European Union Aviation Safety Agency

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Aviation Global Replacement Ratio in EU Taxonomy

An Agency of the European Union

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Executive summary

Global Replacement Ratio (GRR) Overview

The GRR is calculated annually using data from Cirium's Fleets Analyzer, tracking aircraft deliveries and retirements. Only aircraft delivered to commercial operators are included, and those moved to non-commercial roles (e.g., humanitarian, firefighting, and military) are counted as retirements only when permanently withdrawn from use. The GRR uses a ten-year average to account for market fluctuations.

The GRR ensures that the proportion of taxonomy-compliant aircraft is balanced by the number of non-compliant aircraft withdrawn.

Key aspects include:

- **Activity-Based Application**: Criteria for manufacturers, lessors, and operators.
- **Ongoing Acquisitions**: Annual replacement limits based on GRR.
- **Legacy Rights**: Aircraft delivered before December 11, 2023, assessed using the 2024 GRR.

The GRR accounts for market shocks, using a long-term average to smooth fluctuations. It is a tool for ensuring the aviation sector's alignment with sustainability goals.

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1 Calculation of Global Replacement Ratio (GRR)

For aircraft that does not have zero direct (tailpipe) CO_2 emissions, the technical screening criteria for the activity "manufacturing of aircraft" limit the number of aircraft to be taxonomy compliant by the "replacement ratio to ensure that the delivery does not increase the worldwide fleet number"[1].

The GRR is calculated at the beginning of each year based on the concept explained in the following text of the delegated act[2]:

> *"The share of Taxonomy compliance of eligible aircraft shall be limited by the replacement ratio. The replacement ratio shall be calculated based on the proportion of aircraft permanently withdrawn from use to aircraft delivered at the global level averaged over the preceding 10 years as evidenced by verified data available from independent data providers."*

1.1 Data sources

For the purposes of the GRR, **Cirium** has been identified as the most appropriate independent data provider. Cirium is an aviation specialist data provider within a FTSE100 corporate RELX. Its **Fleets Analyzer** product is recognised by industry as the most accurate independent aircraft fleet and aircraft events data available. Cirium and its predecessors have been researching and aggregating commercial aircraft fleet data for more than 50 years.

Cirium's data research and verification methods are detailed in Annex 2.

1.2 Data Considerations

The GRR must be based on commercial aircraft delivered from an original equipment manufacturer (OEM) to its initial operator, and aircraft permanently withdrawn from use (hereafter in this section referred to as retired). The calculation is to be based on delivery and retirement event data from Cirium covering the preceding ten (10) year period.

The following considerations for Aviation industry dynamics must be made when selecting the data to be used and undertaking the calculation.

1.2.1 Commercial aircraft delivered to non-commercial operators

Some commercial aircraft types are delivered new to non-commercial operators for business aviation, government, regulator, military or special mission operations. Business aviation is excluded from the scope of eligible activities under Section 3.21 point (b) of the delegated act, special mission and military activities

[1] Point (b) of section 3.21 of Annex I to _Regulation 2021/2139, as amended by Regulation 2023/2485.

[2] Commission Delegated Regulation (EU) 2023/2485 of 27 June 2023 amending Delegated Regulation (EU) 2021/2139 establishing additional technical screening criteria for determining the conditions under which certain economic activities qualify as contributing substantially to climate change mitigation or climate change adaptation and for determining whether those activities cause no significant harm to any of the other environmental objectives (OJ L, 2023/2485, 21.11.2023, ELI: http://data.europa.eu/eli/reg_del/2023/2485/oj)

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are not described, and OEM R&D is an activity in the manufacturing of aircraft. As such, aircraft originally delivered to these initial operators are excluded from the calculation.

Some aircraft are initially delivered to commercial operators and subsequently leave the commercial fleet via transactions to non-commercial operators such as military or government. Since such aircraft were produced and delivered to an operator for a commercial use purpose, they are to be considered as the "aircraft globally delivered" in the calculation of the GRR. These aircraft shall be treated as a relevant retirement when they are permanently withdrawn from use, not when they are transferred to non-commercial operations.

1.2.2 Delayed Retirements

The effect of delayed retirement means the data should be updated every year and the GRR calculated every year with up-to-date information. The delayed retirements will not be used to recalculate retroactively already established GRR in previous years which might have been impacted by the delayed retirement.

Aircraft which are identified by Cirium as **withdrawn from use** after a period of **storage** are retroactively listed as retired from the date they entered storage. As such the data regarding the number of historical retirements may increase over time.

Cirium takes similar action in the following cases when a storage period ends in retirement.

