Public consultation on the revised Climate, Energy and Environmental Aid Guidelines (CEEAG)

The proposed CO2 and noise criteria for approving state aid to environmentally cleaner aircraft seem flawed and need of a rethink as they reflect neither certification conditions nor the real world performance of existing/new aircraft. State aid for the electrification of airport groundhandling equipment would be a welcome contribution to tackling airport pollution but must form part of a comprehensive approach that was promised in the Green Deal but is yet to appear.

The proposal states that "Aid measures may be allowed for the acquisition and leasing of clean transport vehicles including aircraft where, for commercial aircraft the "certified metric value that exceeds by at least 10% the latest environmental protection standards of the International Civil Aviation Organization (ICAO) contained in Annex 16 to the Chicago Convention, including the CO_2 metric values for aircraft "New Type", as referred to in Article 9, point (2), of Regulation (EU) 2018/113927; or alternatively, if it replaces an aircraft that already exceeds the latest noise and emissions environmental protection ICAO standards for aircraft "New Type", contained in Annex 16 to the Chicago Convention and as referred to in Article 9, point (2), of Regulation (EU) 2018/1139, an aircraft that delivers an improvement in the level of environmental protection by at least 10% compared to the aircraft that is being replaced;

Aircraft CO2 Standards

The proposed aircraft CO2 criteria for approving state aid do not seem to recognize the fact that aircraft flying today are not CO2 certified and very few, if any, are likely to be ICAO/EASA certified in the next 10 years or so. There were no aircraft CO2 certification standards until those agreed for the first time by ICAO in 2016. Two CO2 certification regimes were established; one requiring certification from 2020 for all new type (NT) designs for aircraft that would likely first enter commercial service around 2024 (certification takes time); and the second imposing CO2 design standards governing future modifications (eg neo or max versions) of aircraft already flying and on the market in 2016 as well as "project aircraft" designs – those new aircraft types already being designed and built and due to enter service before the NT standard commenced from the beginning of 2020. This second regime is known as the "aircraft in-production (in-P) standard".

The in-P standard stringency was designed and planned with a view to entering into force in 2023. However a 5 year application and production cutoff delay until 2028 was proposed "out of the blue" at the last minute and hastily agreed at an ICAO CAEP member-only meeting convened behind closed doors. So the first ever in-P standards - whose stringency (albeit technology following – see below) was based on what manufacturers could conceivably achieve by 2023 - were postponed until 2028 along with the requirement for manufacturers to cease production at that time of all in-P aircraft not compliant to the new standard. The original date of 2023 was maintained for derived diversions of non-CO2-certified in-P aircraft already flying. To prevent backsliding.

Few, if any, aircraft versions flying or still in production today will undergo such in-P CO2 certification as there is no legal requirement for them to do so, plus the certification process is lengthy and involves cost to manufacturers. None have yet been so certified. Without today's aircraft being CO2 certified, there will be no way to apply the criteria to determine whether state aid for the purchase/lease of a cleaner aircraft can be justified because no CO2 certification data applying to the aircraft to be replaced will be available. Nor will any new more fuel efficient in-P aircraft versions

requiring certification to the 2028 standard be likely to be available for purchase or lease much before 2028 – or if at all - by then. So the CO2 state aid criteria as currently drafted seem unworkable.

In the absence of aircraft CO2 standards, improvements in aircraft fuel burn/environmental performance have historically been driven by commercial and competitive pressures on aircraft manufacturers. They worked to improve fuel burn (and thus CO2 emissions) performance well before climate change became an issue, because doing so makes new aircraft purchases financially attractive by enabling airlines to reduce direct operating costs. And particularly because the advantages of speed and range that jet aircraft brought over the piston-engined aircraft they replaced resulted in a massive fuel burn penalty[1]. Buying more fuel efficient aircraft to replace less efficient ones can in the first place boost operating margins and, more recently, may also enable airlines to lower compliance costs to climate measures such as the aviation ETS. More fuel efficient aircraft can also enhance a carriers' market competitiveness. But improving fuel efficiency also enables aircraft to fly faster or further on the same amount of fuel consumed. This rebound effect can reduce or even cancel out the gain in operational fuel burn/CO2 performance. So measures to encourage the purchase of cleaner aircraft must be accompanied by *effective* measures on operators that really require them to reduce overall emissions.

