Europe’s ETS raises more questions than answers

by Jennifer Harrington-Snell

Support for the EU’s emissions trading scheme (ETS) doubled year-over-year this past year, leaving operators on both sides of the Atlantic questioning the viability of the industry’s continued participation. The situation became so precarious, in fact, that in May the European Business Aviation Association (EBAA) wrote to the director of a “means” and threatened to advise its members to withdraw support. In spite of some positive developments in recent weeks, some operators—particularly those in the U.S.—are beginning to wonder if non-compliance is an option.

The chief complaint among operators is that the directive favors the airlines and business aviation—especially small, private operators—at a disadvantage. A particular bone of contention is the exemption thresholds all non-commercial operators must meet, even if they emit as little as one ton of CO2 per year in an EU airspace. Commercial operators, meanwhile, are exempt from the reporting process if they emit less than 10,000 tons of CO2 annually (or fewer than 243 flights in three consecutive four-month periods).

Unfortunately, it’s unlikely that non-commercial operators will be given an exemption anytime soon, according to EBAA president and CEO Brian Humphries. A change in the status of non-commercial operators would require support from each of the EU’s member states to change the “mother” directive. “One only hopes that the member states will become as up spending 80 percent of their time looking for money in free allowances,” Hartley said. “In my opinion, that’s one of the most important lessons we can extract from the ETS.”

There is some speculation that the EU might now propose a new carbon tax as a measure equivalent to the ETS, thereby giving the operators who purchase a means of exemption. The ETS regulations recognize other nations’ approaches to environmental mitigation, Brown said. “If the European Commission views something that has been done in the U.S. as an equivalent approach, in theory it could decide that doesn’t actually change anything, it would be a victory for operators in the U.S., many of whom believe the ETS violates international law, the jurisdiction of ICAO and the principles set forth at the Chicago Convention.”

The UK courts decided the complaint had enough merit and was really a community-wide complaint, said Steve Brown, NBAA’s senior vice president of operations and administration. “So it’s been elevated and will be acted on at some point.”

In the U.S., the FAA is considering a “Cash for Carbon” program, in which the administration would set aside up to $6.5 billion over four years to help commercial and GA operators voluntarily commit to carbon neutral growth (from 2020 onward). The money would fund ADS-B/NTC, RNP and RNP avionics equipment, airspace redesigns projects, and the FAA’s Clean (continuum lower energy, emissions and noise) research project. If the operators do not underwrite the costs under the ETS, they might consider using their carbon allowances for free. “It’s possible, therefore, that the ETS would not apply,” Brown said. “It’s even unclear to what extent the legislation will affect transportation as a whole. It’s so early in the discussion, it could go either way.”

Given these developments, operators in the U.S. know there are a number of potential outcomes regarding the ETS. First, the ETSs will go into effect in 2012, and U.S. operators would be forced to comply. “This as a whole. It’s so early in the discussion, it could go either way.”

There is some speculation that the U.S. passes legislation that Europe views as an equivalent approach. “In that case, the ETS would not apply,” Brown said. “But the legal challenges currently in the European Court of Justice are successful, and the ETS will be illegal in the context of the Chicago Convention and international aviation rules.”

Operators are following the challenges and national legislations to see what happens over the next year-and-a-half. “Given that the aviation industry recognizes the value in reducing its impact on the environment, that coupled with the reality there always has to be a cost, both on the environment and the point of view people have the aviation industry wants to have minimal impact on the environment, but whatever is done is to account for that should be cost effective. There’s broad open on whether the ETS will be required and what that will look like.”

The Cost of Compliance

One of the biggest frustrations for operators in the U.S. and Europe is the question of cost. “The carbon credit market is currently seen as a young and immature market,” Brown said. “It hasn’t been around for a long time, and prices have varied quite a lot in the time it has been open. So now knowing what the price of a credit might be in 2012 is pretty speculative; it’s difficult to estimate what the cost might be.”

It’s a good question, but nobody really knows the answer.

Although the cost of the actual carbon credits in question, operators are already looking at the price of the administrative costs. “The U.K. for example, charges £750 ($1,185) to submit the original MBV plan, as well as Continuous at next page

Business Aviation & the environment

There is no silver bullet for reducing the effect of business aviation on the environment, most industry analysts agree, but the combination of new technology—such as engines and airframe components—improved ATC techniques and biofuels promises to dramatically reduce business aviation’s carbon footprint. Governments have entire departments that spend 80 percent of their time looking for money in free allowances. “It’s not as big as we would like, but it is higher than 0.00;” Humphries said. “That’s quite realistic.”