- Case 1 - Intentionally delayed retirement / consignment[3].
  When an aircraft is placed on consignment by a leasing company, it is typically listed as stored. However, **the aircraft may be partially dismantled with the intent the sale or lease of individual components before being formally withdrawn from use**. When Cirium later determines that the aircraft has been permanently withdrawn from use they will update their records to reflect the aircraft as withdrawn from use. The withdrawal date will be backdated to when the aircraft first entered storage. This ensures the historical data accurately represents the aircraft's status as being permanently withdrawn from use rather than its declared status of stored.

- Case 2 - Unintentionally delayed retirement / extended storage.
  Aircraft may also enter storage with an operator or leasing company with the full intention of returning it to service and the aircraft being listed as stored. The aircraft **may be retired having not left storage** should it never find the operational demand from an operator and the costs to return it to service become too high (typically 24-36 months of storage). In this case, Cirium would retroactively update the permanent withdrawal from use date to the entry into storage date.

An example of a situation where a retroactive retirement will be implemented is when Cirium identifies that an aircraft that entered storage in 2021, was dismantled and permanently withdrawn from service in 2024 without returning to service, the retirement date will be retroactively set to 2021.

[3] An aircraft not formally retired but has been parked and revenue generated from the sale or lease of its parts, in effect retired prior to a formal declaration or retirement.

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Figure 1 presents the retirement share by Company Category and deliveries share by Company Category for years 2014-2023 from the Cirium Fleets Analyzer.

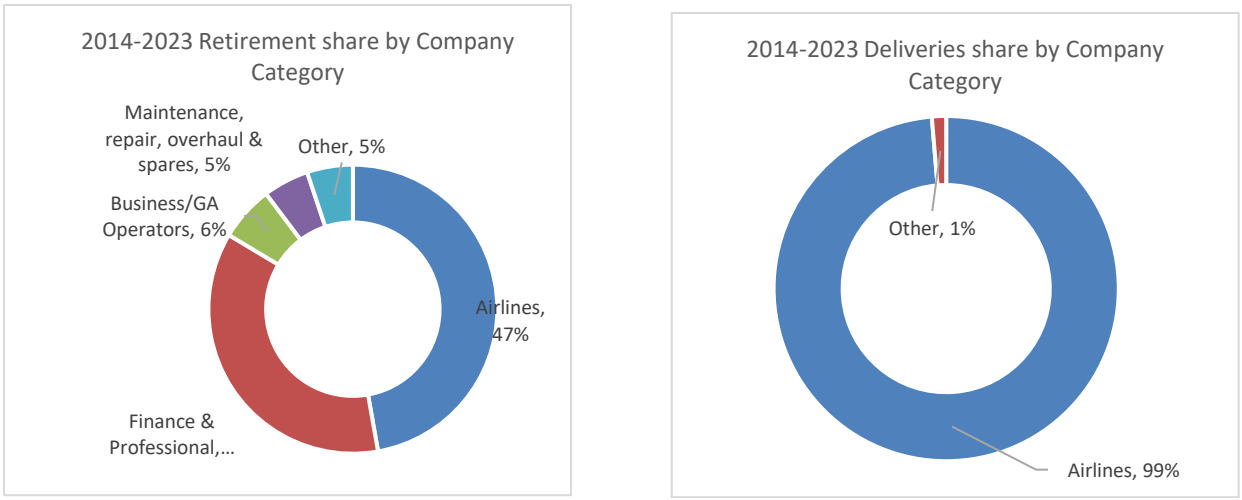

Figure 1: Delivery and retirements share by company category. Source: Cirium Fleets Analyzer.

1.2.3 Deliveries/Production rates and Retirements

Aircraft production rates and retirements can be volatile in reaction to market forces. The nature of how the GRR is calculated can lead to an unrepresentative higher ratio. The method of calculation selected is described in the below section Methods of Calculation.

A higher ratio leads to more aircraft being possibly taxonomy compliant. The application of the GRR to organisations is addressed in the section of this report - Method of Application of the GRR.

During market shocks, such as 9/11, the global financial crisis or COVID-19, both production rates and retirements are likely to react quickly. Changes within one year may not be correlated and can result in significant short-term volatility which is not representative of a long-term trend.

- **Production rates** can be cut within a 12-month window by a manufacturer to meet demand changes. Unsold manufactured airframes present a serious financial liability to an OEM. Cutting and increasing production rates can put pressure on supply chains, staffing and Airline backlogs, however OEMs have demonstrated an ability to quickly slow production to very low levels at short notice. As such, in a market demand downturn, the GRR denominator – production – can quickly decline.

- **Retirements** are based on multiple factors, a major one of which is the expected demand from airlines to operate an airframe. In a market demand downturn, one expects retirements to go up. However, many owners of aircraft, particularly those in good condition, may seek to place an aircraft in storage and wait to see how long the downturn lasts before retirement. The slowdown in production rates by OEMs (which may take years to fully recover) can lead to a shortfall in supply as market demand returns and owners may be prudent to wait years before permanently retiring an aircraft. The result is a typically more consistent number of annual retirements than deliveries.

