

Aircraft age limitations have been implemented in many countries worldwide. This has been a mechanical reaction by regulators with the aim to conform with air safety standards. These limitations have impacted the trading of ageing aircraft.

The impact of age limitations on aircraft remarketability

Age limitations or restrictions implemented by regulatory authorities in about 50 countries worldwide affect or prevent the cross-border transfer (XBT) of aircraft, as defined by the International Civil Aviation Organisation (ICAO). This means an aircraft that has previously been registered in one country, cannot be imported into another country unless it is compliant with its age limitation rules.

The age limitations of each country were initially introduced by regulators to maintain the safety and airworthiness of aircraft from their previous jurisdictions that may be considered to be high risk. Similarly, there are regulators and operators in some jurisdictions that may lack the capability to undertake dependable audits of technical records for used aircraft.

An aircraft's age is not highly correlated with safe operations, but the ability to remarket aircraft in countries with age import restrictions is severely affected when such age limitation rules are implemented. Their effects on aircraft trading are illustrated here.

Definition

Age limitations are imposed by a regulatory authority setting the maximum age at which an aircraft can be added to the country's national register. They are also known as 'Non-Addition Rules'. There is no framework or guidelines on how to implement the limitations. The age limit imposed is usually arbitrary and depends on the regulator.

There are more than 40 countries now have age restrictions in place, even if they may be considered unnecessary. These age limits have been progressively

introduced following aviation safety issues that raised concerns from international bodies, including ICAO and some of the large regulators like the Federal Aviation Administration (FAA) and European Union Aviation Safety Agency (EASA).

Perhaps unsurprisingly, the existence of an age limitation rule does not effectively address the core issue of air safety or compliance. For the most part, these limitations only impair the development of the air transport industry in such countries.

Depending on the jurisdiction to which an aircraft is being transferred, age limitations can affect aircraft as young as five years old. This is an age at which an aircraft typically would not have undergone its first major base check. These limitations tend to be stricter for passenger aircraft than for cargo aircraft, although in some countries there is no differentiation. The average age limitation for those countries affected is 15 years for passenger aircraft, and 20 years for freighters.

In Indonesia, the age limitation also incorporates a further restriction on the aircraft's accumulated flight cycles (FCs), with a limit of 50,000FC. An aircraft cannot be imported to, or operated in, Indonesia if it has exceeded that threshold.

Exemptions are granted in some jurisdictions where aircraft are added to the country's national register on a case-by-case basis. These exemptions are more common for freighters than for passenger aircraft.

"The age restriction is indeed an issue for us in many transactions. It closes off markets to some aircraft in our portfolio, and has a major effect on the

development of aviation in those territories," says Juliet Hewitt, marketing director at SkyWorld Aviation, which has been involved in nearly 600 aircraft transactions worldwide since 1996. "Some types we trade naturally fall into the ageing fleet category, so implementing age limitations in certain territories has an impact on the markets that we can sell/lease to," adds Hewitt.

Implementation basis

Most countries that have imposed age limitations justify them on safety grounds. If the structural maintenance of a particular aircraft has been performed in line with the programme specified by the original equipment manufacturer (OEM), and the technical records have been properly audited, there should be no need to impose these restrictions.

Some regulators, such as Thailand's, however, have imposed age limitations as a 'proxy measure' in an effort to comply with aviation standards. This happened after the FAA downgraded Thailand from a Category 2 to Category 1 rating in 2015, following findings by ICAO during a routine safety audit. Category 1 means that the country affected is not permitted to operate flights or open new routes to the US, until its Category 2 status is reestablished.

The outcome of this audit temporarily caused China, Japan and South Korea to also ban Thai operators from conducting charter flights or adding new services to their countries. Thailand failed to regain its ranking again in 2019.

On top of this, some regulators and operators are perceived to lack the capabilities to properly audit the maintenance records of older aircraft. "If

we acquire an aircraft that has been operated for several years and then place it in another jurisdiction with a new operator, our continuing airworthiness management organisation (CAMO) and maintenance history are transferred with the aircraft to the new operator. It is standard practice that the new operator's technical team audits the aircraft's technical records," says Yuriy Tokarev, director strategy and risk at Aerovista. "I cannot recall any case when we had a problem with the transfer of records in terms of integrity and compliance."

None of the international aviation organisations like ICAO or the International Air Transport Association (IATA) have encouraged the implementation of age restrictions.

