

# FUTURE OF AVIATION: A QUIETER RIDE

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## EU's single sky ambitions remains grounded by national air traffic jams

Labour actions by French air traffic controllers who oppose longstanding EU plans to overhaul air traffic management demonstrate that efforts to improve aviation efficiency and reduce nuisances in Europe's crowded airspace will not happen easily. EurActiv reports from the Paris Air Show.

With air traffic in the EU expected to grow 50% by 2030, the European Commission has waged an uphill battle to get member states to live up to their agreement to implement the Single European Sky, or SES, to make air traffic control more competitive and replace a network of national systems with regional traffic management.

Most national governments missed a December 2012 deadline to implement a key provision of SES, the creation of functional airspace blocks, or FABs, that are to consolidate national air control into regional operations.

Trade unionists in France and several



*Eurocontrol photo*

other countries who led protests on 11 and 12 June contend the plan will cost jobs and compromise safety.

The aviation industry and environmental groups, however, have formed an unusual alliance to support EU commitments to create FABs on grounds that improved coordination could lead to cleaner, quieter and more punctual air travel.

“Controllers are very conservative,” a French industry official whose business works on SES-related contracts told EurActiv at the Paris Air Show, where aircraft makers and suppliers this week are touting technologies they say reduce noise and pollution. “And for national

governments, there are problems with money and political will.”

### Aviation's traffic cops

Technological developments that have improved aerodynamic design and created quieter engines play a leading role in reducing the environmental footprint of aviation. Yet traffic management has a no less significant role: The traffic cops of airspace can ensure more direct routing and reduce the amount of time airplanes spend over populous areas on their approach to landing.

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Andrew Watt, head of environment at Eurocontrol, the Brussels-based civil-military air traffic management and safety organisation, says “performance can be enhanced from the cross-border perspective in that you are losing the concept of national airspace, not necessarily sovereignty over the airspace, but you start to have cross-border air traffic control.”

“Everyone is trying to make the whole system more efficient to be able to cope with increasing numbers of traffic while improving safety levels even further, to be able to generate the capacity, improve safety and reduce environmental impact per flight,” he said in a telephone interview.

Eurocontrol is working in EU nations and 12 other participating countries to reduce the impact of aviation nuisances like noise through changes in landing patterns, so that aircraft spend less time cruising at lower altitudes before they land. The approach from higher altitudes reduces fuel consumption and means people living along flight paths are exposed to less noise since aircraft remain at higher altitudes longer.

Deeper coordination could also allow more direct routing. Airlines say their passengers would benefit from reduced travel times and while the aircraft themselves would spend less time in the air burning jet fuel. The European

Commission estimates that the lack of regionalised traffic management adds 42 kilometres to the typical flight.

## Industry vs. unions

The Association of European Airlines, a Brussels-based industry group, said delays in the Single European Sky cost companies €14 million per day in higher fuel costs and contribute to higher carbon emissions, which the industry is obliged to reduce.

The amount is not insignificant in an industry struggling to remain profitable. European airlines have been among the hardest hit financially in recent years, with revenues trailing the global average. The International Air Transport Association estimates that net profits for European airlines will top \$1.6 billion (€1.2 billion) in 2013, compared to \$4.4 billion in North American and \$4.6 billion for carriers in the Asia-Pacific region.

As the French controllers went on strike, causing flight delays and cancellations across Europe, European Commission Vice President Siim Kallas renewed calls for EU countries to live up to their obligation under a 2009 agreement to incorporate national control operations into nine FABs.

Kallas, the commissioner in charge of transport, has repeatedly lashed out at

governments for failing to act and called for an update to the SES, known as SES2+. The proposal came six months after the commissioner conceded that ambitious plans to consolidate national air traffic control into a regionalised system were being hampered by national inaction despite years of planning.

“Our airlines and their passengers have had to endure more than 10 years of reduced services and missed deadlines on the route to a Single European Sky,” Kallas told a news conference in Brussels.

“We cannot afford to continue this way. Today we are strengthening the nuts and bolts of the system so it can withstand more pressure and deliver ambitious reforms even in difficult economic times,” he said. “We need to boost the competitiveness of the European aviation sector and create more jobs in the airlines and at airports”.

In response, the European Transport Workers’ Federation accused the Commission of trying to put “the economic stability of the sector at risk by introducing competition, liberalisation and more and more market principles.”

The French action was backed by union affiliates in Austria, Belgium, Bulgaria, Czech Republic, Hungary, Italy, Latvia, Portugal, Slovakia and the United Kingdom.

