Sustainable Skies: How the Airline Industry is Addressing Climate Change

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The aviation industry is a major emitter of greenhouse gases, which contribute to climate change and ultimately create weather patterns that adversely affect the airlines' performance and efficiency. This paper provides an overview of the ways in which the airlines are both impacting and impacted by the climate, with recommendations on how industry leaders might create a more sustainable future for aviation. The primary target of this paper is the environmental policy-maker, however, aviation and sustainability enthusiasts may find useful ideas in the paper.

EXECUTIVE SUMMARY

Climate change has become one of the most pressing subjects of the 21st century. While some still debate its existence, the widely held scientific belief is that climate change is indeed occurring, that it is manmade, and that it is happening at a rate that is unprecedented. Left unchecked, the current warming trend could lead to rising sea levels, the destruction of agricultural crops and animals, more extreme weather patterns, and worse.

The transportation industry is one of the largest emitters of greenhouse gases, and aviation is responsible for a large portion of those emissions. Airlines are therefore both contributors to and victims of climate change, as the same greenhouse gases airplanes emit ultimately create unfavorable weather conditions that cause the airlines to be less efficient and burn more fuel – which in turn creates more emissions. It is a cycle that will never stop, until or unless the airlines – and the organizations and associations that govern them – find more responsible, sustainable solutions.

This paper aims to shed light on the ways that airline multinational companies (MNCs) are impacting and impacted by the climate, and demonstrate potential pathways towards a more sustainable future for aviation. It applies key global environment of management concepts to the topic of global climate change,

to help identify the challenges and opportunities airlines face in addressing this critically important issue. Ultimately, the most successful airline MNCs will be those that are able to marry people, planet and profit all together, finding solutions that serve shareholders and sharecroppers alike.

INTRODUCTION TO GLOBAL CLIMATE CHANGE TOPIC

A Climate in Crisis

Few topics have been the subject of as much public discourse over the past few decades as global climate change. While there are those – even in our current administration – who argue against the scientific evidence for climate change, awareness of the issue has reached 90% in developed nations (Leiserowitz & Howe, 2015). In his State of the Union speech, President Barack Obama proclaimed that "no challenge poses a greater threat to future generations than climate change" (2015).

Climate change is not a new phenomenon; the Earth's climate has changed several times throughout history. However, the current warming trend is particularly concerning because "it is proceeding at a rate that is unprecedented" (NASA, n.d.). **Figure 1** shows the change in global temperature means from 1880 to 2017 based on the average temperature between 1951-1980 in degrees Celsius. The U.N.'s Intergovernmental Panel on Climate Change (IPCC) 2014 report, "Climate Change 2014: Impacts, Adaptation, and Vulnerability," asserted that climate change is in fact occurring, that it is caused by humans, that its effects are already apparent – and that it is likely to become even more extreme in the future.

FIGURE 1
**GLOBAL TEMPERATURE MEANS**
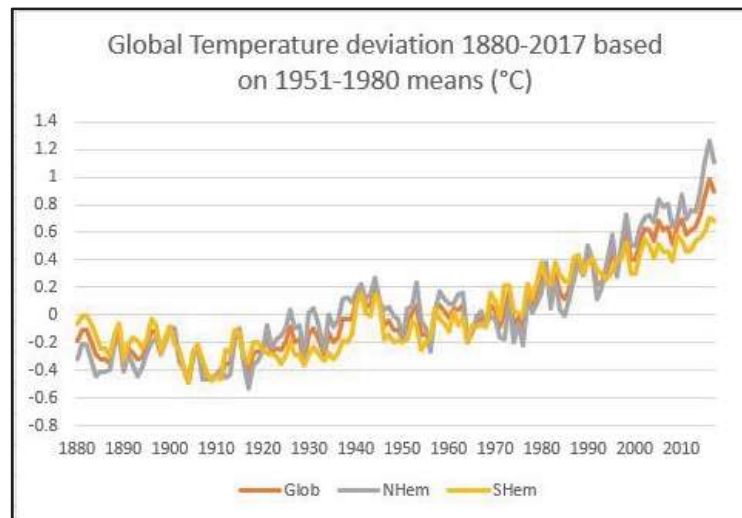
With the growth of the world's population expecting to top 11 billion by the end of the century, according to the United Nation's 2017 World Population Prospects (**Figure 2**), as well as countries becoming more developed and industrialized comes the need for greater quantities of resources. **Figure 3** show the increase in passengers carried on air transportation from 1970-2016. The increasing consumption of fossil fuels for energy and transportation along with the degradation of forests and oceans has already warmed the Earth's climate by 1°C from preindustrial levels (Mann, 2014). Scientists speculate that should the Earth's temperature continue to rise it could lead to the collapse of global food production, extinction of several species, acidification of the oceans, rising of sea levels, severe storms and drought, and will leave some areas in the world uninhabitable (Wright & Nyberg, 2017).
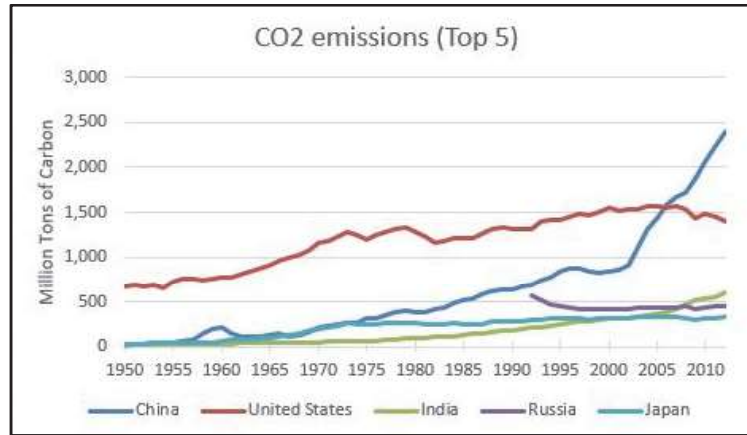
FIGURE 2
WORLD POPULATION FORECAST
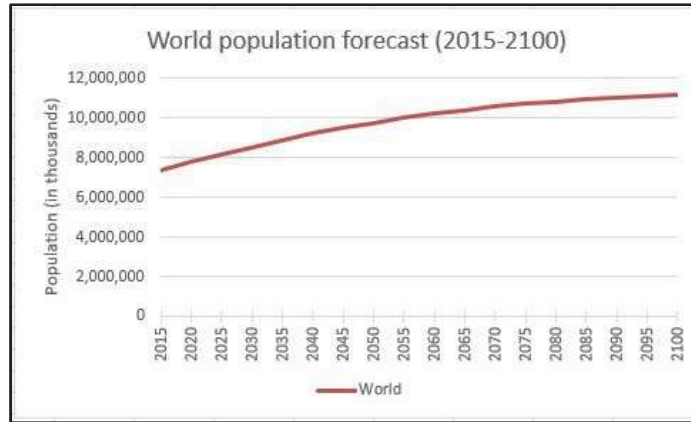
FIGURE 3
NUMBER OF PASSENGERS CARRIED ON COMMERCIAL AIRLINES
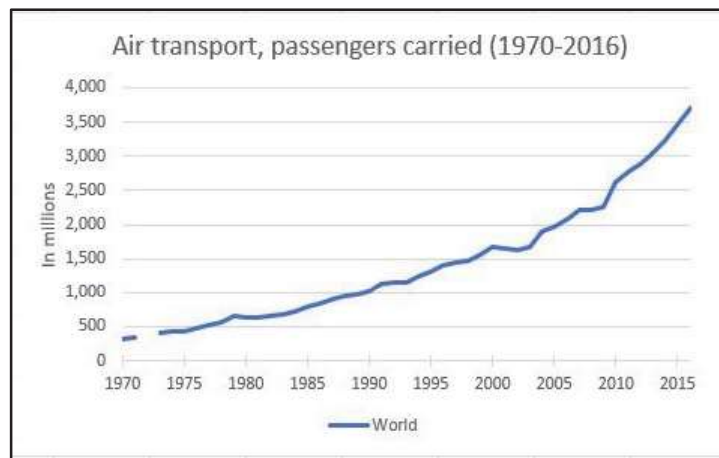
Industrialized nations such as the US have played a larger role in contributing to climate change, as they have been emitting greenhouse gases into the atmosphere for a longer period of time. Emerging markets such as China and India have more recently become contributors to the problem, but are being asked and expected to develop more responsibly than their predecessors – and doing so is often in direct "conflict with the fundamental imperative at the heart of our economic model: grow or die" (Klein, 2014, p. 21). **Figure 4** depicts the CO_2 emissions from the Top 5 contributors from 1950-2012. Industries essential to such growth – including energy, manufacturing and transportation – have garnered particular focus in global climate change debate in recent years.
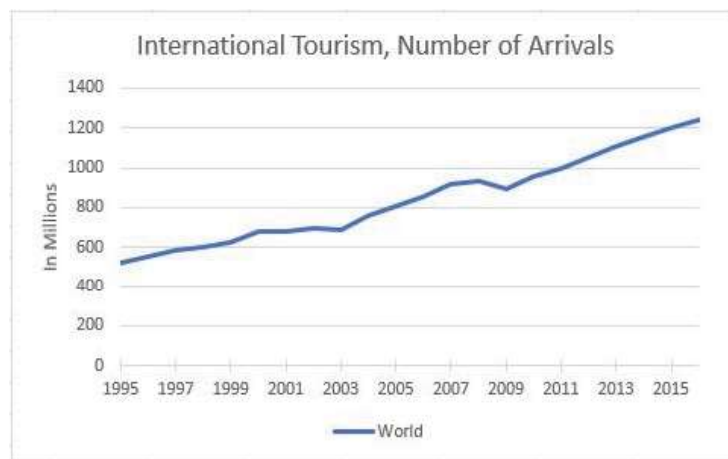
FIGURE 4
CO2 EMISSIONS BY TOP 5 COUNTRIES



Climate Change and the Airline Industry

Over the last half century, international tourism has become one of the largest global economic sectors, playing a significant role in many national and local economies. **Figure 5** shows the increase in international arrivals from 1995-2015. Since 1970, as the world has become more globalized and border travel restrictions have decreased, the world's commercial airline fleet has grown to six times its size, while the number of air miles flown each year has grown by a factor of nine (Scott & Gössling, 2015). **Figure 6** shows the increase in international air miles flown since 2002. Transportation-related emissions account for 14% of the world's greenhouse gas emissions today (Kille, 2014), and "aviation is a 'notable' contributor… most objective reports peg aviation's contribution between 3-5%" (Gehres, personal communication, 2018). Just one round-trip flight between the east and west coast of the United States creates a fifth of the carbon emissions generated by a car over the course of an entire year (Schlossburg, 2017), and international flights can have an even greater impact.