Similarly, the largest regulators (FAA in the US, EASA in Europe, Transport Canada Civil Aviation (TCCA) and National Civil Aviation Agency (ANAC) in Brazil), where the large aircraft manufacturers Airbus, Boeing, Bombardier/DeHavilland and Embraer are based, have not issued initiatives to embrace the adoption of age limitations.

"We tend to see restrictions imposed in regions where the regulatory oversight is weak or incapable of enforcing local regulations and compliance. Countries implement these limitations, hoping that they might keep an aircraft from falling

out of the sky because it is 'less worn out' and if it is 'young on paper'; meaning it has a good and traceable maintenance status," says Brian McCarthy, vice president of sales at Precision Aircraft Solutions.

If maintenance is performed in line with the OEM's maintenance programme, and the operator's approved aircraft maintenance programme (AMP), then it is not necessary to impose an age limitation. The issue is that most regulators have the capabilities to audit the operators and airlines in their jurisdiction, but unfortunately they do not have the necessary resources to show compliance.

Aircraft age and safety

ICAO has researched this topic with several studies and the participation of the Aviation Working Group (AWG) formed by the main OEMs and the largest lessors, and with insights from IATA, EASA and the FAA. In March 2017, ICAO's initiative for 'promoting safety and efficiency in cross-border transfer of aircraft (XBT)' was published.

A key finding of this working group was that there is too much inconsistency in the process for aircraft registration and XBT transactions between different countries. The different approach to

technical records and the interpretation of airworthiness has led to an increased number of jurisdictions implementing actual or de facto limitations on aircraft imports. Based on calendar age, these limitations are more restrictive than the data-driven and approved airworthiness criteria established in the applicable aircraft type certification.

The aviation industry has not fully implemented the use of electronic records.

Acceptance of analogue records scanned in PDF format would be a good start for standardising the process of importing aircraft. The ICAO March 2017 paper considers that adopting electronic paperless records that are compatible between all available maintenance functions and that incorporate common data fields and a limited number of formats, would address language, legibility, record completeness and other issues faced when adding an aircraft to a new registry in another country.

"Age limitation is the wrong approach to ensure higher safety standards. Even if a country like Indonesia implements a very strict age limitation policy, poor adherence to safety standards in maintenance and flight operation in that country cannot be improved with younger aircraft," says

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NATIONAL AGE LIMITS FOR IMPORTED AIRCRAFT

Country	Age limit years	Additional restriction
Kuwait	5 years	Importation
Iran	10 years	Importation
South Korea	10 years	Implemented by operators
Japan	10 years	Passenger and freighter
Mauritania	10 years	Importation - both passenger and freighter
Ethiopia	12 years	Assessed on a case by case basis
Taiwan	12 years	Must be deregistered after 26 years
Algeria	12 years	No imports allowed for freighters
Pakistan	12 years	Importation - both passenger and freighter
Venezuela	12 years	Ranked Cat 2 by FAA
Nepal	14 years	Importation
Brazil	15	22 years for freighters
Egypt	15 years	Importation
Mongolia	15 years	In place since 2018
Bangladesh	15 years	Importation
Indonesia	15 years	Must be deregistered after 50,000 FC
Mexico	15 years	Importation
Russia	15 years	
Turkey	15 years	20 years for freighters
Vietnam	15 years	Importation
Thailand	16 years	22 years for freighters
India	18 years	Limitation relaxed in 2019 down from 15
Myanmar	20 years	Must be deregistered after 25 years
Peru	20 years	15 years for freighters
Saudi Arabia	21 years	
Nigeria	22 years	
Bolivia	25 years	

Source: ICAO and Country Regulators

Tokarev. It is a fact that young aircraft require less maintenance work, but an aircraft maintenance programme is designed around the economic life cycle of the aircraft. “The objective of a maintenance programme is to maintain the same level of safety standards regardless of the aircraft’s age,” concludes Tokarev.

The emphasis should be on maintenance practices, and this requires coordination between regulators, OEMs; maintenance, repair and overhaul (MRO) providers; and the asset owner. The FAA and EASA require operators to implement a Corrosion Prevention and Control Programme (CPCP) in their AMPs to ensure the airworthiness of their fleets.

Many other regulators, however, have just opted for a simplistic and non-procedural approach based on aircraft age. It may therefore appear that these countries have not incorporated a CPCP into their aircraft AMPs. It is therefore easy for these countries to implement an age restriction, but it is difficult to justify.

“After all, it does not make much of a difference if an aircraft is five or 20 years old,” adds Hewitt. “Depending on its operational history, a 10-year old aircraft

could have accumulated more flight hours (FH) and FC than a 20-year old aircraft. Similarly, in some territories, age restrictions do not apply to aircraft already in operation. An operator could be flying an existing fleet of 25-year old aircraft, but be unable to import a 20-year old aircraft into it.”