Airbus and Boing dominate large aircraft manufacturing and together account for 92% of all aviation CO2 in the atmosphere today. This duopoly exploited its market power to dominate the entire ICAO CO2 regulatory standard-setting process – deciding what proprietary aircraft performance data needed to determine stringency would be released under the strictest confidentiality provisions and using safety and other concerns to push back on technological ambition. The end result was that the stringency of the above ICAO CO2 standards is limited to TRL8 technologies already installed on aircraft in 2016. Moreover, the stringency requirements are a single straight line. They don't get more stringent over time, yet aircraft fuel efficiency improvements are dynamic.

Because of the TRL 8 in 2016 condition and other limiting factors, the ICAO standards are weak and technology following and do little if anything to force manufacturers to perform beyond BAU levels of fuel efficiency improvements determined essentially by commercial forces and Airbus/Boeing themselves. Physics also now dictates that improvements become more technically challenging and costly over time. The below graphs from the ICCT[2] show that the CO2 improvements required by the 2020 NT standard are zero for both large aircraft twin and single aisle launched between 2012 and 2019. So all project aircraft launched since 2015 comply with the NT standard.

[1] The last long-haul piston-powered airliners (early 1950s) were as fuel-efficient as today's average turbojet aircraft. https://www.transportenvironment.org/sites/te/files/media/2005-12_nlr_aviation_fuel_efficiency.pdf

[2] https://theicct.org/sites/default/files/publications/ICCT-ICAO_policy-update_revised_jan2017.pdf

Table 1. Estimated metric value reduction required for new in-production aircraft by aircraft category

Aircraft category[1]	MTOM (tonnes)	Metric Value (kg/km)			% reduction	
		2015 worst	2015 average	2028 Target[2]	Worst aircraft	Average aircraft
Very large aircraft	>350	2.95	2.93	2.62	11%	10%
Twin aisle	120 - 350	1.88	1.70	1.75	7%	0%
Single aisle	60 - 120	0.94	0.91	0.86	9%	6%
Regional jets	13.5 - 60	0.71	0.69	0.68	3%	0%
Business jets	<60[3]	0.64	0.56	0.61	6%	0%
Freighters	n/a	2.13	2.06	1.92	10%	7%
Average		1.59	1.49	1.46	8%	4%

[1] Example aircraft include VLA: A380; Twin Aisle: B-777; Single Aisle: A320; Regional Jet: Embraer E-190; Business Jet: Gulfstream G550; Freighter B777-F
[2] Assumes the same MTOMs in the 2015 sales mix. Actual required reductions will vary if the sales mix changes over time.
[3] Also with less than 19 certified seats.

Table 2. Estimated metric value reduction required for new types

Aircraft type[1]	Start date	MTOM (tonnes)	Metric Value (kg/km)		% reduction
			New design aircraft[1]	Required MV	
Very large aircraft	2020	>350	2.75	2.51	10%
Twin aisle	2020	120 - 350	1.51	1.68	0%
Single aisle	2020	60 - 120	0.76	0.82	0%
Regional jets	2020	13.5 - 60	0.55	0.66	0%
Business jets	2023	<60, <19 seats	0.46	0.58	0%

[1] Defined as new types certified between 2011 and 2019. Example range include the 747-8 (2011 EIS, through the 777X (expected 2020 EIS).