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- **The net result** is that GRR may be volatile on a yearly basis as production may decrease quickly and take years to rebalance, while annual retirements remain more consistent. Annually calculated GRR peaks and troughs will therefore be asymmetrical, not normally distributed. The short-term bias in a downturn is likely towards a GRR above 50% (e.g.: above 80% in 2020), with a long period of lower GRR as demand picks back up at a slower pace than production recovery, delaying retirement during production rate growth.

1.3 Method of Calculation

The 10-year average will be calculated by dividing the **total number of retirements** by the **total number of deliveries** in the period (method 1 below).

This has been selected after reviewing the **two available methods** for producing a 10-year average with the goal to **reduce the annual volatility** which can be observed in the GRR.

1. **Method 1: a single 10-year ratio**

   This method calculates a GRR based on the accumulated number (total) of retirements and deliveries over the 10-year period. This method ensures that years of volatile deliveries and/or retirements have a proportionally smaller impact than years of consistently high deliveries and retirements considered as a norm as described in the section above Deliveries/Production rates and Retirements.

   As aviation market cycles are typically over multiple years and asymmetric, this method is the most conservative and representative of trends in fleet replacement.

2. **Method 2: an average of 10 annual ratios**

   This method calculates a GRR by computing the annual Replacement Ratio for each year in a 10-year period, then taking the average of the 10 ratios. The result is a GRR which is sensitive to market shocks driven by very low production rates. This method treats more volatile years of very low production and retirements equally to years of consistently high production and retirements.

   Given the asymmetric nature of retirement and deliveries following the most recent market shock, and those preceding, this method is likely to produce a less conservative GRR and be less representative of long-term trends.

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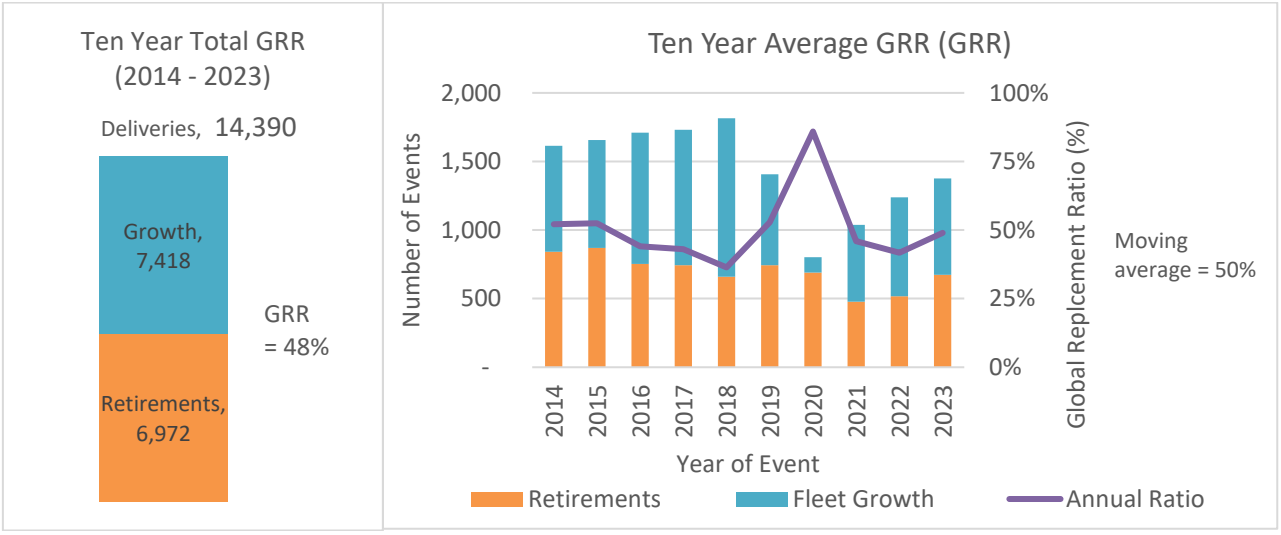

Figure 2: A single 10-year ratio (left) and 10 one-year ratios (right).

Figure 2 illustrates each method of calculation. The graph on the left represents the calculation of a GRR based on the accumulated number of deliveries and retirements in a 10-years period. On the right we have a ratio calculated based on an average of 10 one-year ratios. In this example, the unusually high one-year ratio in 2020 as a result of COVID-19 results in a two percetage points higher GRR.

1.3.1 Querying the Fleets Analyzer product for the purpose of calculating the GRR.

Annex 3 provides a series of steps to produce the Aircraft Event Detail (deliveries and retirements) data Query in the Cirium Fleets Analyzer product for the calculation of the 10-year average GRR. The complete/unfiltered dataset includes a significant amount of data not relevant to the legislation. The query process is to remove the irrelevant data for the calculation of the GRR.