# Copenhagen Airport applies noise lessons to cut air pollution

When trade unionists began raising concerns about the health impact of pollution on airfield ground and service crews, including possible links to cancer, the Copenhagen Airport moved

to restrict aircraft engine use and shift towards greener service vehicles.

The pollution-control efforts at CPH, as Denmark’s main airfield is known by its international location code, mark the first time a European airport has launched a programme specifically aimed at reducing the risks that ultrafine particulate matter emitted from exhaust have on workers who are on the frontline of air services.

Some of the practices have benefitted from lessons learned in reducing another form of aviation pollution – noise.

Copenhagen’s programme also offers long-term potential for reducing

pollutants, greenhouse gas emissions as well as noise pollution at airports across Europe as passenger traffic grows in the years ahead.

“The motivation here is that nobody should get ill or sick from attending their work,” said Jesper A. Jacobsen, a senior environmental project manager for Copenhagen Airports S/A, the partly state-owned company that runs the main international hub at Kastrup, southeast of the capital.

“We are doing this on our own free will because we are concerned about the health implications.”

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## Cleaner air, quieter airports

Techniques for accurate field measurements of ultrafine particulates produced from fuel emissions are relatively new and there are no laws restricting these ground emissions at airports, Jacobsen explained.

But the battle against aviation noise is nothing new. Denmark and other EU states are obliged to control noise under a 2002 regulation that is now being revamped. The updated noise regulation, proposed by the European Commission in December 2011, will reflect advances in engine technologies since the original legislation.

It will also incorporate agreements under the International Civil Aviation Organization (ICAO) to create a “balanced approach” to noise reduction, which calls for the use of quieter aircraft, improved airport planning and operational procedures that cut noise levels in the air as well as around airfields.

Those guidelines overlap with efforts to reduce emissions. New generation engines are 16% more fuel efficient than those in the air today and engines are 75% quieter than those at the dawn of the jet age, according to the European Commission.

### Reducing engine use

CPH has taken steps to improve traffic flow to reduce the time aircraft spend waiting on the runway or taxiing, and placing limits on the use of jet-fuel-run auxiliary power units (APUs), the onboard generators that provide electricity while aircraft are unloading or loading passengers.

“There are quite strict restrictions for the APU usage and they are originally induced by noise, but now we use them for air pollution abatement as well,” Jacobsen told EurActiv in a telephone interview.

“Many of the tasks [are] just common sense. If you are reducing your fuel consumption both in the aircraft and in GSE [ground support equipment] then



*Copenhagen Airport*

you are reducing air pollution and noise pollution as well,” he said.

Copenhagen Airport’s air quality programme was launched in 2010 as a response to trade union concerns linking cancer cases among employees to the air they breathe. Tests showed that airfield workers were consistently exposed to particulate pollution that exceeded the highest levels of Copenhagen’s most congested streets.

Michael Løve, the then-chief operating officer at Copenhagen Airports, referred to the health risks when CPH launched the programme.

“The latest measurements have greatly improved our knowledge of both the amount and the source of the pollution, and the conclusion is clear. We are therefore making a more targeted effort to reduce the amount of particulate matter that our employees are subjected to,” Løve said in a statement.

“No one is prepared to give any specific indications as to the impact of the ultrafine particulate matter, which is one of the explanations of the lack of international threshold values in this area. Research into the health effects may take several years, and we are not prepared to sit back and wait, so we are taking action now.”

The airport’s management, along with trade unions, air traffic controllers

and ground services, all agreed to take steps with benefits for emissions and noise reductions in the short and long term.

### Mixed response

Still, there has been mixed response, partly a result of conservative attitudes in the risk-averse aviation sector. Not all the airlines have embraced the rule despite the potential for fuel savings from reduced motor and generator use, and Jacobsen admitted that some pilots see the rules as a “hassle.”

Managers of other European airports, themselves under pressure to reduce pollution and noise in densely populated urban areas, have taken an interest but are also wary.

“There are other airports that are very interested in what we are doing,” Jacobsen said. “There are also airports that are a little bit afraid of addressing this fine-particle problem, and this so because it is a quite new problem.”

“I think we are regarded as the front-running in this,” Jacobsen said. “A lot of airport are addressing the CO<sub>2</sub> problems, trying to reduce CO<sub>2</sub>, and by doing so you are also reducing air pollution. So a lot of airports of actually working with this but not with the aim of reducing ultrafine particles.”

