Perspective

Eric Kronenberg
Justin White

booz&co.

The Future of Green Aviation

Contact Information

Florham Park, NJ
Eric Kronenberg
Partner
973-410-7621
eric.kronenberg@booz.com

Justin White
Associate
973-410-7674
justin.white@booz.com

Robert Dickinson and Raman Ramanathan also contributed to this Perspective.

EXECUTIVE SUMMARY

Airlines today are faced with a dramatically changing business landscape, largely because of volatile jet fuel prices. U.S. airlines, in particular, face questions about their immediate and long-term solvency. However, the situation is not all dire. There are short-term strategic actions concerning business models and investments that airlines can take to gain an advantage over their competitors and ensure their own viability. Airlines must reduce their consumption of oil-based jet fuel by investing in more fuel-efficient technologies, nurturing the growth of alternative energies, and, more immediately, optimizing their business models. Doing so not only will save the industry billions of dollars but also will help airlines achieve a sustainable, lower-emissions future.

THE NEW IMPERATIVE FOR AIRLINES

Every so often we experience an extraordinary upheaval in the fundamental nature of how we live and, concomitantly, how business operates. Today we are witnessing such a change. Recent and radical volatility in the price of oil will do more to change how we live our lives, what business strategies we employ, where we invest our money, what types of jobs we seek, and what kinds of businesses we create than any phenomenon since the advent of the Internet.

Hyperbole? No. In a world where we are dependent on the availability of cheap and abundant energy to fuel our cars, heat our homes, and propel our planes, our economic well-being is inexorably tied to the price of oil. And nowhere is the need to respond to this reality more urgent than in the aerospace industry. In 2008 alone, U.S. airlines are projected to lose more than US$5 billion. This sea of red ink is fed primarily by fuel prices, which now account for 40 percent or more of airlines' operating costs, up from a historical range of 10 to 15 percent.

Challenged by troubling statistics like these, airlines have no choice but to reduce their consumption of jet fuel. To that end, Booz & Company believes there are three distinct steps they can take:

1) Invest in upgraded equipment and processes that increase fuel efficiency or reduce fuel consumption by optimizing routes and procedures.

2) Transition to alternative sources of fuel.

3) Change the business model and metrics by which performance is measured.

Airlines have no choice but to reduce their consumption of jet fuel.

STEP ONE: INVESTING IN FUEL IMPROVEMENTS

The most important investment that airlines, airports, and the Federal Aviation Administration (FAA) can make to address the rising cost of fuel involves a technology known as required navigation performance (RNP). This innovation includes outfitting aircraft with a variety of navigational equipment, flight management systems, sensors, and avionics so that their precise location is continually tracked. RNP allows air traffic controllers to safely reduce the spacing between aircraft, thereby minimizing the number of planes wasting fuel as they circle while waiting to land. RNP also permits greater implementation of "user-preferred routes," allowing airlines to choose the most efficient paths for their flights and optimize scheduling. Booz & Company estimates that RNP could save U.S. carriers $5 billion to $10 billion in fuel costs per year. *(To compare the value and ease of implementation of various fuel improvement approaches, see Exhibit 1, page 5.)* Similarly, the use of continuous descent approach (CDA) holds a great deal of potential to decrease fuel consumption, but its implementation, like that of RNP, is dependent on cooperation between the FAA and airports. CDA allows pilots to navigate long, gradual landings at idle speed instead of descending, plateauing, increasing power, descending, plateauing, and so on until touchdown. CDA, which has been tested by United Parcel Service Inc. and Airbus SAS, among others, can reduce fuel consumption during landings by 10 percent. But CDA is not practical for some high-density airports because it requires greater spacing between aircraft.

In addition, a number of relatively easy-to-implement technologies involving engine efficiency and reduced aircraft weight and drag could yield large fuel savings, and some of those technologies are already being widely adopted.

For example, Pratt & Whitney, a division of United Technologies Corporation, has developed the PurePower engine (PPE), which the company estimates reduces fuel burn by 12 to 15 percent. These engines are currently on order to outfit new Mitsubishi Regional Jet and Bombardier Cseries aircraft by 2013. However, it is not yet clear whether a PPE can economically be retrofitted to existing planes and maintain its fuel benefits.

Another engine technology increasingly in vogue is actually not new at all. Called open rotor engine, it promises the greatest fuel burn reductions of any engine—20 to 30 percent—but it has been mostly neglected because of restrictions on engine noise. General Electric Company is working with NASA to devise methods to reengineer the acoustic signature of the engine's rotor blades to cut down on clatter. If they succeed, open rotor could become a popular technology, especially for short- and midrange aircraft.

Reducing aircraft weight can also make a significant difference in fuel consumption. The use of lightweight, high-strength composite materials in aircraft has long been championed by Boeing Company, the world's top aircraft maker, but largely resisted by its chief rival, Airbus. We believe there are significant opportunities to aggressively incorporate new composite technologies to minimize weight.