The intention is to produce detailed data to be analysed in Excel after exporting from the product to calculate the total aircraft deliveries to the commercial aviation market – the number of aircraft handed over from an OEM to the initial operator, and the total number of retirements – the permanent withdrawal from use of an aircraft originally delivered to the same market in a given period. The detailed deliveries and retirement events data is produced and then exported to Excel.[4]

An example of the final result rounded to a whole percentage point is below.

Scope of Data	Deliveries	Retirement	2024 GRR (Retirements/Deliveries)
10 Years	**14,390**	**6,972**	$\frac{6,972}{14,390} = 48\%$

[4] Cirium Fleets Analyzer offers functions to aggregate the data, however in doing so, reviewing the content for missing information or erroneous included data is not possible. For the purpose of reviewing the data produced by the product, it is recommended to export the detailed information and conduct the aggregation via pivot-tables in excel.

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1.4 Method of application for the GRR

1.4.1 Application based on activity

EU taxonomy alignment requires that a manufacturer, lessor, and operator each fulfil their respective criteria. Consequently, an aircraft claimed by a lessor to be EU Taxonomy-compliant under Section 6.18. 'Leasing of Aircraft', which is then leased to an airline, cannot be automatically claimed by that airline to be EU Taxonomy-compliant. The airline will have to demonstrate the compliance with the technical screening criteria of Section 6.19. 'Passenger and freight air transport'.

1.4.2 Application to ongoing acquisitions

The GRR will be calculated at the beginning of each year to set the limit of aircraft that could be considered for replacement for the given year.

For an eligible aircraft to be Taxonomy compliant, another non-compliant aircraft in the operator's fleet must be permanently withdrawn from use (retired) or withdrawn from the fleet. The action of withdrawing an aircraft from a fleet includes the sale of an aircraft or the handing back of an aircraft on operating lease from the airline to a lessor.

The sale of an aircraft from an operator to a leasing company may be considered a permanent withdrawal from the fleet provided that the aircraft is not operated by the vendor after the sale has taken place. Should the aircraft be acquired again by the initial seller, the operator will have to demonstrate the fulfilment of the Taxonomy criteria upon the delivery to claim Taxonomy-alignment.

Permanent withdrawals from use (retirements) or from the fleet must be committed to occur within 6 months of a compliant aircraft delivery or acquisition.

- A commitment for one permanent withdrawal from use enables one aircraft to be EU Taxonomy compliant provided all other conditions are met.

- A commitment for one permanent withdrawal from the fleet enables only a portion of an aircraft equivalent to the GRR to be EU taxonomy compliant provided all other conditions are met. This portion is dictated by the GRR.

1.4.3 Application for legacy rights

Legacy rights define EU Taxonomy compliance for aircraft delivered before December 11, 2023 [date of application of the Delegated Regulation]. Eligible aircraft delivered to the operator before this date will have the 2024 GRR applied to their fleets to calculate the number of compliant aircraft. Non-eligible technology is excluded from these calculations.

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Annex 1: Excerpts from Commission Delegated Regulation (EU) 2023/2485

3.21. Manufacturing of aircraft

Description of the activity

Manufacture, repair, maintenance, overhaul, retrofitting, design, repurposing and upgrade of aircraft and aircraft parts and equipment.

The economic activities in this category could be associated with a NACE code, particularly C30.3 and C33.16, in accordance with the statistical classification of economic activities established by Regulation (EC) No 1893/2006.

Where an economic activity in this category does not fulfil the substantial contribution criterion specified in point (a) of this Section, the activity is a transitional activity as referred to in Article 10(2) of Regulation (EU) 2020/852, provided it complies with the remaining technical screening criteria set out in this Section.

Technical screening criteria

Substantial contribution to climate change mitigation

The activity manufactures, repairs, maintains, overhauls, retrofits, designs, repurposes or upgrades one of the following:

(a) the aircraft with zero direct (tailpipe) CO_2 emissions.

(b) until 31 December 2027, the aircraft, other than produced for private or commercial business aviation, meeting the margins specified below and limited by the replacement ratio to ensure that the delivery does not increase the worldwide fleet number:

(i) having maximum take-off mass greater than 5,7 t and less than or equal to 60 t and a certified metric value of CO_2 emissions of at least 11 % less than the New Type limit of the International Civil Aviation Organization (ICAO) standard*12;

(ii) having a maximum take-off mass greater than 60 t and less than or equal to 150 t and a certified metric value of CO2 emissions of at least 2 % less than the New Type limit of the ICAO standard;

(iii) having a maximum take-off mass greater than 150 t and a certified metric value of CO2 emissions of at least 1,5 % less than the New Type limit of the ICAO standard.