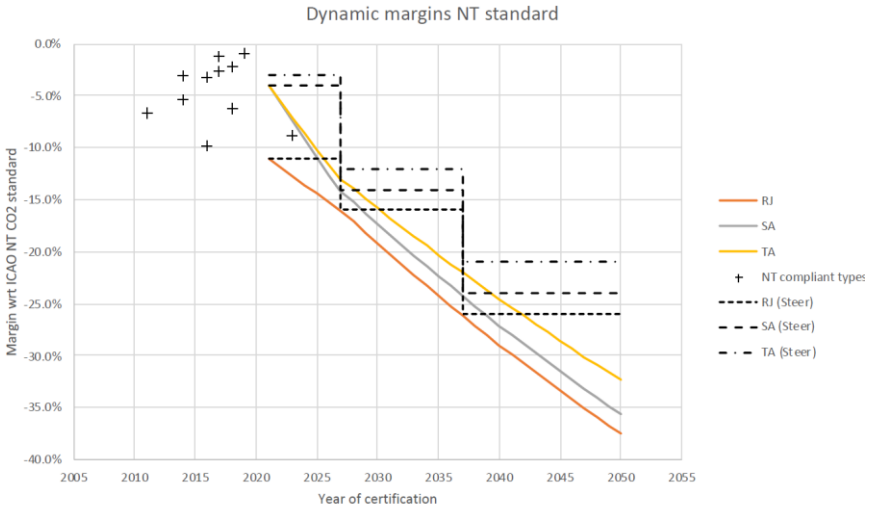
As for the 2028 In-P standard, the ICCT graph shows that zero CO2 improvements over twin aisle large aircraft already flying in 2015 are required and just a 6% reduction for average-performing single aisle large jet aircraft. For both the NT and in-P very large aircraft (ie the A380) standards, reductions of 10% are required. Which explains the sudden and quite unexpected last minute 5 year production cutoff and applicability delay. It was effectively imposed on ICAO by EU CAEP members from state transport ministries bending to Airbus' concern to extend the production line of the A380 which was not compliant to the 2028 In-P standard and would have had to cease production at the end of 2022 if the original In-P date of 2023 had applied. Even worse, Airbus had been considering – urged on by Emirates - whether to develop a neo version of the A380. But substantial design modifications would be needed – possibly even a new wing. Because the existing aspect ratio forced on designers if the ICAO runway separation limit of 80m was not to be extended yet again (it had been extended twice already to accommodate the Boing 747 and then its 400 version and further extensions would require extremely costly runway and taxiway redesigns to accommodate the A380's enormous wing span) led to an inherent 11% fuel burn penalty[3]. It was feared that if a

[3] JL Dalhuijsen, R Slingerland Preliminary wing optimization for very large transport aircraft with wingspan constraints, AIAA paper 2004-0699.

completely new wing design was needed, regulators would deem such modifications as rendering an A380neo to be a new aircraft type subject to a 10% NT CO2 performance improvement requirement not in 2023 - or 2028 – but in 2020. This explanation may help to understand why Airbus and regulators in DG Move had such a close collaboration at the time.[4] US regulators were also in on the act re the 5 year production cut off delay, as a 2023 production cutoff would mean stopping the Boeing 757 production line thus preventing the completion (set for the end of 2027) of an order of 176 civilian-certified KC46 conversions of Boeing 757 passenger aircraft into inflight refueling tankers for the US Air Force.[5]

Table 2 (below) was drawn up by experts and Steer for the aviation taxonomy exercise. It shows clearly that all current in-P aircraft (marked with a +) comply to the NT standard – the 0% line. While the descending coloured lines are the best estimates of what the 2018 ICAO Independent Fuel Burn Expert group considered manufacturers were capable of achieving. ie a 4% improvement by almost all single and twin aisle in-P aircraft in 2020, over 10% by 2025 and over 15% by 2028. Yet the 2028 In-P standard requires zero improvements by then for twin aisle and just 6% for single aisle aircraft. Whether any modified in production aircraft achieve the reductions which the ICAO independent experts reckoned were achievable before the 2028 standard cuts in, may not become public. Because there is no requirement to certify such aircraft. But Table 1 shows clearly how ineffective the NT CO2 standard was. An in-P version of Table 1 would be even more telling as the ICAO independent fuel burn expert estimates show that 15% fuel efficiency improvements from today's aircraft are achievable by then. Yet the Commission now proposes to apply an arbitrary 10% margin to these static technology following standards to determine eligibility for state aid for aircraft purchases/leases over the coming years.