Finally, limiting drag on the aircraft can increase fuel efficiency, and four advanced design elements are often discussed in this context. They involve: (1) structural changes in the aircraft made by using either a blended-wing body (BWB) or forward-swept wings; (2) maximization of laminar flow; (3) the use of winglets, a near vertical extension of a plane's wing tips; and (4) an optimized drag profile for existing aircraft types. Considering today's technology and infrastructure, winglets and optimized drag profiles are the most realistic avenues to pursue. The majority of aircraft now have winglets, which converts some of the otherwise-wasted energy in the vortex around the wing tip vortex into thrust, so this is almost a moot point. But airlines using aircraft without winglets should investigate the economics of retrofitting. At the same time, airplane manufacturers should continue making incremental improvements to fleet architecture aimed at lowering wind resistance, a step that in itself could decrease fuel consumption by as much as 2 percent.

BWB technology, forward-swept wings, and laminar flow are not as promising. BWB and forward-swept wings fundamentally change

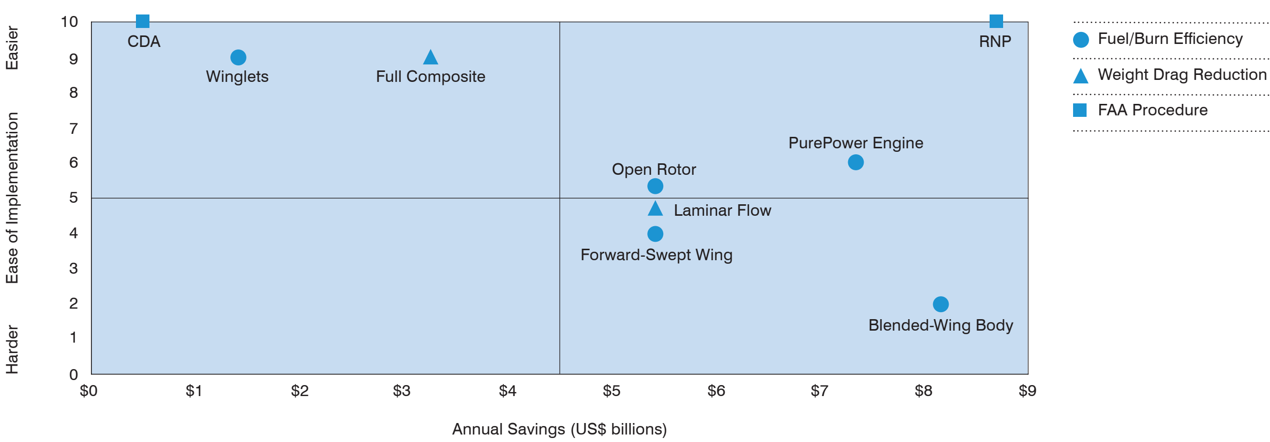
Another engine technology increasingly in vogue is actually not new at all.

the shape of the aircraft, which raises the problem of whether the existing manufacturing and airport infrastructure—such as jetway bridges and terminal gates—can accommodate those planes. With so much capital already invested in the current system, any new technology must be able to leverage the existing infrastructure. As for laminar flow, the argument is more nuanced. Laminar flow, which promotes a smooth, uninterrupted stream of air over an aircraft in flight, reduces drag on the plane and thus increases fuel efficiency. However, to yield the greatest efficiency from this approach, the aircraft wings, engine, and body must be washed after each flight. This is economically and logistically a challenge for airlines, and so minimizes the use of laminar flow. Still, by narrowing the scope and just focusing on washing the engines after each flight, airlines can improve fuel burn by as much as 1.2 percent. Per flight, this may not be a large number, but in the aggregate, it means substantial savings.

Henry Ford famously said, "If I'd asked my customers what they wanted, they'd have said a faster horse." An element of that notion is present in this first step of upgrading existing technology and procedures.

Exhibit 1
Measuring the Value of Fuel Use Improvement Methods

MATRIX OF SAVINGS VS. EASE OF IMPLEMENTATION



Source: Booz & Company

STEP TWO: DEVELOPING ALTERNATIVE SOURCES OF FUEL

At *Aviation Week & Space Technology's* Green Aviation Management Forum in Madrid in September 2008, representatives and researchers from Boeing, Airbus, the FAA, Air France, and KLM spoke at length about what they expect to be the future of alternative energy in aviation.

They concluded that the starting point for evaluating alternative fuels is to establish a set of rules by which to judge each fuel's suitability. The participants agreed on these criteria:

- It cannot be a food stock.
- It must be scalable.
- There must be a stable supply of it.
- It must be a proven solution.
- It must work with the existing jet fuel infrastructure.
- It must at a minimum meet current jet fuel performance standards.
- It must be cost efficient.
- It must not cause a net harm to the environment.

Researchers have investigated a host of different sources, including coal to liquid (CTL), gas to liquid (GTL), and biomass to liquid (BTL). Considering the above criteria, though, the CTL and GTL technologies fail because they are both nonrenewable—that is, finite—and their CO2 emissions present a net harm to the environment.