The share of Taxonomy compliance of eligible aircraft shall be limited by the replacement ratio. The replacement ratio shall be calculated based on the proportion of aircraft permanently withdrawn from use to aircraft delivered at the global level averaged over the preceding 10 years as evidenced by verified data available from independent data providers.

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In the absence of a certificate on the metric values of CO_2 emissions confirming the required margin to the New Type limit of the ICAO standard, the aircraft manufacturer shall deliver a declaration that the aircraft meets the required level of performance and margins of improvement with the condition that the aircraft is certified by 11 December 2026;

(c) from 1 January 2028 to 31 December 2032, the aircraft meeting the technical screening criteria set out in point (b) of this subsection that is certified to operate on 100 % blend of sustainable aviation fuels.

Do no significant harm ("DNSH")

(2) Climate change adapatation

The activity complies with the criteria set out in Appendix A to Annex I of the Delegated Act.

(3) Sustainiable use and protection of water and marine resources

The activity complies with the criteria set out in Appendix B to Annex I of the Delegated Act.

(4) Transition to a circular economy

Measures are in place to prevent generation of waste in the use phase (maintenance) and to manage any remaining waste in accordance with the waste hierarchy.

The activity assesses the availability of and, where feasible, adopts techniques that support:

(a) reuse and use of secondary raw materials and re-used components in products manufactured;

(b) design for high durability, recyclability, easy disassembly and adaptability of products manufactured;

(c) waste management that prioritises recycling over disposal in the manufacturing process;

(d) information on and traceability of substances of concern throughout the life cycle of the manufactured products.

Measures are in place to manage and recycle waste at the end-of life, including through decommissioning contractual agreements with recycling service providers, reflection in financial projections or official project documentation. These measures ensure that components and materials are segregated and treated to maximise recycling and reuse in accordance with the waste hierarchy, EU waste regulation principles and applicable regulations, in particular through the reuse and recycling of batteries and electronics and the critical raw materials therein. These measures also include the control and management of hazardous materials.

(5) Pollution prevention and control

The activity complies with the criteria set out in Appendix C to Annex I of the Delegated Act.

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The aircraft complies with Article 9(2) of Regulation (EU) 2018/1139

The aircraft referred to in points (b) and (c) of this section complies with the following standards:

a) amendment 13 of volume I (noise), Chapter 14 of Annex 16 to the Chicago Convention, where the sum of the difference at all three measurement points between the maximum noise levels and the maximum permitted noise levels specified in 14.4.1.1, 14.4.1.2 and 14.4.1.3, shall not be less than EPNdB;
b) amendment 10 of Volume II (engine emissions), Chapters 2 and 4, of Annex 16 to the Chicago Convention.

(6) Protection and restoration of biodiversity and ecosystems

The activity complies with the criteria set out in Appendix D to Annex I of the Delegated Act.

6.18. Leasing of aircraft

Description of the activity

Renting and leasing of aircraft and aircraft parts and equipment.

The economic activities in this category could be associated with a NACE code, particularly N77.35, in accordance with the statistical classification of economic activities established by Regulation (EC) No 1893/2006.

Where an economic activity in this category does not fulfil the substantial contribution criterion specified in point (a) of this Section, the activity is a transitional activity as referred to in Article 10(2) of Regulation (EU) 2020/852, provided it complies with the remaining technical screening criteria set out in this Section.

Technical screening criteria

Substantial contribution to climate change mitigation

The activity consists of renting or leasing of one of the following:

(a) the aircraft with zero direct (tailpipe) CO2 emissions;

(b) the aircraft delivered before 11 December 2023, complying with the technical screening criteria referred to in Section 3.21., subsection ‘Substantial contribution to climate change mitigation’, points (b) or (c);

(c) the aircraft delivered after 11 December 2023 complying with the technical screening criteria referred to in Section 3.21., subsection “Substantial contribution to climate change mitigation”, points (b) or (c) and with the commitment that another non-compliant aircraft in the fleet is either:

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(i) permanently withdrawn from use within 6 months of delivery of the compliant aircraft, in which case, the replacement ratio does not apply; or

(ii) permanently withdrawn from the fleet within six months of delivery of the compliant aircraft in which case the share of Taxonomy compliance of eligible aircraft is limited by the replacement ratio as set out in Section 3.21;

whereby the aircraft permanently withdrawn from use or from the fleet:

(i) is non-compliant with the margins set out in Section 3.21., subsection "Substantial contribution to climate change mitigation", point (b);

(ii) has at least 80 % of maximum take-off weight of the compliant aircraft;

(iii) has remained in the fleet within at least 12 months prior to its withdrawal;

(iv) has a proof of airworthiness dating back less than 6 months prior to the delivery of the compliant aircraft.