Airlines and freight companies could get as much as 87 percent of their carbon allowance for free, according to Hartley. “The best estimate for business aviation is 15 to 20 percent, if you’re flying into Europe only once a year, you’ll never have to buy allowance to make up even the minor application for [for the free allowances],” Hartley said. “In my view, we are always going to come out as losers.”

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The benefits of implementing NextGen and its European counterpart, the Single European Sky ATM Research (Sesar), are threefold: not only will the new procedures and technologies improve safety and efficiency, but they will also yield environmental benefits. The ultimate goal is to increase air space capacity while reducing fuel burn, emissions and noise.

To that end, the FAA is “moving forward aggressively,” according to Michael Romanowski, director of NextGen integration and implementation. “The infrastructure is starting to emerge, and we’re seeing a lot of success with early operational demonstrations and deployments.”

The operators involved in transoceanic “gate-to-gate” demonstrations of NextGen capabilities (oceanic trajectory-based operations) are saving significant amounts of fuel, for example. “We’re routinely seeing 2- to 3-percent fuel savings per flight,” Romanowski said. “On the Atlantic side, we’ve saved two tons of CO₂ per flight. And by saving fuel, you’re reducing your environmental impact and seeing a reduction in carbon emissions.”

The demonstrations involve not only the FAA and various operators, including American Airlines, Air France, Lufthansa, Qantas and Singapore Airlines, among others, but they also require independent, third-party verifiers. “Some operators have decided to seek help from outside companies, such as ETS Aviation. Carlisle’s company provides administration support, accurate emissions tracking, report submissions and so on and charges fees based on the number of aircraft or flights. A small company might pay $2,500 to $3,500 per year for the service, while a medium-sized company with 30 aircraft might pay $500 per aircraft, or $1,000 flights. The per-aircraft fee is reduced as the size of the operation increases.”

One of the most significant runway closed, the airport did not experience delays.”

Europe’s ETS raises questions

“Gate-to-gate” navigation actually begins long before an aircraft leaves the departure gate or begins to taxi. “The FAA is putting a lot of emphasis on being able to make decisions early,” said Bruce Carmichael, director of the aviation applications program at the National Center for Atmospheric Research (NCAR). “In fact, it would really like to begin many of the traffic management and flight planning exercises as much as 24 hours ahead of time.”

Using NextGen technologies and procedures, such as collaborative departure management (CDM), NextGen airports will be able to coordinate traffic on the ground, thereby eliminating taxi-related delays and ground holds. ASDE-X is a satellite-based surveillance tracking system that gives air traffic controllers an enhanced view of ground traffic, presented as a color display on a map of the airport. It is scheduled for deployment at 35 U.S. airports by year-end.

Traffic Coordination

CDM, meanwhile, involves collaborative decision making by controllers, operators, airport officials and the FAA, among others, based on common knowledge of the activity on the ground. The concept proved successful during initial demonstration work in Memphis. “Just by sharing information with the operators, and helping them understand what’s happening on the ground, they can save 1.5 to 4.5 minutes per flight per aircraft,” Romanowski said. “You start seeing dramatic savings in fuel burn and emissions.”

This past summer, the Port Authority of New York and New Jersey established a CDM command center to manage aircraft flow at JFK while the airport’s main 14,572-foot runway was closed for repairs between March and June.

“In the past, it was not uncommon to see 40 to 60 aircraft lining up for departure,” Romanowski said. “Using CDM, controllers were able to keep a constant stream of eight to 10 aircraft at the end of the runway. Even with the most significant runway closure, the airport did not experience delays.”

From an environmental standpoint, the experiment was a success: “The Port Authority is estimating that operators are saving five million gallons of fuel per year at JFK,” Romanowski said. “It has fundamentally changed how it operates the airport.”

In terms of the actual departure, more airports will be using Rnav departures. “With the level of precision they provide, Rnav departures allow us to use runway capacity much more efficiently,” Romanowski said, adding that Rnav departures have been in place at Dallas/Fort Worth for a number of years. “We’ve seen a 45-percent delay reduction using Rnav departures. And they save in terms of efficiency and fuel burn, in the amount of $30 million.”