This leaves BTL, and, indeed, the consensus seems to be building around algae biomass as the leading candidate. It is not a food stock; it is scalable, stable, and proven; and it will work with existing infrastructure, meet current jet fuel standards, be cost efficient, and be carbon neutral. Boeing, Virgin, GE, Rolls-Royce, Air New Zealand, Continental, NASA, and others are currently testing various biomass fuels.

Price is of critical importance, however. Boeing's research suggests that the alternative fuels the company has investigated would cost $70 to $80 per barrel. So with the recent drop in oil prices to these levels, BTL is, at worst, a cost-neutral, non-carbon, non-volatile energy source. But if oil prices again rise above $100 per barrel, biomass fuels could be a game-changer for airlines—a stable, less expensive energy source that could be readily incorporated into existing infrastructure, requiring no capital expense for retrofitting.

Moreover, the E.U. recently capped aviation emissions in Europe and instituted an emissions trading scheme that applies to all airlines that fly to any European destination, including U.S. airlines. As a result, U.S. airlines must now incorporate the implications of this law into their business models—and hence seriously consider alternative fuel possibilities. Indeed, companies need to start using a double-bottom-line approach that evaluates not only economic costs and benefits but also environmental costs and benefits when making business and investment decisions.

STEP THREE: CHANGING THE BUSINESS MODEL AND METRICS

The final piece is the responsibility of the airlines themselves. High oil prices, cutthroat competition, and damage to the industry from global events such as 9/11 and threats such as SARS have made it difficult for U.S. airlines to thrive and survive. But they still have the power to master, or at least shape, their future. First, airlines must take an objective, data-driven look at their business models and cost structures, challenge existing assumptions, and provide CEOs and program managers with the analysis they need to take decisive, innovative, and informed action.

One measurement whose validity should be actively questioned is the ubiquitous metric of the airline industry, cost per available seat mile (CASM). Although it is an interesting data point, CASM is not the most relevant gauge for determining the success of an airline's business model because it focuses solely on the cost of supply and not on demand. We believe that a better metric would be cost per passenger seat mile, which would calculate the expense of operating the seats that travelers are actually willing to purchase.

Examining operating costs through the prism of demand, and augmenting that data with CASM, would reveal the routes and schedules, types of travelers, and overall markets worth serving, as well as what types of aircraft to put into service. One result of this approach could very well be a rethinking of the hub-and-spoke business model, a sharp rejection of the status quo that could produce vastly improved results for the struggling airline industry.

DON'T WAIT, GET STARTED

For better or worse, volatile oil prices will force the aerospace industry to reevaluate much concerning how it does business, how it creates a sustainable competitive advantage, and how it measures and prioritizes investments. The greatest impediment to change, however, is often that the problem seems too large, too incomprehensible to fully grasp. But inaction is the enemy. Waiting for a 100 percent solution is futile at worst and nebulous at best. A 50 percent solution that can be 100 percent implemented may be the best answer for airlines at this point.

Moreover, airlines that sit back until the "perfect" solution comes along forfeit the initiative to other industry players whose contributions are needed. Instead, management should concern itself with those things that are within its control. Airline executives need not, and should not, worry about cutting down the tree in one stroke; they need only to keep chopping wood. The cumulative effect of a thousand ax strokes—a thousand productive swings of the ax—will fell the tree.

The most recent list of our office addresses and telephone numbers can be found on our website, **www.booz.com**

Worldwide Offices

Asia
Beijing
Hong Kong
Mumbai
Seoul
Shanghai
Taipei
Tokyo

Australia, New Zealand & Southeast Asia
Adelaide
Auckland
Bangkok
Brisbane
Canberra
Jakarta
Kuala Lumpur
Melbourne
Sydney

Europe
Amsterdam
Berlin
Copenhagen
Dublin
Düsseldorf
Frankfurt
Helsinki
London
Madrid
Milan
Moscow
Munich
Oslo
Paris
Rome
Stockholm
Stuttgart
Vienna
Warsaw
Zurich

Middle East
Abu Dhabi
Beirut
Cairo
Dubai
Riyadh

North America
Atlanta
Chicago
Cleveland
Dallas
Detroit
Florham Park
Houston
Los Angeles
McLean
Mexico City
New York City
Parsippany
San Francisco

South America
Buenos Aires
Rio de Janeiro
Santiago
São Paulo

Booz & Company is a leading global management consulting firm, helping the world's top businesses, governments, and organizations.

Our founder, Edwin Booz, defined the profession when he established the first management consulting firm in 1914.

Today, with more than 3,300 people in 58 offices around the world, we bring foresight and knowledge, deep functional expertise, and a practical approach to building capabilities and delivering real impact. We work closely with our clients to create and deliver essential advantage.

For our management magazine *strategy+business*, visit www.strategy-business.com.

Visit www.booz.com to learn more about Booz & Company.

Printed in USA