The lessor ensures that aircraft in point (b) or (c) is operated on sustainable aviation fuels (SAF) consistently with the criteria specified in point (d) and paragraph 2 of Section 6.19 of this Annex.

Do no significant harm ("DNSH")

(2) Climate change adapatation

The activity complies with the criteria set out in Appendix A to Annex I of the Delegated Act.

(3) Sustainiable use and protection of water and marine resources

N/A

(4) Transition to a circular economy

Measures are in place to prevent generation of waste in the use phase (maintenance) and to manage any remaining waste in accordance with the waste hierarchy.

The activity assesses the availability of and, where feasible, adopts techniques that support:

(e) reuse and use of secondary raw materials and re-used components in products manufactured;

(f) design for high durability, recyclability, easy disassembly and adaptability of products manufactured;

(g) waste management that prioritises recycling over disposal in the manufacturing process;

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(h) information on and traceability of substances of concern throughout the life cycle of the manufactured products.

Measures are in place to manage and recycle waste at the end-of life, including through decommissioning contractual agreements with recycling service providers, reflection in financial projections or official project documentation. These measures ensure that components and materials are segregated and treated to maximise recycling and reuse in accordance with the waste hierarchy, EU waste regulation principles and applicable regulations, in particular through the reuse and recycling of batteries and electronics and the critical raw materials therein. These measures also include the control and management of hazardous materials.

(5) Pollution prevention and control

The activity complies with the criteria set out in Appendix C to Annex I of the Delegated Act.

The aircraft complies with Article 9(2) of Regulation (EU) 2018/1139

The aircraft referred to in points (b) and (c) of this section complies with the following standards:

c) amendment 13 of volume I (noise), Chapter 14 of Annex 16 to the Chicago Convention, where the sum of the difference at all three measurement points between the maximum noise levels and the maximum permitted noise levels specified in 14.4.1.1, 14.4.1.2 and 14.4.1.3, shall not be less than EPNdB;
d) amendment 10 of Volume II (engine emissions), Chapters 2 and 4, of Annex 16 to the Chicago Convention.

(6) Protection and restoration of biodiversity and ecosystems

N/A

6.19. Passenger and freight air transport

Description of the activity

Purchase, financing and operation of aircraft including transport of passengers and goods.

The economic activity does not include leasing of aircraft referred to in Section 6.18.

The economic activities in this category could be associated with several NACE codes, in particular H51.1 and H51.21, in accordance with the statistical classification of economic activities established by Regulation (EC) No 1893/2006.

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Where an economic activity in this category does not fulfil the substantial contribution criterion specified in point (a) of this Section, the activity is a transitional activity as referred to in Article 10(2) of Regulation (EU) 2020/852, provided it complies with the remaining technical screening criteria set out in this section.

Technical screening criteria

Substantial contribution to climate change mitigation

The activity is performed using one of the following:

(a) the aircraft with zero direct (tailpipe) CO_2 emissions;

(b) until 31 December 2029, the aircraft acquired before 11 December 2023, complying with the technical screening criteria specified in Section 3.21., subsection "Substantial contribution to climate change mitigation", points (b) or (c);

(c) until 31 December 2029, the aircraft acquired after 11 December 2023, complying with the technical screening criteria specified in Section 3.21., subsection "Substantial contribution to climate change mitigation", points (b) or (c), and with the commitment that another non-compliant aircraft in the fleet is either:

(i) permanently withdrawn from use within 6 months of delivery of the compliant aircraft in which case, the replacement ratio does not apply; or

(ii) permanently withdrawn from the fleet within 6 months of delivery of the compliant aircraft in which case, the share of Taxonomy compliance of eligible aircraft is limited by the replacement ratio as set out in Section 3.21;

whereby the aircraft permanently withdrawn from use or from the fleet:

(i) is non-compliant with the margins defined in Section 3.21., subsection "Substantial contribution to climate change mitigation", point (b);

(ii) has at least 80 % of maximum take-off weight of the compliant aircraft;

(iii) has remained in the fleet within at least 12 months prior to its withdrawal;

(iv) has a proof of airworthiness dating back less than 6 months prior to the delivery of the compliant aircraft;

(d) from 1 January 2030, the aircraft meeting technical screening criteria specified in points (b) or (c) above and operated with a minimum share of sustainable aviation fuels (SAF), corresponding to 15 % in 2030 and increased by 2 percentage points annually thereafter;

(e) the aircraft operated with a minimum share of sustainable aviation fuels (SAF), corresponding to 5 % SAF in 2022, with the percentage of SAF increasing by 2 percentage points annually thereafter.

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The SAF use requirement referred to in points (d) and (e) is calculated with reference to the total aviation fuel used by the compliant aircraft and SAF used at the fleet level. Operators calculate compliance as the ratio of the quantity (expressed in tonnes) of SAF purchased at the fleet level divided by the total aviation fuel used by the compliant aircraft multiplied by 100. SAF are defined in a regulation on ensuring a level playing field for sustainable air transport.