Following taxi and takeoff, aircraft will be able to take advantage of NextGen concepts for climb-out and cruise. “The idea with climb and cruise is to be able to do it in a way that’s the most fuel efficient for the aircraft,” Carmichael said. “To do that requires that all the trajectories for all the aircraft fit together like a jigsaw puzzle.”

The system we use today is too reactive, Carmichael said. “It is based on a large number of asynchronous events that happen independently. We work out the problems when we run into them. We’re trying to move away from that, to a more synchronized operation where the pieces of the puzzle fit together just so.”

Carmichael also said that the FAA will make use of technologies such as automatic dependent surveillance-broadcast (ADS-B) and the traffic management advisor (TMA). Coverage will be nationwide in 2013.

Satellite-based procedures, such as Rnav, can also be used for arrivals. The procedures are being used at Dallas/Fort Worth and Phoenix Sky Harbor International Airport, Romanowski said. “With Rnav arrivals, we’re seeing 900,000 gallons of fuel per year saved and 6,700 tons of carbon. And this is just using it part-time [in Dallas].” Phoenix saw a reduction in carbon emissions, estimated at 2,500 tons annually.

Tailored arrivals, in which aircraft use optimized descent paths, are also saving large quantities of fuel. “We’ve done demonstration flights in San Francisco, Los Angeles and Miami, the procedure saved between 100 and 300 gallons of fuel per flight, Romanowski said, adding that the procedure will be operational next year.

The Key to NextGen

Implementing NextGen will also require a change in the way things are currently run, from a human-centered operation to one that is automated and almost completely reliant on technology. “That is an ambitious idea,” Carmichael said. “It’s not going to be done without a huge culture change, and that’s the biggest single impediment to NextGen.”

Implementing NextGen promises environmental rewards: “Not only will NextGen save 700,000 gallons of fuel per flight, Romanowski said, adding that the procedure will be operational next year.

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Turbofan manufacturers continue ‘green’ efforts

by Kirby J. Harrison

Turbofan manufacturers are developing cleaner, quieter and more environmentally friendly engines that will meet current and future regulatory requirements. That fact should come as no surprise, since they have been doing this all along as the natural byproduct of efforts to build more fuel-efficient and quieter turbofans for a market that demands nothing less. And they were doing so long before government agencies and environmental watchdog groups began taking such an interest in aircraft propulsion.

“We’ve been reducing emissions and increasing turbine efficiency for twenty-five years,” said Walter Di Bartolomeo, v-p of engineering for Pratt & Whitney Canada.

These days, there is the additional motivation provided by a flurry of regulations coming from government agencies in the U.S. and abroad, from the EU Emissions Trading Scheme to the so-called cap-and-trade proposal in the U.S. Not to mention aircraft noise level restrictions set by the FAA, ICAO and thousands of local municipalities. And there are public groups such as the Government Accountability Project, which has criticized the FAA for “intention to greenhouse emissions,” warning of the “harmful effects on the future of U.S. aviation if action is not taken.”

As a result, manufacturers are spending billions of dollars on research and development projects to create more reliable and efficient engines that will reduce both GHG (greenhouse gas) emissions and noise. The technology advances include everything from improved fan, core and exhaust-nozzle designs to composite materials.

This summer, GE Aviation was one of many engine manufacturers that received an award open-rotor technology and flight management and air traffic management systems. The Taps II lean-burn/low emissions combustor is at the center of GE’s eCore hot section, and the company began testing it in June 2009. It will be at the heart of partner CFM International’s Leap-X engine for single-aisle aircraft as well as the company’s next generation of regional and business jet engines. CFM started running phase one of the eCore demonstrator on schedule last year, and phase two was completed this year. Testing of the eCore demonstrator two with the 10-stage compressor and two-stage turbine is scheduled to begin next year. “This is a core that ‘wants’ to run,” said a CFM spokesperson. She added that the result will be an engine that produces a ground noise footprint 75 percent smaller than a comparable current-production engine, keeping noise within the confines of the airport.

GE expects the new core will provide up to 16 percent better fuel efficiency than the best it has in service today. General Electric’s new GENx engine program will produce a turbofan for widebody aircraft and features the latest in carbon-fiber composite materials in both the fan blades and fan case. Their use in the fan case alone will reduce the engine weight by 300 pounds. With such improvements as a 23:1 pressure ratio, pre-mix nested fuel nozzles, four fewer stages and 30 percent fewer parts, the engine is expected to produce emissions 95 percent below current requirements and 15 percent better fuel consumption.