FIGURE 5
NUMBER OF INTERNATIONAL ARRIVALS

FIGURE 6
INTERNATIONAL AIR MILES FLOWN
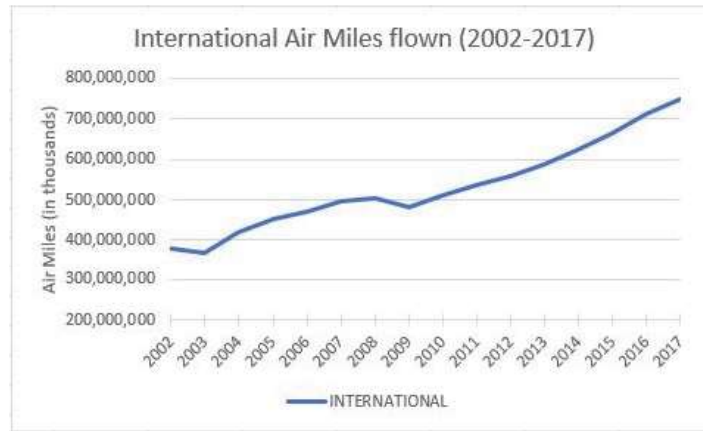
Despite the airline industry being highly globalized, it is not likely that international policy will address this situation in the foreseeable future. Airline MNCs are therefore under tremendous political and social pressure to adopt policies and practices that are more environmentally (and also economically) responsible, yet consumer demand for air travel is growing at a rate far exceeding any gains in fuel efficiency the sector has achieved (Higham et al, 2014). At the same time, climate change has dramatic implications for airlines as well, as increased air temperatures and changing weather conditions make it difficult for airlines to do business as usual, reducing airline capacity and causing changes to flight schedules.

This is a complex, connected challenge; determining how best to navigate it is the focus of many airline industry executives today.

RESEARCH PURPOSE & METHODOLOGY

The research conducted to prepare this paper was intended to answer the following question: "What are the tangible effects of climate change on commercial airline MNCs, and how can airline MNCs work individually – and as an industry – to address and/or resolve them?" Our work included a secondary literature review, as well as primary interviews with airline and tangential industry executives whose responsibilities include sustainability initiative development, implementation and/or management.

OVERVIEW OF THE COMMERCIAL AIRLINE INDUSTRY

Commercial air transportation may be the most quintessential multinational business that operates in the world today. It has been instrumental in opening cross-cultural borders and creating a more globalized society, connecting over 3.3 billion people in nearly 200 countries around the world; according to data provider FlightAware, there are "an average of 9,728 planes – carrying 1,270,406 people – in the sky at any given time" (Avakian, 2017). And that number continues to climb in order to support growth in emerging economies. Today, according to international trade association Air Transport Action Group's website, enviro.aero, the aviation industry is responsible for 3.5% of global GDP.

While global economies could not function as they do without the airline industry, from an environmental impact standpoint, it is arguably one of the largest contributors to climate change – and has accordingly been vilified in related conversations due to its high visibility and the amount of greenhouse gas emissions associated with the industry. The Environmental Protection Agency even asserted that "emissions from airplanes endanger public health because of their contribution to global warming"

(Mouawad & Davenport, 2015, p. 1). In order to thrive and remain competitive into the future, the airlines must place much emphasis on mitigating their impact on the climate.

The global tourism sector is evolving due to a number of factors; Scott & Gössling (2015) stated that key issues include:

> the new geography and market preferences of major tourist flows from emerging economies, the new realities of mobility in a world of fluctuating energy prices and the shift towards a low-carbon economy... and the consequences of climate and environmental change for destination attributes and attractiveness. (p. 282).

One of the biggest challenges facing airline MNCs over the next 10-20 years, according to von Bergner and Lohman (2014), will be "to maintain sustainability, to meet the rising impact on the environment as well as an increasing demand from new markets and to stay attractive at the same time" (p. 157). Over the next three decades, the airline industry aims to reduce its carbon emissions to half the levels of 2005.

Doing so will require massive collaboration among airline MNCs, the industry as a whole, and the nations that rely so heavily on airlines – and the tourism industry in general – as a key source of revenue and GDP. Both the causes and possible solutions to climate change will ultimately be derived from our globalized economy and the corporations of which it consists (Wright & Nyberg, 2017).
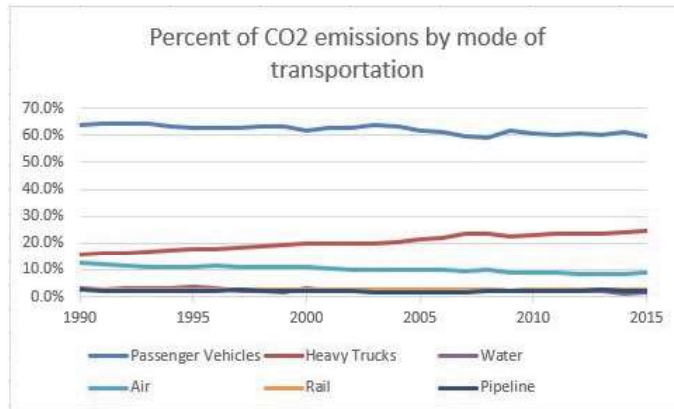
ENVIRONMENTAL IMPACT OF THE AIRLINE INDUSTRY

With climate change generating increasing concern around the world, and political and social pressures mounting to help solve the crisis, the airline industry has sought to understand both the impact it is having on the environment as well as how the changing climate is impacting its operations. Most major airlines have added Corporate Sustainability Officers to their executive teams and have adopted sustainability programs, and the International Air Transport Association (IATA) has created an Environment Committee that advises the association and its members on environmental policies and strategies.

The Airline Industry's Impact on the Environment

The airline industry, as a whole, only accounts for 2% of the world's CO_2 emissions which is a sixth of what is generated by road transportation (oneworld, 2018). **Figure 7** shows the CO_2 emissions created by the transportation sector broken down as a percentage by mode of transportation. According to the Center for Biological Diversity (2018), airplanes also release nitrogen oxides into the environment which cause warming when emitted at high altitudes. Although 2% may not seem like a lot, even small changes to the Earth's temperature can have dramatic effects on the ecosystem. It is critical that the airlines be proactive in reducing CO_2 emissions before the levels climb to the breaking point. According to the International Civil Aviation Organization (ICAO), which is the UN's specialized agency that supports the safe, efficient, secure, economically sustainable, and environmentally responsible global aviation industry, if mitigation measures are not taken, total greenhouse gas emissions associated with aviation will be anywhere from 400%-600% higher in 2050 than in 2010 due to a sevenfold increase in air traffic (Cui & Li, 2017). The aviation industry is aware of its impact on the environment and according to the IATA, environmental issues are at the top of the aviation industry's agenda, alongside safety and security.

FIGURE 7
PERCENT OF CARBON EMISSIONS BY MODE OF TRANSPORTATION

Environment's Impact on the Airline Industry

There are several key environmental factors that go in to ensuring a successful and efficient flight such as temperature, air density, and wind strength and direction. Variations in these factors will impact the feasibility of takeoff and fuel usage during flight. The airline industry is already seeing the negative effects associated with global climate change and if it continues will lead to a reinforcing cycle further escalating the warming effect. Scientists say wind patterns altered by climate variability are costing airlines millions of dollars in extra fuel and flying time – and increasing CO_2 emissions (Radford, 2015). **Figure 8** illustrates jet fuel consumption around the world by region.