Do no significant harm ("DNSH")

(2) Climate change adapatation

The activity complies with the criteria set out in Appendix A to Annex I of the Delegated Act.

(3) Sustainiable use and protection of water and marine resources

N/A

(4) Transition to a circular economy

Measures are in place to manage and recycle waste at the end-of life, including through decommissioning contractual agreements with recycling service providers, reflection in financial projections or official project documentation. These measures ensure that components and materials are segregated and treated to maximise recycling and reuse in accordance with the waste hierarchy, EU waste regulation principles and applicable regulations, in particular through the reuse and recycling of batteries and electronics and the critical raw materials therein. These measures also include the control and management of hazardous materials.

(5) Pollution prevention and control

The activity complies with the criteria set out in Appendix C to Annex I of the Delegated Act.

The aircraft complies with Article 9(2) of Regulation (EU) 2018/1139

The aircraft referred to in points (b) and (c) of this section complies with the following standards:

e) amendment 13 of volume I (noise), Chapter 14 of Annex 16 to the Chicago Convention, where the sum of the difference at all three measurement points between the maximum noise levels and the maximum permitted noise levels specified in 14.4.1.1, 14.4.1.2 and 14.4.1.3, shall not be less than EPNdB;
f) amendment 10 of Volume II (engine emissions), Chapters 2 and 4, of Annex 16 to the Chicago Convention.

(6) Protection and restoration of biodiversity and ecosystems

N/A

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Annex 2: Cirium methods of data integrity and verification

Cirium is an aviation specialist data provider within a FTSE100 corporate RELX. Its Fleets Analyzer product is recognised by industry as the most accurate independent aircraft fleets and aircraft events data available. Cirium and its predecessors have been researching and aggregating commercial aircraft fleet data for more than 50 years. Cirium presently has a team of 11 dedicated aircraft fleet data research experts.

Cirium researches aircraft delivery and retirement using a variety of primary and secondary sources. Primary sources will be the operators, owners, managers and registering authorities of aircraft. This involves building relationships with these entities who will supply data on the basis that it will be used in Cirium's data products. Some of this data can be latent by several weeks or months. Similarly, global aviation registries, typically state/government owned, can also make data publicly available, either on an open source or fee charging basis. These too have a variety of latency and update frequency, ranging from daily to annual. Cirium cross references all these sources against current data, identifying deviation so they can detect transactions involving the manufacture and delivery of aircraft, and changes of ownership, management or operation, and retirement / permanent withdrawal from service correctly. In most cases dates are provided, but where they are not, Cirium may estimate the months or periods when the events have taken place.

Secondary sources are also used to indicate transactions / retirements, but in most cases, only as prompts with primary sources used to confirm transactions / retirements. Where primary sources do or do not wish to confirm or deny the transactions / retirements, Cirium seeks to verify the details via trusted secondary sources. The media and other analytical sources may be used to confirm the accuracy of the event in most cases. Cirium does not claim 100% accuracy in any dataset and all data is supplied on an "as is, as available" basis with best research endeavours exercised at all times to render the data as accurate as possible.

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Annex 3: Cirium Fleets Analyzer Query Steps

The below steps outline how to produce the data query in the online Cirium Fleets Analyzer product, how to exclude data which is not relevant to the calculation of the replacement ratio, and how the data should be treated once extracted to produce a GRR to be applied for a given year.

To produce the data query in Cirium Fleets Analyzer:

- Go to the Aircraft Events tab of the data query product.
    - This is a section of the database that allows for data queries based on events which have occurred to aircraft. There can only be one delivery event and retirement event per aircraft in the database, therefore querying by events will produce the required data for the calculation of the replacement ratio.

Filters must be applied to remove the classifications of aircraft, operator, events and time periods which are not within the scope of the EU Taxonomy or relevant to the GRR calculation.

Apply the following filters:

- Set event date from as 01-01 and year as applicable period minus 10, for 2024 the initial year would be 2014.
- Set event date until as 31-12 and year as applicable period minus 1, for 2024 the final year is 2023.
- Appy the filter “Events”, “Event Category” and select “Deliveries (Delivered)” and “Retirements” to exclude all irrelevant aircraft events from the data.
- Apply the filter “Original Operator”; “Company Category” to include; Airlines, Operator Groups, Finance & Professional. This removes any commercial aircraft types which were not delivered to either an Airline, the holding company for an Airline Group, or a leasing company who may have taken delivery of an aircraft in advance of a lease commencement. By applying the filter to “Original Operator”, aircraft that are converted to non-commercial use and then retired in the time frame are captured in the retirement events data.
- Apply the filter “Market Grouping”, “Market Sector” and select “Commercial” to remove non-commercial aircraft types from the query. To exclude a zero-emission aircraft, the Regional Electric Market Class should be deselected in the filter menu. This filter includes the market sectors as indicated (shaded) in **Table 1**.