Table 2



The additional aid criterion permitting state aid if "an aircraft that delivers an improvement in the level of environmental protection by at least 10% compared to the aircraft that is being replaced" is

[4] See https://www.transportenvironment.org/news/airbus%E2%80%99-hold-eu-aviation-policy-exposed. The last A380 ever produced was in March 2021, nearly 7 years before the In-P standard will take effect.

[5] See https://www.climatechangenews.com/2016/02/23/a-flying-fairy-tale-why-aviation-carbon-cuts-wont-take-off/

also of concern. Firstly because its not clear whether this required 10% improvement is based on certified CO2 values – which in all likelihood will never be calculated by EASA. And secondly, because the 10% is arbitrary and many aircraft will in fact exceed this 10% improvement margin by a long shot. EU industry acknowledged this in their 24 June 2020 letter[6] to the European Commission calling for an incentive scheme similar to that now being proposed. It asked the Commission to

> **Implement a green incentive scheme for airlines and aircraft operators to replace older aircraft** (fixed wing and helicopters) with more modern and environmentally friendly aircraft; use public funds dedicated to the recovery to provide such incentives to aircraft operators. On average, new aircraft models are 20% - 25% more fuel-efficient, and are producing less noise compared to previous generations. Such an incentive scheme would speed up the green transition towards the EU's shorter term ambition of 2030.

By their own admission, the EU aviation industry clearly acknowledges that a 10% improvement is a very modest figure and grossly understates the likely CO2 improvements offered by new clean aircraft. An analysis of new aircraft CO2 performance data held by EASA would confirm the 20%-25% figures cited by industry. A low 10% improvement requirement might simply incentivize the swapping of one very old inefficient aircraft with another quite old one but which shows at least a 10% improvement. All the while potentially undermining sales of the most CO2 efficient new aircraft available on the market. The EU airline industry fully recognized this in its February 2021 letter to the Commission on aviation taxonomy and clearly stated a preference for aid to less than best-in-class fuel efficient aircraft[7]. There also appears to be nothing in the guidelines to prevent the environmentally under-performing aircraft from being a second hand one.

The end result of such CO2 aid criteria would seem to be not so much an incentive to purchase better performing aircraft as merely to use state aid to make already planned business-as-usual aircraft acquisitions. In other words it would serve as a hidden sales subsidy to aircraft manufacturers and an additional subsidy to airlines on the capital costs of new aircraft purchases. There would arguably be no improvement to the environment over BAU because the state aid would not necessarily require or incentivize the purchase of the cleanest performing new aircraft, just make existing planned purchases cheaper.

According to the ICAO CO2 Emissions database[8] which records aircraft compliant to the ICAO CO2 standards, so far only one aircraft – the Trent 7000-72 powered A330-941- has been certified by EASA to the applicable NT standards. No derived versions of non CO2 certified aircraft have been certified to comply with the 2023 requirement nor with the 2028 in-P standard.

The provision to allow a subsidy for the purchase/lease of "an aircraft that delivers an improvement in the level of environmental protection by at least 10% compared to the aircraft that is being replaced" will be open to gaming for a variety of reasons including those set out above.

Prices for marginally cleaner aircraft struggling to find sales because competitor aircraft more than 10% fuel efficient are more expensive, may drop more quickly and become attractive enough to post-Covid cash-strapped carriers than more fuel efficient but much more expensive cleaner aircraft. Even more perversely, all future BAU aircraft purchases in the years before 2028 - and even beyond -

[6] https://www.asd-europe.org/eu-covid-19-green-recovery-funding-for-the-decarbonisation-of-civil-aviation
[7] http://awg.aero/wp-content/uploads/2021/03/AWG-letter-on-EU-taxonomy-for-green-financing-2021.pdf
[8] https://www.easa.europa.eu/domains/environment/easa-aeroplane-co2-emissions-database-0

could conceivably be eligible for state aid thus transferring taxpayer funds to the airline industry with no discernible environmental benefit beyond BAU.

It is also not clear what the impact on the leasing market might be. Existing aircraft owners may decide to sell aircraft and lease back similar versions in return for a subsidy.