GE began experimenting with the open rotor, or unducted fan, design in the 1980s, when the price of fuel was climbing. Like other open-rotor programs, it was put on a back bench when the price of fuel fell. But with growing emphasis on fuel efficiency and greenness, these programs have seen a revival in recent years.

By applying advanced data acquisition systems and computational design tools, GE now believes it has improved the design to reduce fuel consumption by 26 percent (compared with current turbofans) and address the problem of noise inherent in the open rotor. The program also has GE engineers and designers evaluating the open rotor for the Leap-X engine.

GE and CFM are calling Leap-X the “power of the future.” Test results are matching what GE said are “aggressive” targets set by CFM. Endurance testing on the full-scale Leap-X RTM demonstrator, a Sneumo proprietary technology, began this summer and certification is expected in 2014.

The fan and casing will be built of composite materials. The fan’s larger, 3-D woven transfer molding blades will allow much greater efficiency than the CFM56, and the engine will weigh some 500 pounds less than a comparable powerplant with metal fans and casing. It will run on 15 percent less fuel and emit 16 percent less CO2 compared with today’s most fuel-efficient CFM56.

Meanwhile, testing continues on the GE Honda HF120 turbofan that powers the new HondaJet. Features include advanced airfoils, materials and coatings; a high-temperature, reverse-flow combustor configuration; single-stage air-blast fuel nozzles; titanium impeller in the compressor; two-stage, low-pressure turbine; and counter-rotating high-pressure and low-pressure shaft system.

Cost of ownership is key, according to Honda, which is aiming for 5,000 hours between major overhauls.

Honeywell is flight testing improvements to its HTF7000, in pursuit of a lighter-weight engine and reduced fuel burn.

Honeywell will also incorporate technology from its Saber 1 engine improvement program into HTF7000 production engines, and those same improvements will appear in the new HTF7250G and HTF7500. Certification tests are under way for the updated HTF7000.

According to Honeywell v-p of propulsion systems Ron Rich, the Saber 1 technology will meet all ICAO standards, with a 25-percent reduction in NOx (nitrogen oxides) emissions. The company has also launched Saber 2, which is expected to reduce NOx emissions by another 25 percent. The new Tech 7000 technology demonstrator makes use of a fleet of HTF7250s to develop Saber 2 as well as make other improvements “in a relevant environment.” Full component-level testing has already begun and combustion systems are running. “We’ll move toward engine testing near the end of 2010 or early 2011,” said Rich.

The improvements will include the fan, compressor and turbines. Among the goals for Saber 2 are better power-to-weight ratio, a smaller core to reduce engine weight, and a higher pressure ratio for improved fuel burn.

MTU Plans Green Lead with Geared Turbofan

German engine manufacturer MTU Aero Engines has been making much of a geared turbofan, with its Claire (clean air engine) technology leading the way. The aim is to cut CO2 emissions by 20 percent by 2035, and at the Paris Air Show last year MTU was exhibiting a geared turbofan mockup. The first steps are being taken under the umbrella of the European Commission’s Clean Sky joint technology initiative. MTU continues on page 28.

Honeywell Investing Heavily

Honeywell’s HTF7000 fleet recently surpassed 700,000 total hours, and the company continues to make improvements in the line. The HTF7500 that will power Embraer’s new Legacy 450 and Legacy 500 has completed design review and core testing. Engine tests began this summer and certification is expected next year.

As and Gulfstream ramps up for production of its G250, Honeywell is increasing deliveries of its new HTF7250G to the Sa-
Engine makers’ green efforts

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is investing some $27 million in the project and industry partners such as Avio and Volvo Aero are adding another $40 million.

The Claire project will use an existing geared turbofan, focusing on the high-pressure compressor and high-speed low-pressure turbine. Designers expect to reduce the length and weight of the turbine, while improving efficiency by way of the new low-pressure turbine, first-stage concept. The initial target is a 15-percent reduction in fuel burn.

The second step is to combine a two-stage counter-rotating fan with the geared concept, targeting a fuel burn reduction of 20 percent by 2025. The third is implementation of an interconnected recuperative aero-engine concept in which exhaust nozzle heat is used to increase the temperature of the air entering the compressor.

MTU is also a partner in Pratt & Whitney’s PW1000G program. The engine from that program is expected to power the Mitsubishi regional jet and Bombardier’s C Series regional jet.