FIGURE 8
WORLDWIDE JET FUEL CONSUMPTION BY REGION
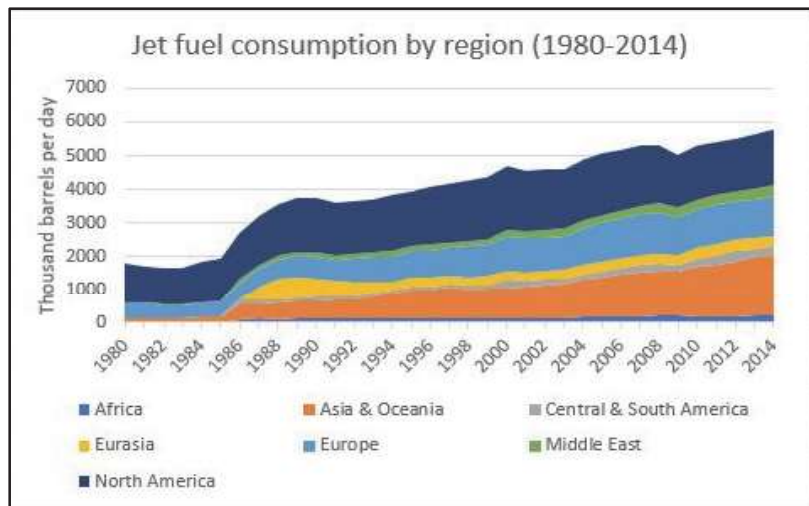
One of the effects of global climate change is that the Earth becomes more susceptible to extreme heat waves, which also negatively affect the airlines industry. Extreme heat could lead to aircraft being grounded and airlines cancelling flights – not to mention all the extra effort involved in rescheduling flights, providing accommodations, issuing refunds or giving out credit for the inconvenience – all of which impacts revenue. We have already seen this happen a few times in the southwest United States; in the summer of 2017, nearly 40 flights were grounded in the Phoenix area due to excessive heat and poor

air conditions for flying. The reason extreme heat causes problems is because hot air is less dense than cool air, which means the wings on the aircraft create less lift; some scientists predict that by potentially as early as the middle of the century, "30% of flights departing during the most blistering parts of the day will not be able to take off at their maximum weight" (Gulliver, 2017, para. 2) because of this. Having to reduce passengers or cargo could have huge financial implications for airlines, which would in turn mean consequences for passengers in terms of increased ticket prices and added fees. The less dense air also reduces engine performance, which results in higher takeoff and landing speeds – which are less fuel efficient – as well as an increased length of runway required (Smith, 2017). The other concern with extreme heat are the temperature of the wheels and brakes. After landing the wheels and brakes need to let the heat dissipate, but if they have a short turnaround time they may not be able to accomplish that (Anonymous Delta pilot, personal communication, 4/23/18). If the brakes are not given enough time for the heat to dissipate they are at greater risk for failure.

Warmer weather will also lead to increased melting of the polar ice caps and expansion of the ocean's water, causing sea levels to rise. **Figure 9** show the change in sea levels since 1880. Should the sea levels rise a foot or more, the runways of virtually every major commercial airport along the East and Gulf coasts would be under water (Frankel, 2017). The warmer weather also leads to concerns regarding the fuel used for aviation. Aviation fuel has a flash point of 38°C (100.4°F) while temperatures in the summer of 2003 peaked at 37.5°C (99.5°F) (Thompson, 2016). If summer temperatures increase another degree there will be potential risks for the fuel combusting and creating fire hazards.

FIGURE 9
GLOBAL MEAN SEA LEVELS
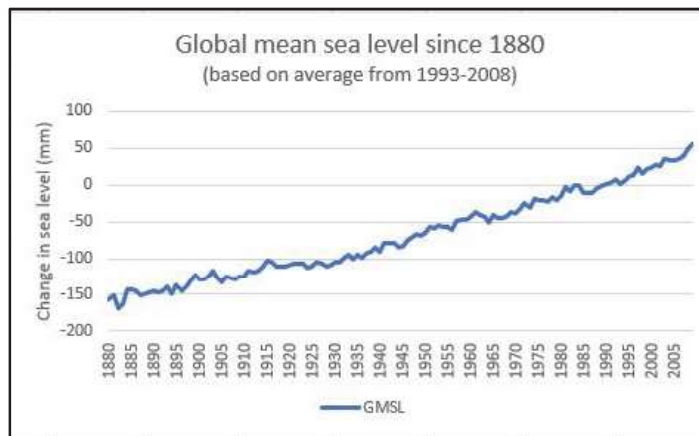
Another effect of warmer weather, albeit not as dramatic, is that it could cause turbulence to occur more commonly and become more intense, due to warmer air creating stronger jet streams. Greater turbulence and high winds could lead to higher costs for the airlines due to increased medical expenses and liability suits from injuries, or greater fuel consumption as airlines are forced to change flight routes or durations (Simmons, 2017).

While airlines are some of the greatest contributors to greenhouse gas emissions, they also stand a lot to lose by not quickly and dramatically reducing their carbon footprint, as the same problem they are helping to create now poses a serious threat to their viability in the near future.

EFFECTS OF CLIMATE CHANGE ON THE AIRLINE INDUSTRY: AN INSTITUTIONAL VIEW

The success or failure of all firms around the globe is determined by a series of institutions – formal and informal "rules of the game" that govern the way business is conducted in various countries. The institution-based view of global business, therefore, "focuses on the dynamic interaction between institutions and firms, and considers firm behavior as the outcome of such behavior" (Peng, p. 22). This holds true for airline MNCs as well, particularly in terms of climate change impacts and implications; airlines must factor both formal and informal institutions into their response to the issue. Adding complexity is the fact that the significance of formal and informal institutions varies greatly among developed and emerging markets; whereas developed nations place more emphasis on formal institutions such as laws and regulations, Rottig (2016) stated:

> Emerging markets are characterized by a number of unique institutional features that generally do not exist in developed markets. These include institutional voids, relative importance of informal compared to formal institutions, institutional pressures by local governments, as well as institutional change and transitions. (p. 4).

Therefore it is critically important that airline MNCs understand the role of institutions in both their home countries, and host countries – and develop strategies for addressing and mitigating climate change that are appropriate and adequate.

Formal Institutions: Political and Economic

The International Air Transport Association (IATA) is a trade association for the world's airlines; they currently represent 280 airlines, which cover 83% of total air traffic worldwide. (IATA, 2017) One of the biggest focuses of IATA is to help align the voice of the commercial airline industry as well as formulate universal targets for growth and sustainability, while also balancing the regulatory and legal requirements of the governments around the world. Due to the nature of commercial airline travel, there are many different factors that must be consistently evaluated when it comes to creating and enforcing climate change mitigation policy in this truly global domain.

"Say an aircraft is manufactured in country A, owned by a company in country B, leased to an airline in country C, takes off from country D, flies over country E, and lands at an airport in country F. Who is responsible for that aircraft's emissions?" (Hodgkinson & Johnson, 2016, p.1). This is the type of question that is consistently being asked by members of trade associations like IATA, and action groups like the Air Transport Action Group (ATAG) which is an independent coalition of 50 multi-national organizations who do business in the aviation industry but are not necessarily commercial airline operators. Organizing a consistent public sustainability policy amongst all of these competing multi-national companies is quite the challenge without political intervention, but it is consistently being tested and challenged by governmental institutions worldwide as environmental policy decisions are constantly being implemented and the MNC's are forced to react to the push-and-pull between borders and nation states desire to implement their own agenda for climate change action.

Beginning with the United Nations Framework Convention on Climate Change (UNFCCC) in 1992, which was the first recognized global summit on climate change, and the subsequent Kyoto Protocol which was adopted in 1997 – which commits its international members to achieving binding emission reductions – commercial airlines have been caught in limbo, due to the fact that "global greenhouse gas emissions from international travel are not included in national totals and fall outside the scope of mitigation efforts from developed countries. Instead, governments agreed that these emissions would be best dealt with by the auspices of ICAO" (Pesmajoglou, 2016, p.2). "Given the global nature of the business, airlines have argued that the rules should be global" (Mouawad & Davenport, 2015, p.2).

Multi-national environmental policy, on the other hand, has not shown the propensity to be able to align with the goals and interests of both IATA and the ICAO. For example, as early as 2008, when the

European Union announced the Emissions Trading Scheme (EU ETS, 2016) for cutting greenhouse gas emissions by focusing on a "cap and trade" approach where companies can buy and sell emissions allowances as needed, it immediately was met with harsh resistance from the commercial airlines industry and other nations when it attempted to include non-EU airlines inside of the mandate. Separate articles of the EU ETS had to be re-written to specifically deal with the global aviation industry. Then, "The United States passed legislation- pointedly titled European Union Emissions Trading Scheme Prohibition Act of 2011 - prohibiting airlines from complying" (Hodgkinson & Johnson, 2015, p.2), and when the European Union sought to force foreign carriers to compliance, "the move was thwarted by the United States, China, and other nations who said they would retaliate if their airlines were forced to do so" (Mouawad & Davenport, 2015, p.2). This creates an uneven playing field for those in the European Union, who still are forced to comply with the EU ETS as long as flights are within the European Economic Area. "It is shown that particularly European network carriers will be affected by a competitive disadvantage compared to non-EU airlines" (Schaefer, Scheelhaase & Grimme, 2010, p.195).

Recognizing the disconnect between sovereign nations, trading blocs, and the ambiguity of whose responsibility it is to mitigate global greenhouse gas emissions in the commercial airline industry, ICAO sought to bring together governments, industry, and environmental groups and introduced the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA, 2016) in 2016. CORSIA is a global market based measure designed to offset international aviation CO_2 emissions in order to stabilize the levels of such emissions from 2021 and onwards until 2050. The implementation plan begins in 2018, and from 2019 requires all ICAO member states (countries), of which there are currently 73, to monitor, report, and verify CO_2 emissions on international flight operations and make sure they comply with ICAO's aspirational goals and basket of measures which includes a "Four Pillar Strategy" for addressing aviation's climate impacts and to meet the carbon targets. According to IATA, these four pillars are:

1. Improved technology, including the deployment of sustainable fuels
2. More efficient aircraft operations
3. Infrastructure improvements
4. A single Global Market-Based Measures (GMBM) to fill the remaining emissions gap

Of particular focus is the final pillar of a GMBM, which IATA claims to be what the industry favors for international aviation. A global market based measure is considered to be an equal offset of carbon emissions via a financial contribution to a cause that reduces carbon emissions or contributes to its decrease.

> Many airlines fly into dozens of countries on a daily basis, they need to have a single point of accountability. If airlines are subject to a patchwork of national or regional CO_2 taxes, offsetting mechanisms, emissions trading schemes, and other carbon pricing instruments, compliance would be necessarily complex and costly. (IATA, 2017).

