

A vintage-style map of East Asia, showing Japan, Korea, and parts of China. The map is overlaid with a stylized illustration of bamboo leaves. The text 'Japan's Green Machine' is prominently displayed in the lower half of the image.

Japan's Green Machine

Among the world's carriers that are serious about improving their environmental performance, Japan Airlines takes a multitude of sustainable actions.

■ By Phil Johnson | Ascend Staff

During an era when environmental and greater sustainability issues have evolved into top priorities — both in the public mind and in the corporate boardroom — certain companies in various industries have taken it upon themselves to become environmental leaders.

These companies are boldly asserting themselves in all things sustainable, to the extent that some of these environmentally conscientious companies have established the credibility to help set the standards for the environmental discussion, at least within their individual industry.

In the global airline industry today, perhaps no carrier more thoroughly exemplifies what it means to be an advocate of “green” practices and technologies than Japan Airlines. In fact, the carrier’s management team has made clear its stance that even though the airline industry has a critical, positive part in bringing people from around the world together for business, pleasure and cultural exchange, JAL also understands the potentially detrimental impact that air transport business operations can have on the global environment.

And regardless of the necessity of every business to forge ahead during this period of worldwide economic slowdown, JAL nonetheless also maintains 100 percent commitment to its obligations in relation to sustainability and the environment.

The International Air Transport Association has estimated that the global airline industry is responsible for generating up to 3 percent of the current total man-made segment of climate change and that by 2050, there’s a possibility that the airline industry’s share of man-made climate-change responsibility could grow to as much as 5 percent.

Just in terms of carbon dioxide — strongly suspected of being one of the key culprits that may be causing measurable levels of global warming — aviation is estimated to be responsible for up to 2 percent of current worldwide CO₂ emissions.

By industry (based on 2005 figures), transportation accounts for 20 percent of all CO₂ emissions in Japan, and looking solely at the airline industry, flights on Japan’s domestic routes account for 4 percent of all emissions in the transportation segment and 0.9 percent of all emissions generated by Japanese industries.

“We have to think differently about CO₂ emissions than companies involved in businesses with low CO₂ emissions,” said JAL President and Chief Executive Officer Haruka Nishimatsu. “Irrespective of the level of attention being paid to the environment by the public, at the JAL Group, environmental initiatives must be a core management issue, not a peripheral one.”

So ensuring a healthy and bountiful global environment for future generations is fully acknowledged by JAL’s executives as one of the carrier’s greatest social responsibilities. And for more than 15 years, JAL has been implementing a variety of measures designed to reduce and

offset the impact its business activities have on the environment.

Compared with 1990 levels, the JAL Group has a goal to cut fuel consumption (and, therefore, CO₂ emissions) by 20 percent in terms of transported capacity by fiscal year 2010. To date (since 1990), JAL has achieved a 16 percent reduction in fuel consumption in terms of transported capacity.

JAL’s total CO₂ emissions in fiscal 2007 (the year ended March 31, 2008) totaled 15 million tons, down 0.77 million tons (or 4.9 percent) from the previous fiscal year. For perspective, this reduction by 0.77 million tons is approximately equivalent to the CO₂ annually absorbed by 55 million Japanese cedars.

Management realizes that one of the most significant ways JAL can slim down its environmental footprint is by reducing — or more efficiently using — the fuel that powers its aircraft (the amount of CO₂ emitted is approximately proportionate to the amount of fuel consumed).

For example, on a long-haul international flight from Tokyo to London using a four-engine Boeing 747-400 with 303 passengers onboard, the aircraft’s engines would emit approximately 356 tons of CO₂, whereas using a twin-engine Boeing 777-200ER on the same route, with 12 percent fewer passenger seats, the aircraft’s engines would emit almost 33 percent less CO₂.

JAL has therefore already replaced the Boeing 747-400 with the more fuel-efficient Boeing 777 aircraft on nearly all of its routes from Asia to Europe. And the carrier is now also gradually replacing the 747 aircraft it uses on its routes between Japan and the United States.