Pratt & Whitney ‘Changes Everything’

At the Farnborough airshow in July, Pratt & Whitney was promoting its PurePower engine core, saying, “This changes everything.” According to Bob Sala, v-p of the next generation product family, “This advanced core contains many key technologies contributing to the lower engine operating cost of the PW1000G.” Current tests are confirming expectations.

The PurePower PW1000G features gearing that allows the fan to operate at lower speeds than the low-pressure compressor and turbine. The combination of the gear system and advanced core, reported P&W, “delivers double-digit improvements in fuel efficiency and emissions with a 50-percent reduction in noise over today’s engines.” Entry into service is scheduled for 2013.

P&W is in the midst of a five-year program during which it expects to spend approximately $1.5 billion in research and development.

The engine manufacturer claims to be the leader in developing low-emission technology, primarily through its Talon (technology affordable low Nox) combustion design. According to Pratt & Whitney Canada, it makes the PW307 “the greenest engine in its market,” with an emissions reduction of 33 percent relative to ICAO standards.

The Talon 2 combustor technology also meets Zurich 5 requirements for avoiding emissions surcharges. It also surpasses ICAO environmental standards by more than 35 percent for CO2 and by more than 50 percent for NOX emissions, unburned hydrocarbons and smoke.

Rolls-Royce E3E Core at the Center

Rolls-Royce announced in July that it has successfully run the latest E3E (efficiency, environment, economy) core engine as part of its two-shaft research. The program is intended to develop future powerplants for business jets and single-aisle airliners.

The latest core-build produced “excellent results” during 40 hours of run trials at Stuttgart University’s altitude test facility, exceeding the flight-envelope requirements, according to the company.

Rolls-Royce said E3E is developing “leading-edge technologies” that increase engine temperature, pressure ratio and component efficiencies, combined with a 25-percent increase in thrust-to-weight ratio.

Other goals include a 15-percent reduction in fuel burn as well as CO2 emissions, along with a 60-percent reduction in NOX emissions.

Specific technologies used on the E3E core include a two-stage shroudless high-pressure turbine; tip clearance control system with advanced ceramic abradable linings; lean-burn combustion; blisked high-pressure compressor air system for bearing-load management; and improved cooling using carbon oil seal and brush-seal air sealing technologies.

The nine-stage blisked high-pressure compressor has thus far demonstrated a 22:1 pressure ratio. More cores are to be tested over the next two years and the program calls for 1,200 cycles of max-takeoff-power endurance testing.

Snecma Continues Silvercrest Development

Despite still lacking a launch customer, Snecma of France continues to develop its Silvercrest business jet engine.

The plan is to build the powerplant in versions developing between 6,500 and 12,000 pounds of thrust to power large-cabin business jets and single-aisle bizliners such as the A319. In addition to better performance in climb and cruise, the Silvercrest is expected to be “environmentally friendly, with low levels of both noise and [GHG] emissions.”

Snecma believes the direct-flow engine, 74 inches long, will yield lower emissions. In fact, the company expects emissions will be 50 percent lower than ICAO CAEP6 standards. In addition, fuel consumption is expected to be 15 percent better than other engines in that class.

Williams International Plays It Close

Williams International, which traditionally plays its research and development cards close to the vest, says it has been improving engine efficiency by about one percent per year on the FJ44 since the FJ44-1A went into production in 1998.

“Our engines have a good combination of low NOX and low CO2,” said v-p of business development Matt Huff. “And all our engines fall into the zero emissions surcharges category for the Zurich model.”

The FJ44-4 was certified in February for Cessna’s new CJ4, and the FJ44-3AP is in the certification process, earmarked for Hawker Beechcraft’s Premier II, the Nextant re-engined Diamond/Beechjet 400 and the PiperJet single.

Also going through certification is the FJ33-5, intended for the Cirrus Vision and Diamond D-jet.

While engine manufacturers are rapidly developing new technology in search of leaner, cleaner and quieter turbofans, hardware is not the only focus in the quest to provide power that is more efficient for customers and more environmentally friendly for government agencies and public watchdog groups.

Alternative fuels are also under examination (see story on page 30), as are changes to the processes that control air traffic aloft and on the ground (see story on page 24).