As a response to CORSIA, the European Parliament Environmental Committee postponed the implementation date of the EU ETS on international flights to Dec 31st, 2020 (Moores, 2017) which would indicate a step in a positive direction for a uniform standard for carbon offsetting. Carbon offsetting however, isn't necessarily the agreed upon method in which aviation emissions should be regulated, as evidenced by the Sustainable Development Goals outlined in the United Nations Paris Climate Conference in 2015, which was backed and signed by the 195 heads of member states of the United Nations at the time (Falk, April 22nd, 2016), and subsequently has been backed out of by the United States when President Donald Trump announced on June 1st, 2017 that the United States would withdraw from the Paris climate accord (Shear, 2017).

Similar to the United States, individual nations have also exerted their will in relationship specifically to airline emissions and subsidies or taxes that must be paid in order to conduct operations. On April 9th, 2018, "the Swedish government proposed aviation tax came into effect, which imposes added emissions fees on airlines flying to or from Sweden amounting to $7 per domestic and EU flights and up to $48 on longer routes" (Nordic Business Insider, 2018). This tax is designed to help achieve Sweden's

Sustainability Goals by 2030, which is fully backed by the Swedish government's desire to put constraints on the aviation industry. "The aviation industry is not accountable for its emissions" according to Social Democrat chair of the Parliamentary committee on the environment and agriculture, Asa Westlund (Nordic Business Insider, 2018).

Major international air carriers Norwegian and SAS have already responded by saying this will negatively impact their bottom line and have already started cancelling routes. Additionally, IATA "strongly opposes any form of national or regional environmental scheme that would result in double and extra-territorial taxation of aviation emissions as this negatively impacts the economy," and believes that anything that doesn't involve incentivizing the use of newer and greener technology makes it an ineffective policy choice (IATA Fact Sheet, 2017, p.2). When asked for comment on the specific matter, Chris Goater, Director of Corporate Communications with IATA exclaimed "Governments use the environment as an excuse, but taxes cover budget deficits and raise revenues and do not directly contribute toward environmental causes" (C. Goater, personal communication, April 18, 2018).

Although there is extensive work and collaboration that has been put into place between the major players IATA, ICAO, and ATAG in influencing policy, it is reasonable to assume that global air carriers are going to have to continually adapt and change with the turbulence of political and economic headwinds, and that CORSIA may not be the only universally agreed upon policy for the mitigation of carbon emissions in the industry.

**Informal Institutions: Social and Cultural**

Climate change perceptions are influenced by a variety of factors, including social and cultural factors. According to Rottig (2016, p.3), "institutional theory suggests that an organization's structure and actions are affected by its social environment." Kollmus & Agyeman (2002) stated that people who live in areas that have existing infrastructure to support a pro-environment belief, such as public transportation and recycling, have increased action toward pro-environmental behavior. The author continues by saying cultural norms play a big part of shaping a person's belief. Although a person may have environmental concerns, their cultural belief that family is the most important aspect of life will motivate that person to take a flight from one country to another to see their family (Kollmuss & Agyeman, 2002).

Cultural Norms and Core Values

Cultural norms play a very important role in shaping a person's behavior. Social psychologist Geert Hofstede "developed a theory of culture which holds that cultural and sociological differences between nations can be categorized and quantified, allowing us to compare national cultures" (Morrison, 2017, p. 90). Using his six cultural dimensions as a framework, one can see how countries with various dimension scores would react to multinational airline corporations and the impact they have on global climate change. More specifically countries with weak uncertainty acceptance, high collectivism and high femininity may show more pro-environment attributes and be motivated to act on beliefs (**Figure 10**).

FIGURE 10
HOFSTEDE COUNTRY COMPARISON
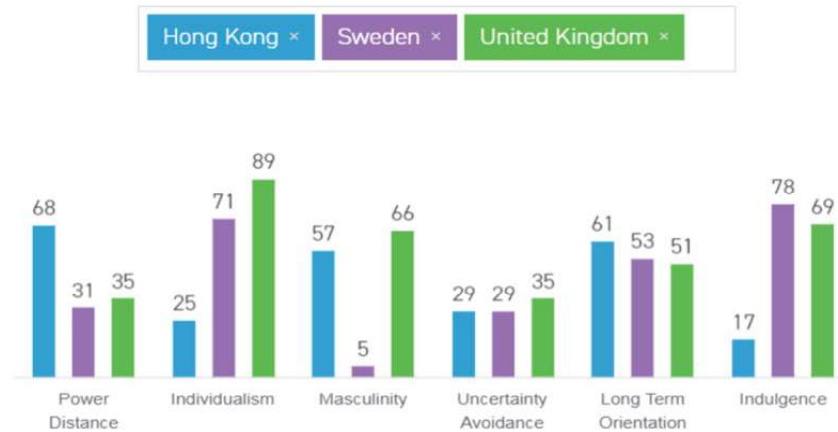
Scandinavia & Societal Pressures Surrounding GCC

A good example of this is the Scandinavian Airlines (SAS), the largest airlines in Scandinavia serving 23 million passengers. (Lynes & Dredge, 2006). Scandinavian Airlines made the decision to make their airlines more environmentally friendly after feeling some societal pressures. In fact, three out of the six primary drivers were directly influenced from their citizens. The airlines wanted to ensure they had a "good corporate citizen" image that embodied the "Scandinavian spirit" and responded to the increased focus their society has on airlines effects on the environment (Lynes & Dredge, 2006). Pressure from key stakeholders helped SAS make the decision to go green in addition to the corporate customers requiring more environmental information being divulged.

Hong Kong & Societal Pressures Surrounding GCC and Airlines

In stark contrast, a study conducted in 2010 examined the attitudes of residents from Hong Kong and their willingness to change the way they travel to reduce environmental impacts. "The study found little demand-side interest in modifying travel, especially among those who travel the most. Less than one-quarter of the regular international tourists cluster is willing to travel less by plane" (McKercher et al, 2010, p312). Awareness of global climate change and multinational airline corporations is high, but the willingness to put this awareness into pro-environmental actions was lacking. As a result of less societal pressures, awareness of carbon offsetting programs offered by airlines is low, and participation was virtually non-existent based on the study. (McKercher et al, 2010). In societies like Hong Kong, the lack of pressure on the airline industry to change will result in more political and economic pressure if change is the goal. Differing country sentiment on global climate change may make the acceptance of global initiatives more difficult to achieve.

UK & Societal Pressures Surrounding GCC

Sally Randles and Sarah Mander conducted a qualitative study on flying in 2009 that focused on frequent flyers from England. One of the questions asked of the participants focused on flying as it relates to emissions and its impact on climate change. Most interviewees stated "something" significant was happening. Of those interviewed some were unwilling to self-restrain their flying on the grounds that many other groups were more to blame for climate change than they were as individuals (Randles & Mander, 2009). Of that small group of interviewees, a significant minority expressed anger in regards to the debate that airlines and emissions have an impact on climate change. It is worth noting that while the majority in the study did consider flying to be a legitimate source of impact in climate change and did feel there should be a shared cost to control airline emissions, that small group experiencing aviation rage

could pose a backlash to the airline industry if they were to impose charges onto consumers to reduce emissions. While the social pressure on airlines varies in intensity based on institutions and cultural dimensions, the majority understood that global climate change is an important topic.

The Next Generation of Societal Pressure

As the knowledge of global climate change has increased and our social climate has changed, millennials have been a growing voice of activism and shaping decisions of businesses throughout industries. This holds true for airlines and their effects on climate change.

Since 2014 millennials have ranked climate change as the number one most serious problem in the world, according to World Economic Forum's Global Shapers Survey (Jackson, 2017). Of the nearly 49% of survey participants that said climate change was their top concern, 78% said they would be willing to change their lifestyle to protect the environment. **Figure 11** and **Figure 12** show the millennial sentiment toward the world's most pressing issues and their willingness to change their lifestyle to protect the environment. As the landscape changes with the new generation of decision makers the social pressure placed on airlines should be expected to increase. Airlines are recognizing this customer base and their perceived social pressure by developing airlines to attract the millennials. An Air-France subsidiary, Joon was introduced in December of 2017 to target the Millennials. The airline is among the top 10 most fuel efficient airlines (Nunez, 2015). Additionally the crew members will have uniforms made out of recycled plastic bottles.

FIGURE 12
WILLINGNESS TO CHANGE LIFESTYLE TO PROTECT ENVIRONMENT AMONGST MILLENNIALS
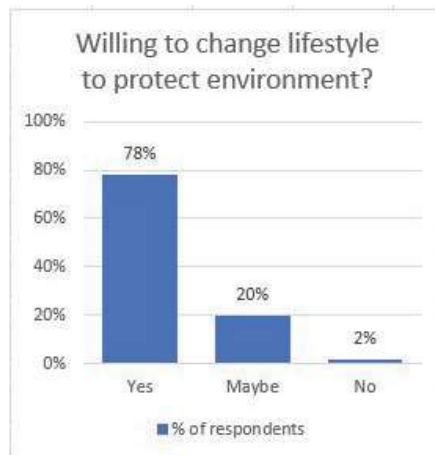
FIGURE 13
FUEL COST AS A PERCENTAGE OF TOTAL OPERATING COSTS
BASED ON 500 WIDEBODY AIRCRAFT
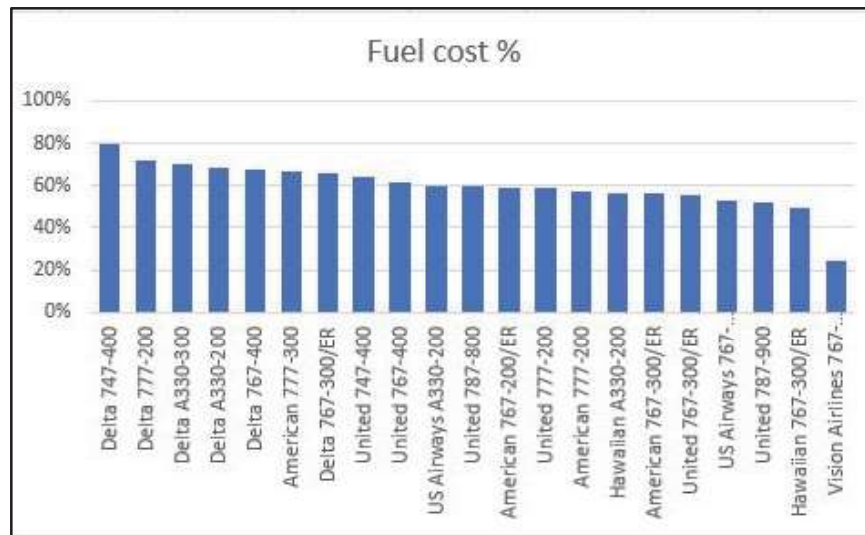
Stakeholder Pressure & Corporate Social Responsibility

The social and cultural pressures on airline MNCs is growing. As society realizes and adjusts to the continued news coverage and data presented on global climate change, airlines will begin to feel the heat. Stakeholders will absorb this social pressure and lean on the airlines to blend capitalism with activism.