Essential, then, to JAL achieving significant CO₂-emission cuts is fleet renewal through the introduction of more-fuel-efficient aircraft equipped with state-of-the-art engines — combined with the retirement of older aircraft. Almost 30 percent of the aircraft in JAL’s fleet have been delivered within the past five years as JAL has retired 90 older-model aircraft.

JAL’s substantial investment in new, more-efficient aircraft continues, as the carrier still has outstanding orders for more than 80 new aircraft, including the advanced Boeing 787 equipped with GENx engines, which are General Electric engines of next-generation-turbofan design, anticipated under normal circumstances to use 20 percent less fuel than today’s comparable aircraft engines.

Nonetheless, JAL is going even further in terms of its fuel-consumption reduction measures. The carrier’s planners have estimated that trimming just 1 kilogram (or about 2.2 pounds) from the weight of each aircraft will cumulatively reduce CO₂ emissions across the JAL fleet by 76 tons a year.

In pursuit of such incremental weight reduction, JAL has been looking at its flight operations from every conceivable angle to find various innovative ways to reduce aircraft weight, even if just by a single gram.

So among other things, JAL has been reducing both the weight and numbers of items onboard its aircraft, including equipment such as galleys, meal carts and trays, and meals and magazines.

Several years ago, JAL introduced lightweight porcelain tableware, which is approxi-



Photo courtesy of JAL

JAL became the first airline to conduct a demonstration flight using a sustainable biofuel, which consisted of a blend of 50 percent biofuel and 50 percent traditional Jet-A fuel in one of the four Pratt & Whitney JT9D engines of a Boeing 747-300 aircraft.

mately 20 percent lighter, for meal service in first and business class. Also, JAL has made in-flight cutlery in economy class — including premium economy — 2 grams lighter per item.

Furthermore, JAL has found it can make an individual aircraft 23 kilograms lighter by reducing, for example, the number of newspapers and magazines carried onboard international flights. Through a combination of various methods, JAL, on one of its typical 777 aircraft, has managed an overall weight reduction of 500 kilograms.

JAL has also reduced the average weight of cargo containers carried onboard its aircraft by 26 kilograms per unit on international routes, and by 14 kilograms per unit on domestic Japanese routes.

Previously, JAL cargo containers have all been made of aluminum alloy, but JAL, in fiscal year 2007, started using Twintex — a new material made of polypropylene and glass fibers — in the side panels of the containers. And JAL plans to steadily update its multipurpose containers on international routes with this material (at this point, more than 10 percent of JAL's containers have been replaced with the new lighter version).

The average number of these containers in the belly of one of JAL's 777-300ER aircraft is 44 (which translates to a total weight reduction, with the new material, of 1,144 kilograms), and in the belly of one of JAL's 747-400 aircraft is 30 (which translates to a total weight reduction, with the new material, of 780 kilograms).

In terms of cargo aircraft, JAL is now operating more of its freighters in bare metal, saving the weight of paint. In 1992, JAL began operating 747 cargo aircraft with unpainted exteriors, helping to reduce weight by approximately 150 to 200 kilograms per aircraft. And during fiscal year 2007, JAL took delivery of three 767-300F aircraft (all of these aircraft arrived and remain unpainted, which in effect reduces their weight by approximately 110 kilograms per aircraft).

By using hot water to regularly clean the jet engines of its large and midsize aircraft, JAL has managed to improve engine performance by approximately 1 percent.

Having cleaned half of its aircraft engines in this manner, JAL estimates its fleet CO₂ emissions have been reduced by about 53,000 tons, which is equivalent to the emissions generated by 980 round trips between Tokyo and Sapporo (a city world-renowned as the host of the 1972 Winter Olympics, located on the northern Japanese island of Hokkaido).