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Table 1: Market sector filters to be applied for “Market Sector”, “market Class” and “Market Grouping”

Market Sector	Market Class	Market Grouping
Advanced Air Mobility	Balloons	Aerobatic
Business	Business Electric	Balloons
Commercial	Business Jets	Bombers
General Aviation	Business Pistons	Business Electric - Multi Engine
Helicopters	Business Turboprops	Business Electric - Single Engine
Military Fixed-wing	Civil Piston Helicopters	Business Jets - Bizliners - Narrowbody
Tiltrotor	Civil Turbine Helicopters	Business Jets - Bizliners - Widebody
Utility Transport	Combat - Front Line	Business Jets - Large
	Combat - Support	Business Jets - Light
	General Aviation - Multi Engine	Business Jets - Long Range
	General Aviation - Single Engine	Business Jets - Midsize
	Gliders	Business Jets - Super Midsize
	Gyrocopters	Business Jets - Very Light Jets
	Military Piston Helicopters	Business Pistons - All
	Military Turbine Helicopters	Business Pistons - Multi Engine
	Narrowbody Jets	Business Pistons - Single Engine
	Regional Electric	Business Turboprops - Multi Engine
	Regional Jets	Business Turboprops - Single Engine
	Regional Turboprops	Civil Piston - Multi Engine
	Supersonic Jets	Civil Piston - Single Engine
	Tiltrotor - Civil	Civil Turbine Multi - Heavy
	Tiltrotor - Military	Civil Turbine Multi - Light
	Trainers	Civil Turbine Multi - Medium
	Utility Jets	Civil Turbine Multi - Super Medium
	Utility Pistons	Civil Turbine Multi - Very Heavy
	Utility Turboprops	Civil Turbine Single - Heavy
	Widebody Jets	Civil Turbine Single - Intermediate
	eVTOL	Civil Turbine Single - Light
		Civil Turbine Single - Medium
		Electronic warfare
		Fighters/Multi-Role
		Gliders
		Gliders - Self Launching
		Gyrocopters
		Homebuilt
		Jet Trainers
		Light Sport Aircraft

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	Military Piston Helicopters - Multi-Role
	Military Pistong Helicopters - Naval
	Military Transport - Large
	Military Transport - Medium
	Military Transport - Small
	Military Turbine Helicopters - Attack
	Military Turbine Helicopters - Multi-Role
	Military Turbine Helicopters - Naval
	Motor Gliders
	Narrowbody Jets - Intermediate
	Narrowbody Jets - Large
	Narrowbody Jets - Not Defined
	Narrowbody Jets - Small
	Patrol / Surveillance
	Piston Singles - Light
	Piston Trainers
	Piston Twins - Light
	Reconnaissance
	Regional Electric - Small
	Regional Jets - Intermediate
	Regional Jets - Large
	Regional Jets - Small
	Regional Turboprop - Intermediate
	Regional Turboprop - Large
	Regional Turboprop - Not Defined
	Regional Turboprop - Small
	Strike/Ground Attack
	Supersonic Jets - Intermediate
	Supersonic Jets - Small
	Tanker
	Tiltrotor - Civil - All
	Tiltrotor - Military - All
	Turboprop Trainers
	Ultralight
	Utility Jets - Large
	Utility Jets - Medium
	Utility Jets - Small
	Utility Pistons - Large
	Utility Pistons - Medium
	Utility Pistons - Small

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	Utility Turboprops - Large
	Utility Turboprops - Medium
	Utility Turboprops - Small
	Widebody Jets - Intermediate
	Widebody Jets - Large
	Widebody Jets - Not Defined
	Widebody Jets - Small
	eVTOL - UAV/AUS
	eVTOL - Urban Air Mobility

Exporting the data and calculate the GRR.

The Cirium Fleets Analyzer product provides options to export the data to excel (or a comparable spreadsheet product). Set the column to "Event Type" and the data to Values to a "Count of Serial Number". Optionally, set the rows to Group by Years (Event Date), this will provide insights to the annual volatility in deliveries and retirement events to better communicate the annual changes expected in the GRR. The column Grand Total will have the total deliveries and retirement events for calculating the ten-year average GRR.

Divide the 10-year total Retirement events by Deliveries events to produce the GRR. An example of the final result is below.

Year of Event	Deliveries	Retirements	Annual GRR (Retirements/Deliveries)
10 Year Total GRR	**14,390**	**6,972**	**48%**

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European Union Aviation Safety Agency

Konrad-Adenauer-Ufer 3
50668 Cologne
Germany

Web www.easa.europa.eu

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