Corporate social responsibility (CSR) was once termed "hypocritical window dressing", by Milton Friedman; he said that businesspeople inclined toward CSR "reveal a suicidal impulse" (Koehn, 2013). Although that was the thinking in 1970, today's executives accept social responsibility as part of doing good business.

> Solving today's burning issues-social, environmental, political, and financial- requires bigger goals, new incentives, and a preconception of what business really is. It also requires leaders with moral muscle who are willing to pursue sustainable goodness and positive impact despite colossal challenges. (Koehn, 2013, p.1).

The aviation industry has adopted this view on combining business and activism. "Competing and winning in today's economy requires a strategy that incorporates environment sustainability" (Abdullah et al, 2015, p. 246).

The airline industry has had an increased focus on becoming "green". There are three distinct areas of focus for the industry to benchmark to become more environmentally friendly; daily operational activities, corporate environment management practices and corporate policies and strategic planning. In the article "Benchmarking Key Success Factors for the Future Green Airline Industry", the authors pointed out several opportunities for the industry to become more efficient for environmental sustainability as well as improved financial impacts to the industry. One of these opportunities of improvement includes "greening on board"; this program consists of onboard recycling. The "airline industry discarded 9,000 tons of plastics, enough aluminum cans a year to build 58 Boeing 747 jets and enough newspaper and magazines to cover up 230 feet depth of football field" (Abdullah, et al, 2015, p. 251). Stakeholders understand that implementing this program will not only result in more fuel-efficiency but will increase the passenger's perception of airline's priority on reducing their environmental impact and in turn improve their "green image".

In addition to onboard green activities, the industry has begun an ambitious fleet renewal program that replaces older airplanes with more fuel efficient aircrafts. "According to AirFrance, modern airplanes are more fuel efficient on the basis of their performance calculated in liters of kerosene per passenger per 100km and yet are able to reduce the production of CO2, NOx, and noise" (Adbullah et al, 2015, p. 252). Stakeholders believe that by making this change it will not only be an example of their commitment to passengers on the airline's environmental priority but also improve operations for the airlines.

External forces including socially concerned investors and environmentally conscious customers are shaping the decisions of management in the airline industry. The firm's own stakeholders are increasingly expecting their companies to behave in a socially responsible way. The industry's commitment and action to improve environmental sustainability is essential if the industry is to continue to grow.

The Issue of Legitimacy

The extent to which airline MNCs understand and adhere to formal and informal institutions in each country has a dramatic impact on how each firm is perceived by local constituencies. If an MNC is deemed to be acting in an appropriate and responsible manner, then it is more likely to be accepted, approved and supported by the larger community; this is known as legitimacy (Rottig, personal communication, February 3, 2018). Legitimacy is critically important to airline MNCs as it can influence a firm's ability to compete in each of its respective markets.

How legitimacy manifests itself can vary dramatically between developed and emerging nations. In the former, both formal and informal institutions are firmly established and rooted in the local ecosystem, and both play equally important roles in determining legitimacy. In emerging markets, legitimacy is more the dependent upon cultural values and norms, and is concerned with a firm's social performance and involvement in the local communities. Local governments often demand "a stake in the local operations of foreign MNCs or the requirement to partner with local, state-owned companies. (They) therefore, become a central player in the corporate governance system in emerging markets and so have more influence over the actions, structures and strategies of companies compared to governments in developed countries" (Rottig, 2016, p. 8).

Where climate change policy is concerned, local governments have the power to withdraw an airline's legitimacy if they do not follow that society's related formal institutions, making it difficult for the airline to obtain the critical resources required to do business in that country. The public, media and financial communities can create barriers for the airlines to thrive if they do not adhere to the informal institutions concerning climate-related policy and behavior, controlling public perception and limiting demand, and limiting access to funding and financial support. Legitimacy is therefore a key contributor to the success or failure of airline MNCs around the globe, and needs to be carefully considered by each firm as a part of its global strategy, and in particular as it relates to sustainability.

ADDRESSING GLOBAL CLIMATE CHANGE, PROFITABLY

Global climate change is not a new phenomenon, but it has now reached critical mass in a number of industries where they can begin to see tangible impact on the overall bottom line due to disruptions in the business model. CORSIA is really only the first step in addressing the issue on a uniform basis within the industry itself, and it came nearly 25 years after the UNFCCC convened in 1992. Upon further examination of CORSIA guidelines, it is clear that the GMBM approach for carbon emissions is only a fallback to the primary goals of its "Four Pillar" strategy to address climate impacts from aviation emissions. Trading schemes, cap-and-trade, and carbon offsets are not effective tools for lower CO2 emissions, but rather seek to only mitigate their impact. If the aviation industry is going to truly impact the reduction of CO2 emissions on the environment, then it must focus on the first three pillars of particular importance to the industry, the first of which is the improvement of technology, including the deployment of sustainable alternative fuels. "Promoting alternative aviation fuels with a low-carbon production pathway could assist in decarbonizing aviation to an extent – and European airlines have lobbied for financial and policy support for this for years" (P. Gehres, personal communication, April 25,

2018). This in fact may be the key for the industry to achieve its goals to not only reduce carbon emissions but also maintain or even increase profitability for commercial airlines around the world.

Many within the industry have been proactive in the approach to sustainability far before the guidelines put forward by the ICAO proposals adopted in 2016. Between 2009-2016, airlines have improved fuel efficiency by 10.2% over that period (IATA Fact Sheet, 2017). Companies like China Airlines have also proactively taken the approach to have an average fuel efficiency target of 1.5% per year (China Airlines, 2012). Other airlines such as Delta, have policies in place to minimize the consumption of fuel such as using only one engine when taxiing, minimizing the amount of warmup time for the engines if the aircraft has already flown, or utilizing external power from the airport instead of running the APU (Anonymous Delta pilot, personal communication, April 23, 2018).

One reason behind this efficiency is a massive upgrade of fleets that is occuring within the global aviation industry. OneWorld airlines, an alliance of 13 major airlines including American Airlines in the USA, Japan Airlines, LATAM, Qantas, and Qatar Air to name a few, are in the midst of re-equipping their fleets with 1325 new more fuel-efficient aircraft that produce less greenhouse gases. The cost has been $65 Billion with another $90 Billion planned within the next few years (OneWorld Fact Sheet, 2018). Such new technology, according to industry sources are considered to be 15-20% more fuel efficient than the models that they replace (IATA Fact Sheet, Dec 2017). Virgin Atlantic has also undertaken a $7 Billion investment in its fleet upgrade program, resulting in the a reduction of 30% in CO2 emissions in 2014 (ATAG, 2014). Investing billions upon billions in new fleets definitely reduces CO2 emissions but how does that really impact the bottom line? Two words: Fuel efficiency. Historically one of the major drivers for aircraft technological innovation has been fuel and costs associated with it. Since fuel costs account for 20% to as high as 50% of the direct operating cost of aircraft, it is the single most effective way to reduce all-in costs (Lee & Mo, 2011). Aviation sustainability expert Paul Gehres noted that "an airline's primary role is to optimise for fuel efficiency, which they already have every incentive to do. Fuel is their largest cost and poor fuel cost management could quickly bankrupt an airline" (personal communication, April 26, 2018).

Figure 13 shows the fuel cost as a percentage of total operating costs based on data reported on 500 Wide-body aircraft.

Even simple operational improvements can be made to increase fuel efficiency, like adding wingtip devices to an aircraft, which can reduce fuel usage by an additional 4%. On the contrary, "if the total round-trip time of every flight in the world were to increase by one minute, then over the course of a single year, commercial jets around the world would spend 300,000 additional hours in the air, costing $3 billion in fuel, and releasing 10 billion more kilograms of CO2" (Arndt, 2015, p.2). This highlights the importance of airlines to "break the cycle" of increasing climate change effects and be steadfast in their determination to mitigate these effects.