In early 1990, JAL flight crewmembers set up a fuel-efficiency committee to explore ways of flying in a more eco-friendly fashion. This committee has since been reorganized as the operations division team, with several members meeting every two months to discuss how to avoid excessive fuel usage and then communicating the results of these discussions to fellow flight crews.



JAL Capt. Keiji Kobayashi (left), featured with JAL CEO Haruka Nishimatsu, piloted the industry's first demonstration flight using a sustainable biofuel blend in one of the engines of a Boeing 747-300 aircraft.

The team's findings have led, for example, to a decrease in the use of auxiliary power units at the airport, more accurate measurement of fuel loaded onboard, more optimal timing and angle of flap operation, reduced use of reverse-thrust on landing, and turning off one of the four engines on 747 aircraft while taxiing.

APUs onboard the aircraft provide electricity for onboard air conditioning and lighting while the aircraft is on the ground with the main engines disengaged. Since an operating APU consumes between 600 and 700 liters of fuel per hour, JAL pilots try not to start up these power units until shortly before takeoff, and they rely on ground power units at the airport for electricity and air conditioning. APUs generate approximately 1,200 kilograms of CO₂ per hour, compared to 44 kilograms of CO₂ for GPUs.

To work toward greater fuel efficiency, the amount of fuel onboard an aircraft must be accurately measured. At one time, fuel was loaded onboard JAL aircraft in units of 1,000 pounds (around 450 kilograms), but JAL decided to modify the fuel load to 100-pound (45-kilogram) units.

More precise measures of the amount of fuel required for safe arrival at each destination has allowed JAL to achieve weight savings of approximately 400 kilograms per flight.

In addition, JAL is committed to recycling every possible item, from aluminum cans and

paper to old uniforms. The carrier has even adopted a green procurement policy. For example, it now only uses in-flight chopsticks that are made from certifiable Japanese wood obtained through domestic forest-thinning procedures.

The bulk of paper onboard JAL's aircraft is generally accounted for among the magazines offered to passengers, including *Skyward*, JAL's in-flight magazine, and *JEN Guide*, JAL's in-flight-entertainment guide. Each month, JAL crews remove the old copies from all aircraft and replace them with new copies.

Years ago, such waste was generally either burned or transported to landfills. In 2004, however, JAL at Narita, Kansai, Haneda and Fukuoka airports created special project teams to address this issue. And as a result, the airline introduced new storage carts that make it easier to collect magazines within the limited space of the aircraft cabin. Today, these airports recycle about 600 tons of magazines each year — almost equivalent to the maximum takeoff weight of two 777-200ER aircraft.

JAL executives have expressed interest in exploring ways to reduce reliance on conventional fuels, which would again contribute to an overall reduction of CO₂ emissions.

In partnership with Boeing, Pratt & Whitney, and Honeywell's universal oil products (a refining technology developer), JAL was the first carrier to conduct a demonstration flight using a sustainable biofuel refined primarily from

camelina, an energy crop. This also represented the first biofuel demo by an Asian carrier as well as the first biofuel demo using Pratt & Whitney aircraft engines.

The demo flight effectively brings the airline industry closer to finding a commercially viable second-generation biofuel that could help reduce the impact of carbon dioxide emissions generated by aviation, while also reducing the industry's reliance on traditional petroleum-based fuels. The test conducted on Jan. 30 involved a blend of 50 percent biofuel and 50 percent traditional Jet-A (kerosene) fuel in one of the four Pratt & Whitney JT9D engines of a JAL-owned Boeing 747-300 aircraft.

The biofuel component was a mixture of three second-generation biofuel feedstocks: camelina (84 percent), jatropha (less than 16 percent) and algae (less than 1 percent). JAL, Boeing, Pratt & Whitney, and Honeywell's UOP have committed to the use of second-generation biofuel feedstocks that represent more efficient and sustainable energy than their first-generation predecessors.

Second-generation biofuel feedstocks, such as camelina, jatropha and algae, do not compete with natural food or water resources and do not contribute to detrimental environmental activity such as deforestation.

