 output per year when completed. This is done alongside upgrades of ground facilities such as terminals and offices to enhance energy efficiency, as well as wind and solar projects for alternative power. The company is also pursuing ambitious recycling of inflight waste and ground waste which is standard in its Flight Attendant Manual. This program diverts an estimated 800 tonnes of waste from landfills (AAG, 2012; Welsh, 2010). These audacious initiatives however result in a significant dis-benefit of sustainable development which is the high cost of transformation and uptake of new technologies. This impacts industry players' financial positions, a challenge exacerbated by the industry's slim margins which hinder their economic capacity.

Alaska Air Group however prides itself in its year-over-year load factors (percentage of seats filled) which has helped improve its efficiency. As of 2012, Alaska Airlines had achieved reductions in carbon emission intensity per revenue passenger mile 7. 8% since 2009 and 29. 8% since 2004. Its total carbon emissions have decreased 3. 2% in 8 years despite a 27% growth in business. Its sustainability initiatives have significantly contributed to the creation of direct economic value benefiting employees and investors with the company achieving record full-year adjusted net income of 287. 4 million dollars, leading in profitability in spite of global economic challenges impacting aviation (AAG, 2012; Cornelissen and Clarke, 2010).

Conclusion

Grim statistics of the impact of aviation on environmental impact and contribution to climate change paint a gloomy picture of the sustainability of the industry’s anticipated growth. IPCC and experts even propose the constraint of the growth of aviation to stem this impact. Nevertheless, there is potential in innovation and technological advancements leading to reduction in emissions and progress is being made to realize these gains. This progress is hindered by ‘ first mover’ competitive disadvantage as well as various hurdles to the success of initiatives brought about significantly by the fragmentation in the industry with the lack of a comprehensive and unilateral framework governing progress.

This frustrates enthusiasm of executives and the industry and hinders progress to sustainable development. The example of Alaska Air Group, however, clearly demonstrates that aviation can achieve dramatic improvements required to in environmental performance. Innovations in aircraft and fuel designs, as well as airline and airport operations can have significant positive effects for sustainability in the aviation industry in the short and longer term. Sustainable development requires the participation of all stakeholders in the industry for success of initiatives. Stakeholders encompass governments, regulatory and advisory organizations, industry players, employees, interest groups, and customers.

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