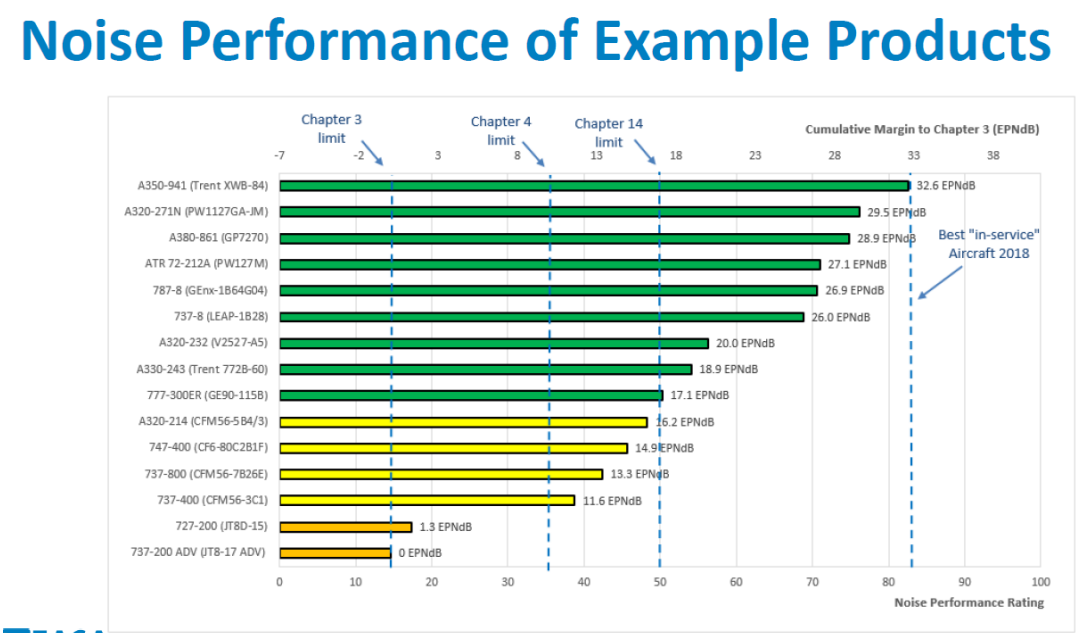
Or what conditions apply to the airlines/manufacturers in question. Presumably the eligibility aid criteria will need to be applied in a non discriminatory fashion ie not just to EU registered carriers or aircraft only produced by EU manufacturers. In which case could a non EU airline qualify for state aid for the purchase of a Boeing aircraft and never fly it to the EU, thus making no contribution to EU climate/environmental goals?

If the aircraft to be replaced has not been certified – and none are ever likely to be certified – then there is no way to determine whether the newly purchased/leased aircraft being proposed for state aid can perform 10% better.

Aircraft Noise

Some of the above considerations apply also to the provisions governing state aid for purchasing/leasing aircraft exceeding ICAO/EASA noise standards by at least 10%. One big difference is that all commercial aircraft flying today comply with ICAO/EASA aircraft noise standards which have been in place at progressively more stringent step change levels for the past 50 years. So there will be no problem being able to compare how differing aircraft perform to the noise standards. The problem is that a 10% improvement margin requirement makes little sense as aircraft noise is measured in decibels which are on a logarithmic scale. The marginal improvement requirement should be stated in increments of decibels not as a %. But at what level?

ICAO introduced the first global standard on aircraft noise, Chapter 2 in 1972, Chapter 3 in 1977, the phaseout of Chapter 2 aircraft was agreed in 1990, Chapter 4 in 2001 and Chapter 14 in 2013 coming into effect in 2017 and 2020 depending on the aircraft type. The below graph was prepared by EASA for a 2019 stakeholder consultation on aircraft labelling.



It show that successive ICAO noise standards are set according to **E**ffective **P**erceived **N**oise measurements (a measure of the relative noisiness of an individual aircraft pass-by event) and stated in decibels (EPNdB). The scale at the top compares the marginal improvement of each new Chapter – so Chapter 4 was 10 EPNdB more stringent than Chapter 3 and Chapter 14 is 7 EPNdB more stringent than Chapter 4.