Another study by the ICAO Airworthiness Assurance Working Group (AAWG), titled ‘Analysis of the Impact of Aircraft Age on Safety for Air Transport Jet Airplanes’, explored the correlation between Widespread Fatigue Damage (WFD) and an aircraft’s age.

It also analysed the operational Limits of Validity (LOV) for aircraft structures and their implications for airworthiness. These serve as limits, over which an aircraft should not be operated. LOVs can be accounted for by FH or FC. The analysis took into account western-built aircraft with maximum take-off weights (MTOWs) above 60,000lbs. The key finding of the study is that there is no correlation between the age of airframes and accident occurrence.

“In North America and Europe, the accident rates are low and there is no statistical correlation between aircraft age

and the observed accident rates,” says John Hansman, professor at the International Center for Air Transportation at the Massachusetts Institute of Technology. “The accident rate for North America is essentially flat up until 40 years of aircraft age.”

The incidence of WFD increases with age, but only a small percentage of accidents in aircraft that are older than 20 years feature aircraft age-related WFD as the root cause of an accident. WFD is not a high-risk factor on its own. The LOV approach has been adopted by the FAA, EASA and other large regulators, and is also supported by the OEMs. The LOV is the total accumulated FC or FH for which it has been determined that WFD is unlikely to occur in the aircraft structure. If through engineering and testing it is established that WFD will not occur, the LOV can be extended by the OEMs in coordination with the regulator.

There is no correlation between aircraft age and safety until year 18 of its operation, but even after this the correlation is very low at less than 0.002 fatal aircraft accidents per year.

There is another inflection point with an increase in correlation between aircraft age and accident rate on aircraft more than 27 years of age. This rise, however, is mainly driven by incidents in less developed regions, with Africa accounting for most of this variation.

The low capital costs of mid-life and mature aircraft are a big factor contributing to their deployment in countries with weaker infrastructure, crew training and regulatory oversight, and where human factors are more likely to result in an accident. “If chronological age is not a valid indicator of increased safety risk, then imposing conservative age-based import restrictions reduces the population of available aircraft and thereby increases the cost and reduces the access to air transportation for those states that impose such restrictions,” concludes Hansman.

Strictest jurisdictions

At least 50 countries have officially implemented age limitations for the XBT of aircraft (*see chart, this page*). Many other countries have not implemented age limitations, but still apply age restrictions controls. An example is China.

The most restrictive age limitation in the world has been implemented by Kuwait at five years, when an aircraft is only at the beginning of its economic life, and certainly in its first maintenance base check cycle. “Perhaps this is due to political reasons or to limit competition,” says Tokarev. At the other end of the spectrum, Nigeria and Bolivia have age restrictions for aircraft older than 22 and 25 years of age.



Even though age limitations are in place in some developed countries like Japan and Taiwan, they are more common in countries where the regulator has no reliable compliance structure or in developing countries. “Age restrictions are particularly prevalent in the Asia Pacific region, generally at 15-20 years. This is an area where there is significant geographical opportunity for regional carriers,” says Hewitt. “It is the wrong approach. There’s no safety implication for older aircraft, and this unnecessary rule is stifling growth of smaller operators and curtailing start-ups.” The implications for financing aircraft in these jurisdictions are evident. “Small, regional, and start-up carriers in an undeveloped jurisdiction simply do not have access to funds, either through loans or leasing, to invest in newer aircraft. If age limitation rules mean that they cannot bring older aircraft in instead, these carriers will find it difficult to succeed,” adds Hewitt.

South Korea has a very strict limitation capped at 10 years. It is true that for some time the safety record of airlines in South Korea was very low, but this was mainly caused by a poor crew resource management (CRM) and cockpit culture. But it was not the regulator in South Korea that implemented age limitations; it was actually the eight main carriers which jointly agreed in 2015 to restrict themselves from importing any aircraft older than 10 years into their fleets. This measure is counterintuitive, since the operators are denying themselves access to equipment in the used market, which increases their fleet acquisition costs.

India has a growing domestic aviation sector. A good percentage of India’s enormous population is concentrated in a

relatively small number of megacities, while a lot of people also live in the regions. India’s domestic aviation market has not grown at the same pace as in other developing economies. India introduced age limit restrictions more than two decades ago. They were recently relaxed to allow importation of aircraft of up to 18 years of age. This may allow the market to flourish at a faster rate and allow new entrants to better serve the needs of the domestic and regional markets.