# Heavy metal thunder: Aircraft grow quieter as rock drones on

When jet-powered passenger aircraft first went into service in the 1950s, their engines were as loud as rock bands. Times have changed, but public discord over noise has not. EurActiv reports from the Paris Air Show.

Today's engines are on average 75% quieter than those produced at the dawn of the jet age, manufacturers say, a result of steady technological improvements that along with more aerodynamic aircraft have reduced the nuisance of flying for passengers and those on the ground.

Yet even if planes are quieter, the surge in air traffic means noise remains a political bombshell in Europe, which leads the world in noise-based flight restrictions. EU states are also obliged to limit noise around airports under a 2002 regulation that is now being revamped to reflect the anticipated growth in the airline industry.

The updated noise regulation, proposed by the European Commission in December 2011, reflect obligations under the International Civil Aviation Organization (ICAO) to create a "balanced approach" to noise pollution, including the use of quieter aircraft, improved airport planning and operational procedures that cut noise levels in the air as well as around airfields.

The aviation industry says it is doing its part through new engine technologies and future airplane designs

that will make flying machines quieter than household appliances. Some of the newest aircraft engines coming on the market produce noise equivalent to a food mixer or coffee grinder, or about 85 decibels.

Put another way, "that's like standing on a busy street corner in Manhattan or London or Paris, whereas the early jet planes were 120 and above – they were rock bands. Rock bands haven't gotten any quieter but airplanes have," said Alan H. Epstein, vice president for technology and environment for Pratt & Whitney, an engine manufacturer.

## Booming business

The world's top engine manufacturers - including Rolls Royce in Europe, and US-based Pratt & Whitney and General Electric - expect business to boom in the years ahead driven by demand for quieter, more fuel-efficient propulsion systems and aircraft.

Boeing forecasts that the number of airplanes in service will double - from 20,310 in 2012 to 41,240 - by 2032. Airbus, Boeing's chief rival for medium- and long-range passenger jets, also foresees a doubling of the world's air fleet over 20 years.

Lighter, composite metals have made aircraft themselves more agile and wind resistant - thus quieter as they move through the air. Similarly, jet engines have become more fine-tuned, resulting in less noise and greater fuel efficiency. They have also changed in shape, becoming broader and shorter compared to the tubular jet propulsion systems of the past.

"An airplane needs a certain amount of thrust and you can make the thrust by moving a lot of air slowly, or little bit of air very fast," Epstein explained in an interview. "The noise gets made by the speed of the air being moved. So from a noise point of view, you want to move as much air as you possible can as slowly as you possibly can. But the inside of the engines – all those compressors and

turbines - want to turn really fast.

"In the past we've had a compromise between the parts that turned slowly and the parts that want to turn fast because they were all connected just by a shaft. Putting a gear – like the gear on your car - it lets the motor turn fast and the wheels turn at whatever speed they want to go at."

## The next generation

Researchers are already looking to a future that is quieter and more efficient. The American space agency NASA and the EU-financed Clean Sky Initiative have both backed research into aircraft that could replace today's conventional tube-and-wing designs in the next 20 years. Clean Sky, launched in 2008 with €1.6 billion in funding, is now in its second phase.

Among the futuristic designs that would reduce fuel consumption and noise are aircraft with V-shaped wings blinding into the fuselage, and engines mounted on top of the wings.

"Doing that actually shields the citizen on the ground from rather a lot of the engine noise," said Andrew Watt, head of environment at Eurocontrol, the Brussels-based civil-military air traffic management and safety organisation.

Eurocontrol is also working to reduce noise through changes in landing patterns, so that aircraft spend less time cruising at lower altitudes before they begin their landing. This gliding approach from higher altitudes reduces fuel consumption and means people living along flight paths endure less noise since aircraft are at higher altitudes.

The EU air control organisation hopes to expand the regular use of what is known as continuous descent operations to more than 200 airports by 2014.

"On the approach, aerodynamic noise is actually quite significant, in particular once you deploy the

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control surfaces and you deploy the undercarriage,” Watt said. “The aircraft is no longer as clean, as slippery as it was through the air, so that causes turbulence which generates the noise. So often times on the approach, it can be that the dominant factor is the fuselage noise and not that of the engines.”

### Demonstrators want restraint

But those living in flight paths may be less convinced that their world is getting quieter.

Protest groups for years have demanded moratoriums on new runways and terminals at hub airports as well as bans on night passenger and cargo flights.