It is also obvious from the EASA chart above that the most recent ICAO/EASA standard, Chapter 14, is being very significantly exceeded by many aircraft flying today. The best in-service aircraft at the time EASA prepared the graph was the Trent-engined A350 -941 exceeding the just-compliant to Chapter 14 GE engined 777-300ER by 15.5 EPNdB which is a simple mathematical increase of over 90%. It would seem more appropriate to develop a state aid criterion based on actual decibel (EPNdB) increments, not percentages while taking into account that using Chapter 14 as the baseline would demand a very significant increase of ambition when setting new criteria. Setting taxonomy criteria in decibel increments is exactly what the Steer study recommended.[9]

Table 3: Technical screening criteria – aircraft noise pollution EPNdB below ICAO Chapter 14 standard

Aircraft category	2021	2027	2037
Regional aircraft (>=20 seats)	13	14.5	17
Single aisle 101-220 seats	12	15.5	24
Twin aisle (>220 seats)	15	19.5	26.5

Another issue not clear from the proposed guidelines – and setting aside for a moment the absence of aircraft certified CO2 values – is how the aid criteria would handle noise and CO2 improvements together because any cleaner aircraft will perform better on both criteria.

Groundhandling equipment.

The proposals relating to state aid for airport groundhandling equipment are welcome but partial, and need to form part of a comprehensive regulatory approach to reducing EU airport pollution which is still missing from the Green Deal. The Commission's December 2019 Communication promised "action in relation to maritime transport, including to regulate access of the most polluting ships to EU ports and to oblige docked ships to use shore-side electricity. Similarly, air quality should be improved near airports by tackling the emissions of pollutants by aeroplanes and airport operations."

The Commission has delivered on shipping but seems to be ignoring aviation. The July 14 Fuel EU Maritime proposal requires ships operating within the EU MRV scope to progressively reduce the carbon intensity of their energy use and to accelerate the mitigation of ship air pollution in ports by mandating the use of shore side electricity by ships at berth. This proposal complements such action by including provisions for state aid to promote the acquisition of zero carbon clean groundhandling and clean terminal equipment at airports but does so within a policy vacuum.

[9] Steer Feb 2021, Sustainable Finance Taxonomy for the Aviation Sector

Aid may be granted for the acquisition or leasing of new or used clean transport vehicles for air, road, railway, inland waterway, sea, and coastal passenger and freight transport, and for the acquisition and leasing of clean groundhandling equipment and clean terminal equipment.

Aid may also be granted for the retrofitting of transport vehicles, allowing them to qualify as clean transport vehicles.

'clean groundhandling equipment' means equipment used in service activities incidental to air transportation that has zero direct (tailpipe) CO_2 emissions;

'clean terminal equipment' means equipment used for the loading, unloading and transhipment of goods and intermodal loading units, and moving cargo within the terminal area, that have zero direct (tailpipe) CO_2 emissions;

The Commission should proceed urgently with specific proposals to tackle "emissions of pollutants by aeroplanes and airport operations". It seems from the above definition of "clean terminal equipment", for instance, that airport terminal operations as well as passenger transport vehicles and buses on the ramp are excluded from the state aid provisions such that the Green Deal fails to adopt an approach to zero emission airport operations as it has now done for sea ports.

Airport air pollution is a significant and growing issue. Noise pollution from aircraft around airports has been regulated at the aircraft level since 1972. ACI Europe has a voluntary program for net zero CO2 airports in 2050 but the time for voluntary measures has long passed and a clear regulatory approach in the Green Deal is missing. Obvious measures that should be mandated include requiring airport terminal operations to utilize an increasing share of zero carbon electricity (see for example the solar array around runways at Schiphol airport); the mandated transition to electrify all bus and ramp vehicle operations; terminal passenger buses are not classified as ground handling equipment and are usually owned and managed by the airport authority itself or local urban transport operators not groundhandling agents; specific requirements for the electrification of aircraft pushback and taxiing equipment whose inclusion in the state aid criteria is not clear. But above all, longstanding calls for the desulpherisation of kerosene need to be implemented now at EU level. Such action can inspire similar moves beyond Europe starting in North America.

Bill Hemmings

02 August 2021