Freighter vs passenger aircraft

The age limitations for freighter aircraft have different dynamics than passenger aircraft. Likewise, ‘Non-Addition Rules’ affect narrowbodies differently to widebodies. When a narrowbody is converted it is usually transferred to an operator in another country than that of the original operator of the feedstock, so the aircraft has to be added to the new country’s registry.

“In contrast, widebody conversions tend to remain with the original operator of the feedstock, or an operator in the same jurisdiction,” says Andy Coupland, chief executive officer at Aircraft Analytics. A key point is that age limitations for freighters tend to be more relaxed from a safety perspective, because their main function is to carry cargo, with few crew members on board.

The typical economic life of an aircraft starts as an asset deployed with a large mainline carrier. At the end of the financial term or first lease the aircraft is usually transferred to a second-tier operator, or remains with the same operator until it is fully depreciated. Then there are three avenues for the asset:

ATR aircraft have supplemental type certificates for freighter conversion. However, the age restrictions of several countries could the market for converted aircraft.

conversion, part-out, or permanent retirement from service. “Ageing aircraft are finding new roles, particularly in the freighter market, or special purpose applications (for example firebombers and reconnaissance). We are increasingly being creative in finding opportunities, particularly in the freighter market, due to fewer restrictions. For example, the ATRs and Saabs have approved supplemental type certificates (STCs) for freight conversion so can cross over into the cargo market,” adds Hewitt.

The EASA does not implement a direct restriction as such in Europe, but aircraft have to be EASA-compliant, which requires compliance with noise abatement rules and emissions. “These noise restrictions apply more to heavier, older aircraft. Fortunately to date, on the regional trading side, Skyworld has not met significant resistance to acquiring aircraft due to noise. Of course inner-city airports prefer to operate newer and quieter aircraft,” concludes Hewitt.

Access to funding and ECA

There is a challenge for operators based in countries that are not signatories to the Aviation Protocol of the Cape Town Convention. It is difficult for a carrier that operates in a jurisdiction where age limitations are in place and the Cape Town protocol does not apply, to finance aircraft.

Export Credit Agencies (ECA) provide funding for aircraft at interest rates below the minimum premium rate to countries that are signatories of the Cape Town convention. Non-signatories have to pay a premium.

Start-up and small carriers in under-developed jurisdictions are not the only airlines at a disadvantage. Mainline carriers in established markets face higher barriers accessing finance. “Age restrictions cause real hardship for flag carriers, and put them at a disadvantage in the competitive market place,” continues McCarthy. Legacy carriers in countries with booming, liberalised air industries, and growing middle classes have restricted access to credit, finance and leasing facilities.

An example of one such country is Peru. It is not a signatory of the Cape Town convention, but has seen a boom in passenger traffic due to new services being offered by low-cost carriers (LCCs)

like VivaAir, which has the backing of Irelandia Aviation, parent company to Ryanair. In fact, the carrier's A320 fleet, leased from GECAS, is under the Colombian registry, while aircraft operated for LATAM Peru are under the Chilean registry.

Tradeability of older aircraft

Age restrictions severely restrict the trading of ageing aircraft. One of the reasons behind expediting the launch of the 737-800NG conversion programme is that many markets are now blocked for converted 737 Classics. "We have lost several business opportunities due to these limitations. For example, the introduction of a 12-year limitation in Pakistan meant that we had to drop a project to source 737-300 Classics for one of the country's airlines," says Tokarev. "Aergo Capital mostly acquires aircraft from established lessors. The company had been quite active in placing 737 Classics until 2014-2015 when the availability of assets within the proper age range, generally younger than 20 years, significantly reduced. There were still a certain number of 737 Classics in operation with major airlines like Southwest, but they were in a particular specification and with a lot of accumulated FH and FC in the range of

70,000FH and 40,000FC, which caused serious additional maintenance expenses".

This type of aircraft is in the conversion threshold, but is not suitable feedstock because of the issues described. Similarly, they could still operate in passenger roles, but age restrictions are now so widespread that most markets are not viable for these aircraft.

Some jurisdictions are sourcing aircraft for remarketing purposes, but there are challenges with aircraft arriving from particular jurisdictions. "We made several attempts to deal with Japanese airlines, but their standard practice is to squeeze all resources to the last drop, so their aircraft are probably not even attractive assets even for teardown purposes," says Torakev. "When we looked at assets from Korean carriers, there is no availability. There was only one aircraft listed by one of the lessors last year."