In May, hundreds of anti-noise demonstrators mixed with travellers at Frankfurt’s airport and earlier this month similar protests were held in Berlin, where the much-delayed Brandenburg

Willy Brandt Airport is nearly completion.

Demonstrators opposed to the redevelopment of Istanbul’s Gezi park also called on the Turkish government to reconsider other major public works projects, including what would be the world’s largest airport just outside the city.

In Brussels, airport noise has sparked intercommunal tensions, with the European capital’s French-speaking communities long complaining that they bear the brunt of take-offs and landings to spare Flemish-speaking suburbs close to the airport.

Europe already leads the world in imposing operating restrictions on cargo and passenger operations, limits that are viewed as bad for business in an industry with round-the-clock operations and customers across the world. Of the world’s 161 major airports with night flying limits or bans, 106 are in Europe.

ICAO’s “balance approach” to noise discourages such flying bans, noting that “operating restrictions can have significant economic implications for the airlines concerned, both those based in the states taking action and those based in other states (particularly developing countries) that operate to and from the affected airports.”

Pratt & Whitney’s Epstein acknowledged that aircraft noise would remain politically sensitive even as propulsion grows quieter.

“What the airports decide to do with that lack of noise is a political question – it can be longer flight hours, it can be more flights per day ... or it could be reducing the noise for the community,” he said in a telephone interview. “It’s a questions that will generate a lot of press because it has no unique technical answer. It’s a political-economic answer and I suspect the optimum is different for different communities.”



Aircraft engine: Photo by Pratt & Whitney

# Aircraft engine exec: No more rock bands in the air

Since the dawn of the jet age, aircraft engines have gotten progressively quieter and technological developments will make them even easier on the ear, says Alan H. Epstein, who helps produce quieter and more fuel-efficient aircraft propulsion systems.



*Dr Alan H. Epstein is vice president for technology and environment for Pratt & Whitney, a manufacturer of aircraft engines. This is an excerpt of an interview with EurActiv's Timothy Spence ahead of the Paris Air Show, 17-23 June.*

*The US company supplies engines to Airbus and other plane manufactures and its new geared-turbofan engine family, the PurePower PW1000G, will be used on the Airbus 320neo, and Bombardier of Canada's new medium-range CS100 and CS300 passenger jets, the Russian-built Irkut MS-21 and the Mitsubishi Regional Jet. The*

*PW1000G engine completed its first flight test on 15 May.*

**New engines about to come on the market are reportedly 75% quieter than those in the air today. How noisy is that on take-off?**

In decibels, the number is about 85 – that's like standing on a busy street corner in Manhattan or London or Paris, whereas the early jet planes were 120 and above – they were rock bands. Rock bands haven't gotten any quieter, but airplanes have.

**Anyone who lives near an airport or on a flight path might take a different view. Aren't we looking at years before this technology catches up with what's in the air today?**

No, the technology is a real product. The Neo flew last week, the CSeries engine is certified by Transport Canada and the [CSeries] airplane is going to fly this month. It will take time as the new airplanes go into the fleet. You can only make so many airplanes per year, and it will take time for the old airplanes to come out.

Once Bombardier has several test airplanes flying and they start flying around for marketing purposes, they'll fly it into noise-sensitive communities and there will start to be groundswells from people saying, 'Why should we put up with these noisy airplanes when we could be flying on these things.'

Notwithstanding, people are still going to be complaining about noise.

**You've gone from a rock band to urban traffic in terms of noise. Do you see a point where one of your engines is as quiet as an electric motor in a car?**

It isn't the motor that makes the noise anymore. It's the pushing of the airplane. So in other words, I could conceive of an electric-powered airline. Now to do that, I would need the world's

longest extension cord, but as a thought experiment I could electrically power an airplane. All that means is I have an electric motor turning a shaft and I still need a propeller or fan that pushes the airplane.

**What makes the engine so quiet?**

An airplane needs a certain amount of thrust and you can make the thrust by moving a lot of air slowly, or little bit of air very fast. The noise gets made by the speed of the air being moved. So from a noise point of view, you want to move as much air as you possible can as slowly as you possibly can. But the inside of the engines – all those compressors and turbines - want to turn really fast.

In the past we've had a compromise between the parts that turned slowly and the parts that want to turn fast because they were all connected just by a shaft. Putting a gear – like the gear on your car - it lets the motor turn fast and the wheels turn at whatever speed they want to go at.