Since none of these is the elusive silver bullet, the solution will...
The alternative aviation fuel industry continues to conduct flight tests to validate the use of new jet-fuel blends. At the end of April, United Airlines became the first U.S. commercial carrier to fly using a certified synthetic-fuel blend that received ASTM approval last year. The 40:60 mix powered one of the engines on an Airbus A319 in an engineering qualification flight that departed Denver International Airport and reached an altitude of 39,000 feet. The drop-in fuel, supplied by Los Angeles-based producer Rentec, was derived from natural gas and converted to liquid through the Fischer-Tropsch process.

“Building 10 billion gallons of [alternative aviation fuel] capacity can take a while,” said Lane. “The entire biofuels industry by comparison has around 30 billion gallons of capacity worldwide and that’s taken most of 25 years to build.”

Even when the alternative fuels arrive in quantity it might take some time before they find their way into the tanks of business aircraft. As production increases, the price for alternative fuels will presumably drop to the range of standard jet fuel, but until then, much of the supply will be used by the military and by commercial carriers.

At the end of last year, potential large-scale alternative fuel providers Rentech and AltAir Fuels announced they had signed non-binding agreements with numerous airlines to provide hundreds of millions of gallons of renewable jet fuels starting in 2012. In March the Air Transport Association (ATA) and the U.S. Department of Defense announced a strategic alliance. The joining of the world’s two largest consumers of jet fuel—the order of 1.5 million barrels a day—was aimed at spurring the growth of the alternative fuel market, as well as leveraging efforts and research between the two groups.

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Based on its tremendous thirst for jet fuel, the alliance is expected to have a large impact. “If it weren’t for the airlines and the military thinking that they are willing to buy fuel in advance of it actually being produced, then I don’t think there is any hope for these things to move forward right now,” said Holmgren.

Report continues on page 32
EPA begins ruling process to phase out leaded avgas

by Curt Epstein

With the deadline for the comment period on the Environmental Protection Agency’s advanced notice of proposed rulemaking (ANPRM) to phase out leaded avgas having just passed, many in the industry remain galvanized for possible effects of the proposed mandate.

The EPA published the ANPRM at the end of April, stating its intention to determine whether emissions from aircraft using leaded aviation gasoline (avgas) cause or contribute to air pollution, which can endanger public health. While the Industry Avgas Coalition, a group consisting of aviation associations such as NBAA, AOPA and NATA, along with petroleum industry representatives asked the agency to extend the deadline to the end of October, the EPA settled on August 27.

The 107-page ANPRM was issued in further response to a 2006 petition submitted by the environmental activist group Friends of the Earth titled “Petition for Rulemaking Seeking the Regulation of Lead Emissions from General Aviation Aircraft Under § 231 of the Clean Air Act.” Section 231 of the Clean Air Act establishes the EPA’s authority to regulate aircraft emissions of air pollution.

The most recent revision of the National Ambient Air Quality Standard, formulated in 2008, found that serious health effects could result from much lower levels of lead than previously believed. The standard did not identify a safe level of lead exposure. Under the Clean Air Act, if the EPA administrator determines lead emissions from the use of leaded avgas “cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare,” then the agency would be mandated to establish emissions standards for piston-engine aircraft in conjunction with the FAA. Establishment of such standards would include evaluating the technical feasibility of reducing or eliminating leaded aviation gasoline.

For future aircraft, this could mean a requirement that all newly manufactured general aviation piston engines run on unleaded aviation gasoline some future date. For in-service aircraft, the EPA acknowledges greater technical and logistical hurdles. “In many cases, the implementation of this concept might depend upon efforts and actions of aircraft and engine manufacturers and engine airlines to identify the necessary modifications and developing hardware as necessary,” the agency noted.

According to the General Aviation Manufacturers Association, in 2008 the ranks of U.S. piston-powered aircraft included 144,220 singles and 18,385 twins. “Given the potentially large number of affected aircraft and the potential complexities involved, a program affecting in-use aircraft engines would need careful consideration by both the EPA and FAA, and the two agencies would need to work together in considering any potential program affecting the in-use fleet,” the agency stated.

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Business Aviation & the environment

OEMs embrace more-electric aircraft systems by Thierry Dubois

Business jet manufacturers are quickly gravitating toward more-electric architectures, where electricity replaces hydraulic and mechanical systems that include electricity into its core to allow for greater efficiencies and environmental benefits.

Dassault engineers are studying all-electric architectures Dassault is coordinating more easily.

As a result of the interest in more-electric aircraft, Bombardier tested electric brakes, landing gear or even control-surface actuation.