Of particular interest to commercial airline carriers around the world are the development of Sustainable Aviation Fuels or SAF's. One of the biggest drivers of fuel efficiency innovation is a sharp rise in oil prices (**Figure 14**), and a consumer resistance to offsetting those increases through fare hikes. And because of this, carriers have begun to experiment in running their aircraft on SAF's with hybrid fuel setups, which have the potential to cut emissions by up to 80% over its lifecycle, compared to conventional jet fuels (ATAG, 2017, p.7) SAF's are made by blending traditional kerosene with renewable hydrocarbon. The major hydrocarbon sources are:

1. Municipal Solid Waste- household waste like food scraps, clippings, papers
2. Cellosic Waste- excess wood, agricultural and forestry residues
3. Used Cooking Oil- plant or animal fat
4. Camelina- primarily an energy crop to produce renewal fuels

FIGURE 14
CRUDE OIL PRICES ($/BARREL)

Crude oil prices 1861 - 2016

US ($) per barrel
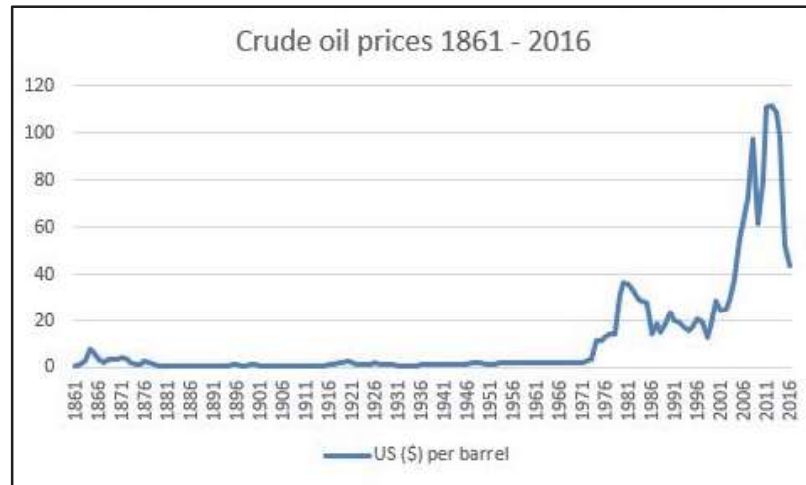
The first SAF flight was conducted 10 years ago in 2008, and now has developed into over 100,000 commercial flights being flown on these fuels but only four airports around the world are regularly supplied with SAF's as of November 2017 (ATAG, 2017). There are pros and cons to the SAF discussion for airlines. There is no disputing the reduction in CO_2, but the main question is how does it help a commercial airline maintain a profitable edge? One of the most notable economic benefits is that SAF's can help provide a solution to price fluctuations related to fuel cost volatility that constantly faces aviation (ATAG, 2017, p.7). Also under the CORSIA agreement, SAF's will be taken into consideration which means that the financial burden of offsets will be limited if at all necessary under the plan. Considering that only a small percentage of commercial flights utilize SAF's it likely would have a minimal effect, especially when you also consider the high overall costs of SAF's themselves.

In an IATA study "The Cost of Going Green" it is estimated that the earliest sustainable fuels were six times more expensive than kerosene, and while the pricing gap has narrowed recent estimates still put it at between two to three times the cost of conventional fuel (IATA, 2017). IATA Director Chris Goater says "SAF's have been reduced to close to competitive to about 2x cost of traditional jet fuel" in isolated examples (C. Goater, personal communication, April 18, 2018). Several airlines have attempted to band together to reduce costs. AirFrance, Lufthansa, Qantas and Cathay Pacific have invested in many projects and have joined biofuel alliances to protect biofuel resources and reduce biofuel price (Chang, Chen, & Hsu, 2015). "In order to get meaningful reductions in cost, policy influence must be strengthened by groups like IATA and ATAG as it relates to Sustainable Airline Fuels (SAFs) and putting the pressure on government to put policy mechanisms in place" (C. Goater, personal communication, April 18, 2018) "The fossil fuel industry has had a 100 year start compared to SAF, and a concerted effort by governments is required to foster these promising renewable options to help drive long term viability" (ATAG, 2017, p.16). As an example, a new report by a coalition of NGO's found that the G20 countries provided an average of $71.8 billion dollars for fossil fuel projects per year between 2013-2015 compared with just $18.7 billion for renewable energy (Carrington, July 5, 2017, p.2). In the state of California, low-carbon fuel standards (LCFS) credits apply to only renewable diesel but not aviation fuels, therefore adding a premium that has to be added to renewable jet fuel to offset the value that LCFS delivers on renewable diesel to almost $1 per gallon (Paylor, 2017). There are even lobbying firms – particularly in the US – endangering the biofuels movement by fighting to have certain fuel types classified as "sustainable", despite them not really being any lower in carbon than fossil fuels (P. Gehres, personal communication, April 25, 2018).

These headwinds have not deterred airlines like United, who in March 2015 became the first airline to use sustainable airlines fuels on an ongoing basis, and made a $30 million investment in Fulcrum BioEnergy (Chen, June 30th, 2015, p.1). Boeing has also collaborated with their clients by partnering with Virgin America and Lanzatech which produces ethanol based biofuel, and another firm in Finland to gain approval or renewable diesel (Called HEFA+), which could eventually meet more than 1 percent of global aviation demand at a price that is competitive with fossil-based fuels. (Boeing Company, June 22nd, 2017, p.3.) "With government involvement we can achieve critical mass and hope that our goal of 1 billion passengers will have traveled on airplanes flown with biofuels by 2025" (C. Goater, personal communication, April 18, 2018).

IMPLICATIONS FOR AIRLINE MNCS

While mitigating the effects of climate change is a key focus of airline MNCs for the simple reason of conducting environmentally sound business practices for the greater good of the planet, airline executives must also look at the issue through a political, social, technological, and economical perspective in order to craft their industry response to the issue. **Figure 15** depicts alternative strategies multi-national airlines may choose to utilize to combat the impact global climate change is having on their industry. These forces are interrelated and managers of MNCs need to compile a list of issues arising from these forces that are relevant to their firm.

FIGURE 15
ALTERNATIVE STRATEGY MATRIX

		Political		Social		Technological			Economic
		Political disconnect	Lack of Global policy/regulation	Culture	CSR	High fuel consumption	Grounded aircraft	Weather	Undercapacity flights
	Effect on Industry	Various policy changes due to political agenda	Compliance varies by country/region	Varying levels of urgency in finding soultion	Airlines waiting for regulation to make improvements	Greater CO_2 emissions, higher costs	Lost revenue	Lost revenue, asset risk	Lost revenue
Alternative Strategies	Lobby for government incentive programs	No effect; Difficult to overcome with changing party members	No effect; incentives would still vary by country/region	Government providing catalyst to prioritize sustainability	Provides avenue to find solution before compliance is mandatory	Government providing catalyst to stir innovation	Government providing catalyst to stir innovation	Government providing catalyst to stir innovation	No effect
	Make CSR a core value	No effect; Difficult to overcome with changing party members	No effect	Embed sustainability into company culture	Employees take initiative and create their own solutions	No effect	No effect	No effect	No effect
	Improve Operational Performance	No effect; Difficult to overcome with changing party members	No effect	No effect	No effect	Find innovative solutions to reduce CO_2 emissions	Find innovative solutions to prevent groundings due to heat (new material, increasing	Minimize risk by utlizing predictive analytics and flight route optimization	Increasing operating parameters will minimize need to reduce weight
	Support and participate in global initiatives such as CORSIA	No effect; Difficult to overcome with changing party members	Aids in progressing towards global policy	Demonstrates high urgency in finding solution	Work toward a solution before being mandated	No effect	No effect	No effect	No effect

As it relates to CO2 emissions, just as much evidence exists that major commercial airlines not only contribute to climate change, but that aviation may also be one of the biggest industries to suffer from the changing environment. Due to their multinational status and easily recognizable brands, airline MNCs have an opportunity to be a leader within the global community for innovation and education about global climate change and can be a true platform for global political integration, "to collaborate on a cross national political basis and coordinate a response to a crisis affecting countries around the world" (D. Rottig, personal communication, Jan 14, 2018). This political action must continue to be led by IATA, ICAO, and ATAG, which must continue to pressure sovereign nations with a unified voice of the commercial airline industry and truly embrace a single message to the world about climate change

progress. This will prove to be difficult largely due to the fact that there is no single uniform international commercial law (D. Rottig, personal communication, Jan 14, 2018). At some point in time however, global climate change goes beyond politics and begins to challenge our everyday way of living life.

Socially the world is beginning to embrace these challenges and put pressures on the political landscape, but we are still very far behind in the form of education as it relates to global climate change and firms' everyday impact on the environment. Consequently, MNC's now also have a responsibility that goes beyond making a profit and must walk the fine line of balancing corporate social responsibility and profitability. This will require collaboration with the end consumer to help educate them about their overall carbon footprint, specifically as it relates to air travel – and more importantly, how they should offset it. Airlines have a wonderful captive audience during the duration of these flights and should be obligated to disclose their CO2 emissions and how they contribute to global climate change, while also leading consumers to viable offset options in easy-to-access methods of delivery, like onboard TV, electronic ticket downloading options, and maybe even PA announcements; "Ladies and gentlemen, this is your captain speaking. Please make sure to offset your carbon footprint before departing the plane today!" Perhaps they could even go so far as incentivizing a passenger with non-financial perks like pre-boarding or snacks to participate in an offset program.

In addition to the social and cultural implications of more sustainable business practices, finding ways to reduce energy consumption has financial and technological benefits for airlines as well, these benefits have been found to be both causal and correlative. In essence, doing good has been shown to be good for business. Having an environmentally friendly and compliant operations plan is not only mandatory in today's world, but commercial airline MNC's must also anticipate more political and regulatory uncertainty. Because of this, being accommodative to policy to do all that is required is not enough, but instead the focus must shift to being more proactive, and doing more than what is asked. Although these updates to technology, operations, and even consumer relations may be short term financially disruptive, they can be game changers and prove to be long term smart for the overall bottom line, especially for an industry that sees historically the lowest ROIC in any major U.S. business of only 5.9% (D. Rottig, Personal Communication, February 24, 2018). It is time that commercial airlines begin to venture outside their industry and participate in some vertical integration of core and non-core business in order to diversify not only their economic portfolios but also their ability to develop SAF's at a sustainable price. These can be used not only in their operations but also to sell to those other 12% of carbon emitters in the transportation industry utilizing fossil fuels, since they will be tackling the same environmental issues in the next few decades. This may prove to be the most impactful decision for the all MNC's bottom lines, but also the question is who is going to be the most disruptive in the transportation industry and best marry planet and profit together.