If you take the A320, the current engines flying on that [plan] are 63-inch-[160 cm] - diameter fans; the new Neo with the GTF [geared turbofan] has an 81-inch-[206 cm]-diameter fan, so there's an enormous amount of area increase. We have some [illustrations] – there aren't photographs yet because the airplane isn't ready yet – and it looks a little strange because it looks like this little plane with these enormous engines on it.

**Is there a correlation between noise reduction and fuel efficiency?**

Turning the fan really slowly dramatically reduces the fuel consumption. So on the Airbus Neo, you are talking about a 16% reduction in fuel consumption that goes along with the noise reduction. My suspicion is that most of the airlines, if not all the airlines,

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are buying these as fast as they can to get the fuel consumption because fuel is now 50% of their direct operating costs. The noise is a bonus.

#### So the motivation is fuel efficiency?

That's my interpretation of our customers' actions. If you are running a business that has historically lost money for the last century and the price of fuel has ballooned so that it's more than 50% of your operating costs, you're desperate to reduce fuel burn and these new engines are an enormous step in that direction.

#### Is it possible to retrofit a plane with these newer, quieter, more efficient engines?

Yes, it's physically possible. Historically it's never been economically viable.

#### There is more and more effort in Europe to shift away from the traditional 'stair-step' approach to landing an airplane to a more direct approach. Would that have any impact on noise reduction?

There is a big effect. You're talking about continuous descent arrival, or CDA, and the idea is that it keeps the noise off the ground because the airplane is higher for longer.

There is the noise you make but the noise you hear is a function of how far away you are. For a [Boeing] 747-400, for example, the noise contour on the ground is reduced by between 35 and 40% using a CDA approach [compared] to a standard approach.

You asked me a question that I did not answer, and that was is it possible to build a virtually quiet engine.

There was a study done by MIT and Cambridge University for a virtually silent airplane, and virtually silent means

not that it didn't make any noise, but if you were standing on the street and the airplane flew over, you wouldn't hear it because the noise was below the ambient noise in an urban environment. You couldn't do that in the country where the only noise is crickets at night, but you can in the city.



*A plane on display at Farnborough. Reuters photo by Luke MacGregor*

## Airbus, Boeing in long-haul race to market green aircraft

Aviation superpowers Airbus and Boeing are battling to dominate the transcontinental jet market, each vowing to outdo the other in delivering quieter, more fuel-efficient aircraft. EurActiv reports from the Paris Air Show.

The transatlantic rivals face growing global competition for mid-range aircraft but are virtually unchallenged in producing long-distance planes, or

those with ranges of 10,000 kilometres or more, that are the most profitable to operate and in growing demand.

With jet fuel prices accounting for about half of airline operating costs, efficiency has become a key selling point. At the Paris Air Show this week, each company sought to outpace the other by promoting its latest products as greener, quieter and cheaper to operate.

US-based Boeing on Tuesday (18 June) announced its newest long-distance jet, the 787-10, the latest version of its 787 Dreamliner series that began commercial service in 2011.

"The 787-10 Dreamliner will be the most efficient jetliner in history," Raymond L. Conner, chief executive of Boeing's commercial airlines division, said in introducing the plane at the Paris show. "The 787-10 is 25% more efficient than airplanes of its size today and more than 10% better than anything being offered by the competition for the future."

The company's chairman and chief executive, W. James McNerney Jr., said Boeing already had 102 orders for the aircraft that will be delivered starting in 2018.

Europe's Airbus made similar environmental performance claims about its A350 XWB series, saying lighter composite metals and advanced engines will produce one of the most efficient aircraft ever. XWB stands for extra-wide body, which Airbus said will provide a more spacious ride for the 270 passengers on the aircraft's shorter model and up to 440 on the stretch version.

Airbus got a head start on the biennial Paris event with test flight of its A350 on Friday (14 June). The company says it has orders for 613 of the advanced aircraft.

"The A350 XWB is fantastic and impressive," John Leahy, the Airbus chief operating officer, said in a statement after

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the test flight in Toulouse, France. “Did you hear how quiet it was? We’re going to set new standards with the A350 XWB – not just for comfort and performance, but for environmental friendliness as well.”

Airbus and Boeing anticipate a doubling of aircraft demand over 20 years as passenger numbers grow and airlines seek to capitalise on more efficient engines and aerodynamic designs that reduce fuel consumption. Boeing reported 1,338 total orders in 2012, compared to 914 for Airbus.