The fuel for the JAL demo flight was successfully converted from plant-based oil to biofuel by Honeywell's UOP, using proprietary hydro-processing technology to complete the fuel conversion. To create the 50 percent blend, the biofuel was then blended with typical jet fuel.

Subsequent laboratory testing by Boeing, UOP and several independent laboratories verified that the blended biofuel meets industry criteria for jet-fuel performance. Ground-based jet-engine performance testing by Pratt & Whitney of similar fuels further established that the biofuel blend either meets or exceeds the performance criteria in place for commercial aviation jet fuel today.

At Tokyo's Haneda Airport, JAL Group companies have also been working together with the Japan Civil Aviation Bureau and a group of other companies in testing biodiesel fuel that has been refined from waste tempura oil collected from restaurants.

As part of the trials, JAL has tested the novel fuel in one of its tug vehicles, which is most commonly used to transport heavy loads around the airport and for baggage transportation. In using a 50/50 mixture of light oil and biodiesel fuel, no modification of the tug was necessary.

Being a member of a global airline industry has also enabled JAL to play some unique roles in fostering environmental improvement. Because forests theoretically mitigate the effects of such challenges as global warming by absorbing CO₂ emitted through the burning of fossil fuels, JAL has supported the Boreal Forest Fire Control Initiative and other similar projects.

With the overall aim of preventing or at least effectively containing wildfires through early

detection, information gathering and analysis, JAL's pilots flying over vast open regions including Indonesia, Siberia and Alaska have been reporting any fire outbreaks they happen to spot, with more than 700 blazes reported in the past six years.

Since 1993, JAL has also been participating in a global-warming observation project, monitoring greenhouse gases in the upper atmosphere using specially fitted air-sample-collection and -measuring equipment. The program now involves five JAL aircraft on international routes, measuring the CO₂ concentration in the upper atmosphere.

The data collected using JAL aircraft are helping scientists study and better understand the causes and effects of measurable increments in global warming and overall climate change.

And beyond JAL's own regular air transportation activities, the carrier has been supporting the Japanese government's energy-saving "Team Minus 6 Percent" initiative by reducing levels of office heating during the winter and office cooling during the summer, cutting CO₂ emissions at JAL's offices in Japan by more than 10 percent during the last five years.

Also in support of the campaign, JAL has shown a Team Minus 6 Percent public-information video on its domestic flights, making a sincere appeal to members of the general public to consider ways they use energy in their everyday lives and encouraging them to economically use and conserve energy in every way possible.

As company policy, JAL is also applying innovative flying and routing techniques including tailored arrival and user-preferred route to allow its aircraft to arrive at their destinations while using the least amount of fuel and producing the fewest CO₂ emissions in the process.

Additionally, JAL has instituted a voluntary customer carbon-offset program, enabling its passengers to purchase credits that are spent specifically on environmental procedures that effectively offset passengers' individual measures of carbon generation during that particular trip.

Furthermore, JAL's commitment to finding and eventually introducing biofuel alternatives to conventional fossil fuels in its aircraft and ground vehicles represents a trailblazing effort for commercial aviation, essentially helping make commercial aviation the first global-transport sector to place verifiable sustainability practices in its fuel-supply chain.

All of these and more measures are key elements of JAL's equation to do its part in helping substantially improve the global environment.

"As a symbol of our commitment to the environment, we operate an airplane with a green tail — and all employees are sharing in the effort to accelerate and carry out specific environmental activities," Nishimatsu said.

In the actions of its top executives and others throughout the organization, the JAL Group has exhibited a level of determination that may even be unique in worldwide corporate business circles to seriously combat the possible long-term detrimental effects of potentially harmful emissions and to leave a much more healthful environment as a genuine legacy to future generations. **F**

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Photo courtesy of Boeing

As part of its environmental sustainability strategy, JAL continues investing in new, more-efficient aircraft, such as the Boeing 787, which under normal conditions is estimated to burn 20 percent less fuel than current comparable aircraft.