CONCLUSION

The topic of global climate change continues to be a key discussion point for the aviation industry. As the warming trend continues and MNCs of all types are expected to do their part to reduce its impacts, pressure is on the airlines in particular to serve their shareholders while also serving the greater good. The impact of the changing climate *on* the industry is of growing significance, as it has a direct correlation to airline performance. As a result, marked improvements are being made in mitigating the impact *of* aviation on the planet. Strides in one area necessarily dictate improvements in the other.

Airline MNCs are expected to continue to place greater focus on sustainability programs over the next few years; many will begin following CORSIA's offsetting scheme, as well as other sustainability imperatives. The question is whether these efforts will be significant enough to pave a pathway to a low-carbon industry by 2050. "Because," as Paul Gehres noted (personal communication, April 25, 2018), "if we aren't making strategic decisions now, a low-carbon 2050 would simply mean a lot less flying."

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APPENDIX

Interview Transcripts

Paul Gehres, Advisor - Climate and Sustainability, Low Carbon Concepts, London, U.K.
(1) What is Low Carbon Concepts, and what do you do in your current role? (Are you a consultancy?)
    I work as an independent environmental consultant under the brand Low Carbon Concepts. I work on corporate sustainability and climate projects, including corporate sustainability reporting, policy analysis, and greenhouse gas accounting.

(2) How do you work with the aviation industry – the airlines in particular?
    I worked as the analyst of the environmental team at British Airways for 4.5 years. I've worked on aviation issues for other airlines and fuel companies subsequently as a consultant.
    My work has included developing corporate environmental policies, conducting analysis and scenarios work to develop the company's policy positions (primarily on climate and biofuel-related policies), and preparing environmental reports for investors (including initiatives like CDP and DJSI).

(3) Aviation-related greenhouse gas emissions are a big contributor to the climate crisis. In turn, climate change creates unfavorable conditions for the airlines, causing them to burn more fuel. What do you believe is/should be the role of the airlines in mitigating climate change?
    First for context - I'd say aviation is a 'notable' contributor to climate change. Most objective reports peg aviation's contribution between 3-5% (depending on your view of radiative forcing). This is significant, but remember that road transport is a significantly larger contributor. Having worked on projects to encourage commuters to shift to travelling by bike and public transport (pre-BA), I'm comparatively less worried about aviation than I am about road transport emissions'.
    But yes - no question commercial aviation physically requires the combustion of huge quantities of fuel (resulting in a large volume of CO_2e emissions).
    An airline's primary role is to optimise for fuel efficiency, which they already have every incentive to do. Fuel is their largest cost and poor fuel cost management could quickly bankrupt an airline. Improving fuel efficiency can include taking the most direct route and minimising excess weight.
    In a 2050 world with major climate regulations, one could imagine a big reduction in the number of indirect flights that are so common today with the hub-and-spoke model.
    Airlines already want the most fuel-efficient airplanes and all buy very similar models of aircraft from Boeing, Airbus, etc. Promoting alternative aviation fuels with a low-carbon production pathway could assist in decarbonising aviation to an extent and European airlines have lobbied for financial and policy support for this for years (I've been involved in some of this).
    However, aircraft manufacturers (e.g. Boeing, Airbus, Embraer) and fuel companies (e.g. Shell, Exxon, Total, BP) need to lead on the design and low-carbon fuels areas. It is their area of expertise and unlike airlines, they are exceptionally profitable and cash-rich entities.

(4) How important do you believe sustainability is to the airline industry? How has that changed over the last 5 years?
    It's probably more worrying to the airline industry than most, at least from the climate perspective. A poorly designed climate regulation (say, a really high fuel tax, adopted quickly, not phased-in over time) could really disrupt the industry.
    While the climate challenge ahead is intimidating, it's impressive how far we've come in 10 years. The industry leaders who pushed the envelope back in 2009 via the group AGD really should be proud. CORSIA is imperfect for many reasons, but in 2012 I didn't think it would even come to pass.

(5) What would you consider to be your greatest accomplishment as a firm or individual as it relates to mitigating the environmental impact of commercial airline travel? (If not from your current position, perhaps from your days at British Airlines?)

We worked hard to highlight the upstream emissions of aviation in our annual reporting when I worked at BA. While it's commonplace now, I'm not certain any major airline was reporting its supply chain emissions from upstream fuel production and aircraft manufacturing at the time. And it's an important message to disseminate - for every tonne of CO2 you emit from combusting the fuel, another ~0.2 has been emitted upstream via the production process.

Transparency is a serious accomplishment, and folks like CDP are rightly lauded for their efforts.

(6) How do you believe cultural and political differences across borders influence climate change discussions and action?

I'm not a great resource on this. But as a US expat who's spent 10 years in Europe, it's clear that Europeans have a healthier dialogue around climate regulation than the US at the moment. The EU ETS has inherent challenges because it is hard to run a regional (non-global) emissions trading scheme that jointly reduces CO2, avoids competitive distortion, and avoids carbon leakage to countries without an ETS in place. But it's an impressive system and some of the criticisms from non-European countries are fairly petty.

That said - the US is really superior at innovation funding. While US airlines were a little slower to get excited about low-carbon fuels than European ones, I'd say they have the most momentum right now because the US government is really enlightened / willing-to-invest in risky ventures via grants, loan guarantees, etc. It's a serious advantage.

(7) Are you familiar with the "Four Pillars" strategy outlined by CORSIA in 2016? If so, do you believe the airlines should be following it? Do you know any that are?

I'm very familiar with IATA's activities and roadmap work. I hadn't really clocked that a lot of this is now branded as the 'four pillars'.

Yes - most airlines have some programme of work to promote fuel efficiency (which sometimes gets called operational measures or similar). Many airlines are getting involved in the biofuel space, and excitingly many in the advanced biofuel space with technologies that are significantly lower-carbon than fossil fuels. It's still worrying to me that certain lobbying organisations (particularly in the US, to be blunt) could kill this biofuel opportunity by lobbying for certain fuel pathways to be classed as 'sustainable' or 'low-carbon' when they definitely aren't. If this happened, the PR backlash from this would be devastating and a major setback in building paths to a lower-carbon future.

Many airlines will start to comply with the CORSIA offsetting scheme in the next few years. The real question is whether this initial scheme can develop into a path to a low-carbon industry by 2050. Because if we aren't making strategic decisions now, a low-carbon 2050 would simply mean a lot less flying.

Chris Goater, Director of Corporate Communications, International Air Transport Association (IATA), Geneva, Switzerland.
(1) Tell me what you have seen since ICAO announced the CORSIA guidelines in 2016.

Many airlines have reinforced their commitment to the process and have committed to working towards the guidelines outlined by CORSIA that are to go into effect in 2021 already. This is still a "state issue" however and their needs to be be a recognized shared responsibility to the issue. 73 states have signed up for this as of March of 2018, yet two major countries, India and Russia specifically have not. We have called on nations to acknowledge the Global Market Based Measures outlined by CORSIA.

(2) How did IATA feel about the Aviation Tax recently put into place by Sweden on April 9th, 2018?

We obviously were against it and we lobbied hard for it not to go into place. Many countries use the environment as an excuse, but taxes are usually used to cover budget deficits and raise revenues, and are not designed or guaranteed to offset environmental issues.

(3) Do you feel the same way about the EU ETS? (European Union Emissions Trading Scheme)

The EU ETS doesn't go into effect until 2020 but we prefer that the states adhere to the CORSIA guidelines well before that.

(4) Can you tell me about any specific success stories as it relates to Sustainable Airline Fuels (SAF's)?

SAF's are a really important area of our focus. In fact I would consider them to be the "Magic bullet" when it comes down to whether we will be able to hit or exceed our carbon reduction goals. They are only in their infancy however. By 2020, we hope to have about 1 million flights flown with SAF's, but that is just a drop in the ocean as it relates to the amount of global air traffic.

There has been some encouraging news out of Asia as it relates to SAF's, specifically with Cathay Pacific and the SAF investments they have made and the As/PAC region has done a good job of cutting emissions. Also they have made some headway on route efficiency and have been able to fly what is considered to be a perfect flight with the most fuel efficient route possible.

(5) What challenges do you face with SAF's?

We need government to put policy mechanisms in place that help promote the use of SAF's. The United States currently has one and the European Union is debating one now. The biggest challenge for SAF's is the cost of the fuels. There has been a lot of progress but they still are hard to quantify the costs compared to jet fuel. I would estimate that we have seen ranges from almost competitive in price to about twice the costs of jet fuel today.

(6) Is there a key message or takeaway from our discussion today?

I would say that with government involvement we can achieve critical mass and easily hit our target of flying one billion passengers on sustainable airline fuels by 2025.

Pilot Captain, Delta Airlines, Atlanta, GA (name omitted at interviewee's request).
(1) Can you please introduce yourself and your role at the company and how long you have been in the position.

My name is (*omitted at interviewee's request*). I am a captain with Delta Airlines on an Airbus 319, 320, 321. I am based in Atlanta, GA. I was previously a Northwest pilot in 1996 and we consequently merged with Delta in 2008.