### Battling higher fuel costs

Competition is growing across the aviation sector for more fuel-efficiency aircraft that are also quieter.

Fuel consumption accounts for about half of operating costs. Jet fuel prices have fallen since hitting \$180 per barrel in June 2008 yet have edged up this year, closing on Friday at \$121, up 2.6% from a week earlier and 6.5% from a year ago.

Costs in Europe are higher, closing last week at \$123 (€92) per barrel, up 7.2% from 2012. The higher prices have cut into airlines’ bottom lines despite a recent improvement in financial outlook for the industry.

Air carriers are also under pressure to reduce emissions. The EU’s Emissions Trading System (ETS) took effect for airlines in 2012, previously applying only to industries and energy companies as a market-based approach to reducing carbon emissions.

The European Commission has suspended the law’s application to international flights arriving and departing EU airports pending negotiations in International Civil Aviation Organisation, the Montréal-based body that sets global standards for air carriers. Even if the EU reverses course on the ETS, it is expected some international deal on global emissions reductions will emerge from the talks.



*An Airbus 380 takes off at the Paris Air Show.  
Airbus photo/S. Ramadier*

Airbus and Boeing are not only competing to be fuel efficient. The companies say their newest generations of aircraft offer better comfort for passengers and more flexible layout options for airlines buying them.

These models include updates of the Boeing 747 and 777, and new versions of the company’s Dreamliner. Airbus makes the same claims with the world’s biggest passenger plane, the A380, the new A350 and a revamped A320, the ‘Neo’.

### In-flight problems

But grand ambitions often conflict with both market and production realities. The introduction of the A380, a hulking double-deck passenger liner that made its maiden commercial flight in October 2007, suffered setbacks in 2011 and 2012 due to isolated engine failures and wing cracks.

In January 2013, the 787 Dreamliner was grounded worldwide for three months because of faulty batteries. Two 787s were in service in Europe at the time, both flown by Polish Airlines.

The two aviation superpowers also

face rising competition at the other end of the spectrum, for the medium-range aircraft common on intra-European routes.

Russia’s United Aircraft Corporation is touting its medium-range MC-21 jetliner that is expected to be operational by 2017, with a market focused initially on Asia and the former Soviet republics. Representatives of the 7-year-old firm say the MC-21 will be 15% more fuel efficient than comparable aircraft flown today.

Commercial Aircraft Corporation of China, launched in 2008, is planning production of the C919, the country’s first domestic single-aisle passenger liner. Bombardier, a Canadian aircraft maker, and Brazil’s Embraer are introducing medium-range jets to complement their traditional fleet of regional jets that generally carry 100 or fewer passengers.

Such competition could spell trouble for Airbus and Boeing in the rapidly growing single-aisle markets now dominated by the Airbus 320 and Boeing 737. Both companies also have records of failing to meet their production deadlines on new models.



# Public concern may turn volume down on military jets

Though civilian airlines are pressing for quieter, more efficient aircraft, noise output is low on the list of priorities for the sector's military wing, but there are indications that may be changing.

Noise from civilian aviation is governed by a number of national and European-level rules and international agreements. But military aircraft are exempt from all EU-level legislation, a European Commission spokesman said.

Equally, there is little legislation governing military noise at national level, and little appetite for change. The military has long benefited from special status, its difficult mission to defend public interests affording it a certain lee-way.

Truls Gjestland, a noise researcher at SINTEF, Scandinavia's largest research institute, said: "They do whatever they like. Noise has never been a design criteria for military aircraft. It's usually power and it's speed and it's capability of carrying lots of weapons, missiles. Noise was never an issue."

But military activity has been an issue for residents near airbases, who complain of disturbed sleep and impacts on their quality of life. According to a study by the Dutch National Institute for Public Health and the Environment, military noise also has an economic cost, with huge impacts on house price depreciation.

## Residential concerns

The study, "Valuing airport noise in the Netherlands", rates airport noise as responsible for about €1 billion depreciation



*UK Royal Air Force "Red Arrows" performing on 28 February 2013. Photo: UK government*

in real estate value. Military airbases, it says, account for about 30% of that figure, compared to just 5% for other airports than Amsterdam International Airport Schiphol, which alone accounts for 65%.

The authors concluded that "military airbases and flying areas seem to result in more depreciation than civil airports".

Few studies exist on the impacts of military noise, but there is evidence of adverse health effects. A 2009 study by the World Health Organization (WHO), "Night Noise Guidelines for Europe", referred to strong links between noise from military aircraft and behavioral awakening in adults. Compared to other noise sources, "military aircraft showed a very strong effect" in disturbing sleep patterns, the study said. But it conceded that the results were of limited applicability as the people polled lived near the end of the runway, where there is most noise.

Gjestland, who is preparing a report on the subject, suggests that military airplanes may affect sleep more than conventional aircraft as they tend to have different flight patterns, such as more nighttime activity - curfews are imposed on the civil sector - and training exercises in the early morning.

Military aircraft also have larger engines and travel faster, creating shorter yet louder bursts of noise, the form which most affects sleep.

## Operational effectiveness

Complaints from the public mean that armies are becoming more and more aware of the impacts of their noise on local residents but they concede that some disturbance is inevitable.

A spokesman for the British Ministry of Defence (MOD) told EurActiv: "The MOD is always mindful of its responsibilities to the general public and treats all flying complaints seriously. It would be preferable if air operations could be conducted without disturbance to those on the ground."

"However, this is not always possible. We have a responsibility to ensure that military aircrews are fully trained and prepared for operational duty, but in meeting this requirement we will continue to do all we can to minimise disturbance."

The MOD says, however, that it does take the environment into account when choosing its airplanes and also tries to follow as much as possible non-binding guidelines for keeping within civil aviation standards. "When the MOD purchases, or develops, an aircraft a process is followed that provides an environmental features matrix for the evaluation of environmental impact. Noise is a feature of the matrix. Guidance is also provided on how MOD aircraft should, so far as is practicable,

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comply with ICAO [International Air Certification Organisation] standards.”

But these environmental questions are a secondary concern. “The primary criteria for evaluating which aircraft to purchase are value for money for the taxpayer and operational effectiveness,” the MOD said.

## Engineering

Advances in engineering mean that the armed forces can reconcile more than ever operational effectiveness with low noise output, with urban warfare providing a testing ground for stealth machinery. In 2011, high-tech stealth helicopters burst into the public consciousness as US forces used a low-noise Blackhawk helicopter in the raid on Al Qaeda leader Osama Bin Laden’s compound in Abbottabad, Pakistan.

The picture is different for fighter aircraft, which rely less on stealth than helicopters and land-based vehicles and more on their speed and power to surprise the enemy. Their stealthiness comes more from evading radar detection than a muffled engine, SINTEF’s Gjestland said.

But with engineering improvements and tweaks to flight behaviour, the armed forces can even take steps to mitigate the roar of a fighter jet. New models are

designed for ever greater maneuverability, allowing pilots to carry out quieter take-offs and landings.

Sebastien Carlsson, a spokesman for Saab Group, told EurActiv the Swedish aerospace and defence company’s latest fighter, the JAS 39 Gripen, allows for “great flexibility in performing noise abatement maneuvers during take-off and landing.” He added: “This is important because peacetime military flight operations can be scheduled and performed in a way that minimises the noise impact on the environment.”

Further, the auxiliary power unit (APU) of the Gripen is designed to meet stringent noise levels during ground operations.

## Attitude

While Gjestland greets warmly the engineering changes, he believes that the armed forces will not change their noise behaviour unless they really want to. There may be little appetite for regulation but to the SINTEF researcher the army’s main reason for reducing its noise footprint is public relations.

Recent controversial international military campaigns mean its reputation is not what it once was. Gjestland has noticed a change. “Over the last years

environmental issues have become more important,” he said. “The military depends on good relations to their neighbors, and neighbors are concerned regarding noise,” he said. “They want a quiet and peaceful place for themselves and not being waken up during the night. Thus the military tries to reduce the noise impact to their surroundings.”

Ultimately, to Gjestland noise is not just about the decibel level but attitude. In his research on civil airports, Gjestland comes up with a noise annoyance level through surveys of local residents. “We do surveys, actually ask people how annoyed are you and they check the noise level and so on.” he said.

The surveys have yielded interesting results.

“The response is not only driven by the noise itself but is very much an attitudinal question,” he said. “If you like what is going on, if you depend on the activity then you have another attitude than if you think this airbase is a nuisance.”

“If you don’t like the military you are very annoyed by military noise. But if you work at the airbase, if you have another job, that you deliver goods and services to the airbase, you sort of depend on the airbase being there then you are more tolerant. So this is a very very complex question.”

# Winging it: EU researchers look for novel ways to cut aircraft noise

As jet engines grow quieter, European researchers are turning to other parts of aircraft to reduce noise to spare those living near airports and to make the final

moments before landing more comfortable for passengers. EurActiv reports from the Paris Air Show.