(2) Are you okay with me using your name and title or do you want to remain anonymous?

I don't want you to use my name. I am not in a position to speak on behalf of Delta. I am just a pilot. I am not a representative of the company.

(3) In flying the aircraft, do you know if there have been any changes regarding sustainability initiatives from the airline or from what you have seen in the company? Have they done anything to minimize the impact on the environment?

Yeah, Delta is very proactive in trying to decrease the effects on the environment. As a matter of fact, we have a fuel policy where we try to minimize the use of engines on the ground. Don't use both engines if you don't need to. Use only one engine to move while on the ground.

(4) Do you know if they have done any fleet upgrades?

Yeah. Delta is constantly renovating the fleet. They try to get rid of the older planes that consume more fuel with newer, more fuel-efficient planes. I don't know the average age of the planes, but I think in comparison with the other major airlines it's pretty good. It's first or second in the industry.

(5) As a pilot, have you seen any disruptions in your normal pattern of work? Have you had to change your routes, have flights taken longer, used more fuel or anything like that because of weather?

No, there is more traffic, especially in the Northeast. There's a lot of congestion, a lot of holds, but it's because of more traffic itself, more planes flying, not necessarily the environment itself. Now lately, it's well documented, the super storms have affected the airlines. Delta is very proactive in minimizing the effects on the passengers by cancelling flights ahead of time, rescheduling passengers on other flights around the weather. It seems the company is very proactive around minimizing the effects on people.

(6) In your experience, would you say there has been an increase in the number of cancelled flights due to the super storms?

I do not have the data. Maybe its because its being publicized more. I cannot be sure. Maybe its because the media is more aware. It seems like in the last 3 years companies are more proactive. Before that, companies were caught off-guard and they didn't move people around or cancel flights and that disrupted schedules. It's not that they are cancelling flights because of the weather itself, they are cancelling ahead of the weather. They're more organized, they're more proactive about doing that. Does that have to do with the weather itself being more intense than before or with the companies realizing that if they do not act in time they will be disturbing people more? I don't know which one it is. It seems that there are more cancellations, but only because companies are more proactive to do so.

(7) In our research we found some articles that talked about how in extreme heat, it effects the engine performance, the amount of runway needed to takeoff, so can you talk about that a little bit?

Yeah, that's normal. The hotter the day or the temperature and the higher the altitude the longer it will take for the plane to takeoff and the more runway its going to need. So if it's a hot day in Denver, it's a really bad for the airlines. So yeah, we are all aware of those facts, so the company acts appropriately. Sometimes the airplane cannot take all the passengers and has to reduce the weight. The company restricts either the amount of passengers or cargo, but that's only a very few occasions, like high temperature, high altitude, that affects that. Because I remember places like Denver or Bogota, Colombia. That just affects everyone the same. If you're trying to book a flight, like myself as an employee going to Bogota, as a matter of fact I was just about to do so, the company has a statement when you're about to make the reservation "Remember that the flights to Bogota are not traditionally the same. The temperature there is too hot and there is high altitude of about 7,000 ft. We are not going to be able to take all the passengers."

(8) In the past, have you been able to make those same flights without having to reduce the weight or is that something that has also been occurring with the increase in temperatures?

I cannot say that I see a major difference. They're always the same place. From when I started working with the airline it's been "Oh, I got to fly to Denver in the summer. Oh freak, my wheels are gonna get hotter and the brakes." The temperature of the brakes on the wheels, you have to let the heat dissipate, so if you have a short turnaround like 45 minutes, you might not gonna accomplish that so you try to minimize the amount of braking that you need to. You just be safe and don't use overbraking. Just use the amount you need to. Minimize the amount of braking. You manage to mitigate the amount of risk by thinking about it ahead. So no, I cannot say that it is more of an issue than it was in the past. Not from my point of view.

(9) You mentioned that you do flights to Bogota, do you do any other international flights like over to Europe?

I actually have not flown to Bogota, I was going as a passenger. I've flown domestically for most of my life. I did international, mostly to Europe and Asia for 6 years.

(10) Has that been recently that you did those flights to Europe and Asia?

The Europe, I have not flown to Europe in the last 5 years. I was a First Officer and upgraded to Captain on the smaller equipment what we call domestic flying. I was flying an Airbus 330 as a co-pilot, then I upgraded to the smaller Airbus 319, 320, 321. Eventually, hopefully I will be able to fly the big ones again as a captain. It's all based on seniority, so I have to wait my turn.

(11) In our research we found some organizations that are trying to put some regulation around the sustainability effort like IATA, ICAO, and we came across something called CORSIA, are you familiar with CORSIA?

No I'm not. I don't know if this is part of the subject or not, but I know they are testing what is called solid fuels. I don't know if that will decrease the impact on the environment or not. Is that one of the regulations? That they have to switch from regular petroleum-based fuel?

(12) I don't know if that was part of the agreement, but I know one alternative that we found in our research are called SAF's. Do you know if Delta has been looking into that at all?

No, I would not be able to speak on that. That's more of a corporate world. As a pilot, I know what the company publishes. Delta has been honored and awarded several times for being so proactive in trying to save the environment and things like that. Minimize the impact on the environment, but I don't know specific policies like that. Sorry.

(13) So I want to go back because you had mentioned how when you are on the ground they tell you just to use the one engine if you need to. Are there any other best practices that Delta uses to be environmentally friendly?

Oh yeah, we call it Single-Engine Taxi. If the airplane has already flown that day, it only requires 2 minutes for warmup on the engine, so we don't start the engine until 4 or 5 minutes prior to departure. Sometimes if you're too heavy it is better to use two engines otherwise if you use just one engine, you use more fuel and make more of an impact on the environment. That's one thing, the other thing, with specific times like 5 minutes prior to departure, the cargo door should be closed and the passengers manifested and all that. Everyone should be seated, so when we push back we don't take delays. When we push back from the gate, we try to get out of the gate and start rolling within a minute and a half. That's just all the same thing you don't want the aircraft sitting and running with one engine waiting for clearance from the tower to taxi and wasting more fuel and having a greater impact on the environment. Delta is very proactive on that. We're always, especially me, trying to get a direct flight because you will get there sooner and use less amount of fuel. So you request from ATC, can we get a direct route.

(14) So is that something Delta attempts to do, optimize the flight scheduling so they have the most amount of direct flights as possible?

Exactly. And remember that Delta always presents a flight plan to the government and the FAA. "We want the route to go like this", but they have other constraints. The FAA may have something going on for example going to Palm Beach sometimes, the president is in so there is a perimeter around the area where the president is and things like that. Military areas, for example, if you fly from Miami to New York, we would love to go over the water straight up to North Carolina, from North Carolina to New York, but sometimes that will be flying over, what they call, a restricted military area, so when those areas are "hot", in other words, they are conducting military training in that area, then we cannot use it. Then we have to come over land and it takes longer. Delta always is trying to find a straight line as much as possible, so it is up to the FAA to approve that based on whatever constraints they have that day.

(15) Have you worked with any airline other than Delta in your career?

Yeah, I worked for American Eagle. I was with Northwest before it became Delta, and before Northwest it was American Eagle.

(16) Is there anything that you can think of the Delta does that you would consider to be above and beyond where you have worked in the past?

Yeah, not just because I work for Delta, but I think that Delta management is a very conscientious group. They're always looking at ideas, as a matter of fact, they welcome input. All the changes that have occurred in the last 10 years I have been with Delta, is all based on pilot input. For example, these aircraft don't have external power. That's another thing, when you get to the gate, you're going to need electricity when you shut off the engine, right? Okay, you can get it out of two forms. You can get from the APU, it's like a third engine inside the aircraft. It's called the APU, the auxiliary power unit, or we can have external power, which is electricity that comes from the airport. It doesn't use fuel as I understand. I don't know if it comes from a power plant or…but it come from the airport. So the building itself, so Delta is always trying to talk with airports around where we operate to have the external power ready and available for the airplanes so we don't have to use the APU and that way you can minimize the effect on the environment, but you also use less fuel and it's less cost to the company. Fuel is just cost. So like I said, as a pilot, everytime I go to the airport and they don't have external power I report that to Delta immediately and somebody will find out why the external power is not available and what we can do. Things like that. Like the truck that pushes the aircraft back from the gate, in the past, we would use the engines. The engines would be put on reverse and would use the power from the aircraft to push us back. Well, that unleashes a lot of fuel and is bad for the environment and is higher cost to Delta. So Delta bought the trucks and puts them in every airport. One per gate. Delta is very proactive in maintaining that equipment. Obviously, first safety, then comfort, then cost, then environment. Environment and cost basically are part of the same thing I guess.

(17) In our research we also found that as the air gets warmer it makes the jet streams become stronger and it could create more turbulence. Have you experienced anything like that? Have you experienced more turbulence?

No I cannot say that I have felt more turbulence. I think that the amount of heat, the increase in temperature, the thunderstorms seem to be stronger, but you mitigate that by using radar and going around it. So yeah, there could be a possibility of a disturbance to the traffic from the thunderstorms, but the jet stream is something I have no knowledge. When the jet stream is at your back you can tell. Lately, I have seen jet streams at 150-160 mph, and we had it at our back so it was helping. The turbulence associated with the jet stream is dependent on the altitude of the jet stream and where you are. That all can be mitigated by knowing which altitudes are being affected by them. To be honest, has it been one of those things that I need to be aware of it all the time? No.

(18) Another thing we found in our research are that there are some airlines that are putting on like sensors or data collection devices on the aircraft to help some of these agencies get some data on the environment and do some analysis. Are aware of Delta doing anything like that with their aircraft?

No. I have not been informed nor have I seen any apparatus on the airplane that measures that. If they are doing it, I am not aware of it.