Researchers working with financial support from the EU’s Clean Sky programme are experimenting with designs that could one day replace hinged flaps on aircraft wings, creating a continuous surface that would reduce noise and fuel consumption.

It could take years before such developments are ready for commercial use. But Martin Lehmann, a researcher at the Fraunhofer Institute in Germany, says “the first impressions are quite good” that “gapless” wings could one day improve the

environmental footprint of aviation.

The research is part of a project financed by the EU’s Clean Sky Joint Technology Initiative, launched in 2008 to encourage public-private cooperation with a goal of cutting fuel consumption and reducing noise by 75%.

Today’s engines are on average 75% quieter than those produced at the start of the jet age 50 years ago, a result of steady technological improvements that along with more aerodynamic aviation designs have reduced the nuisance of flying for passengers and those living in the vicinity of airfields.

## More traffic, more nuisance

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Yet even if planes are quieter, the steady growth of air traffic means noise remains a political bombshell in Europe, which leads the world in noise-based flight restrictions. EU states are obliged to limit noise around airports under a 2002 regulation that is now being revamped to reflect the anticipated growth in the airline industry.

Engines are big noise culprits on take-off, when maximum power is needed to lift aircraft to their cruising altitude. But on approach to landing, it is mainly the turbulence that creates noise – wind blowing through gaps between the wing and flaps and whistling in the cavities where landing gear are stored.

One solution is designing an insulating cover that can pop into place when landing gear are lowered on the runway approach. Another is taking a lesson from birds, creating a smoother wing surface without the need for bulky flaps that pilots now need to manoeuvre their planes towards the runway.

Reducing or eliminating the gaps between the wing and the hinged flaps are technical challenges that Fraunhofer and other researchers in the Clean Sky Smart Fixed Wing Aircraft, or SFWA, project are working on.

“It’s a dream of aeronautical engineers from I don’t know how long,” Valerio Carli, who is also involved in the Fraunhofer’s public-private partnership, told EurActiv at the Paris Air Show.

Eliminating hinges and flaps also

reduces the plane’s weight, yielding fuel savings. Passengers have a gentler landing as well.

**A breath away from quieter aviation**

Researchers are experimenting with making wings more elastic to replace the need for hinges – creating what they call “gapless profiles.” Carli said the goal is to reduce noise levels by 10 decibels, equivalent to the sound of breathing, but a level that researchers say produces a significant reduction when combined with other technological advances and air-traffic management measures.

Some of the newest aircraft engines coming on the market produce noise equivalent to a food mixer or coffee grinder, or about 85 decibels.

The race is on to create ever quieter aircraft and to reduce noise pollution around airports. Industry officials say the noticeable benefits of replacing older fleets with quiet planes will gradually decline because of growing traffic.

There are 28,000 flights a day in Europe’s airspace and the European Commission estimates that the volume will grow by 50% before 2030, creating pressure to for more efficient air traffic flow and better environmental performance from airplanes.

Fraunhofer and its Clean Sky partners, which include leading aircraft and engine manufacturers, are not alone in trying

to make airplanes as agile as a bird.

Researchers at Cambridge University and the Massachusetts Institute of Technology in 2006 unveiled their concept of the post-2030 airplane, with flapless V-shape wings and rear-mounted engines.

The American space agency NASA has also designed a flap-free airplane with engines mounted on the top of the fuselage, to reduce the sound that reaches the ground even further.

For now, the Fraunhofer’s researchers say there are major design challenges ahead and are wary of guessing when their elastic wing concept might be available for commercial use. One challenge is reducing the physical stress on wings during descent. Another is finding the right materials that are strong but flexible.

Wing stress poses “a big problem” for the project, Fraunhofer’s Lehmann explained, adding that aeroelastic wings would most likely be used on smaller aircraft first rather than on transcontinental giants.



*NASA quiet jet: NASA photo*

## For information on EurActiv Special Reports...

**Contact us**

**Delia Nicolaescu**  
events@euractiv.com  
tel. +32(0)2 788 36 72

**Ross Melzer**  
publicaffairs@euractiv.com  
tel. +32(0)2 226 58 17

*Other relevant contacts:*

**Rick Zedník**  
ceo@euractiv.com  
tel. +32(0)2 226 58 12

**Frédéric Simon**  
executiveeditor@euractiv.com  
tel. +32(0)2 788 36 78