This problem is also exacerbated by the average of fleets worldwide. "About half of the current active western-built turboprops are now older than 15 years. With the production of new aircraft cut down to just one primary manufacturer, this portion of aged aircraft will increase during the coming years, leaving a gap in the market and a virtual monopoly for only one primary OEM," adds Hewitt.

Impact on lessors & traders

The share of the leased fleet was less than 5% of the total in the early 1990s. It is projected that by 2020, nearly 50% of the world's airline fleet will be leased. As a result, the safe and efficient transfer of aircraft between borders is critical to cross-border transactions in this space.

China has the second largest aircraft fleet in the world, with about 3,200, mainly western-built, aircraft in active service. China's regulator is the Civil Aviation Authority of China (CAAC), and importation of aircraft is subject to compliance with the operations certification for large airplanes CCAR 121. "There is not a defined age limitation. All aircraft to be added to the Chinese registry will be assessed according to CCAR 121 and other related regulations. This is on the basis of individual assessment of each aircraft," says Yan Xue, member of the Board of Directors at China Merchants Bank, CMB Financial Leasing. "The importer may have to make modifications to the aircraft, and add and certify systems and equipment to meet the CCAR121 requirements, but this is usually not cost-effective."

The process of introducing a used aircraft to the Chinese registry is not just limited to imports. "During operation,



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An 26 year old ex-US Airways 757-200, converted by ST Engineering at Seletar Airport in Singapore, was successfully placed on the Chinese aircraft register. It is now in service with SF Airlines.

the operator might find it hard to import spares and maintenance items that can fulfil the CAAC's requirements," adds Xue. Overall, and despite the absence of a fixed age restriction, there may not be a good business case for introducing used passenger aircraft to the Chinese market, because of the need to comply with the CAAC's strict rules.

"An exception to this rule is passenger-to-freighter converted aircraft," continues Xue. "Many retired 757s equipped with RB211 engines that had finished their economic life as passenger aircraft in other countries have been converted to cargo aircraft following the CAAC regulations." These aircraft can be operated for as long as they comply with the airworthiness requirements set out by converted aircraft by the CAAC.

An example of this is a 757-200 airframe that was delivered in 1994 to USAirways. It was retired by American Airlines at the end of 2017, converted by ST Engineering at Seletar Airport in Singapore at the end of 2018, and returned to operation with SF Airlines as a 26-year-old converted freighter.

If the converted aircraft's depreciation profile is in line with the cost of acquisition and conversion, it can be operated until the end of its economic life for as long as it complies with the CAAC's airworthiness regulations. This is probably at year 35, which the industry accepts as the standard economic life cycle of an aircraft.

SF Airlines has a fleet of 27 757-200SF(M) aircraft with an average age of 25.5 years, with the oldest being 31 years old. It is expected that they will stay in their fleet and will be retired from service and be fully depreciated on the books

after 10 years of operation. SF Airlines has successfully inducted 757-200s in its fleet from North American and European operations in the Chinese register under an XBT. It has also acquired 757-200s from other Chinese operators. These aircraft will have completed their full useful economic life cycle when they are retired.

"Operators have been given some relief. For example, past operating pedigree can be taken into account," says McCarthy. Each regulator, where age restrictions apply, approaches them differently. "Multiple past operators can really kill an asset for import if it is close to the age of consideration," adds McCarthy.

The aircraft's past ownership is referred to as its 'pedigree'. "An aircraft that has remained in service with a single operator in a developed jurisdiction has a higher chance of being remarketed than an aircraft that has transitioned between several operators," continues McCarthy. "The same principle applies when aircraft, due to excess capacity or cash constraints, have been sub-leased to third operators. This is common in the holiday charter market, or in the case of aircraft that have been sub-leased by a carrier based in a country where demand is contracting, to a carrier in another jurisdiction where demand for air travel is booming."

The aircraft's jurisdiction also plays a role. "Assets that have been operating under EASA's jurisdiction seem to have a better acceptance," adds McCarthy. Lessors would take this into consideration when placing an aircraft into a jurisdiction with an age restriction. "The stricter the age limitation, the

younger the aircraft should be, so more expensive values and lease rates apply. When leasing or financing the aircraft we are primarily looking at the customer's creditworthiness, and the situation in the jurisdiction in case we need to repossess the aircraft," concludes Tokarev.

In summary

Age limitations have become more widespread throughout the world. Some countries implement them rigidly, others are more flexible depending on the past history of the aircraft.

There are some jurisdictions where there is no explicit age restriction, but the regulators nevertheless still apply them, and in other cases the process of importing aircraft is so difficult that their transfer is simply not economically viable. The rules tend to be harder for passenger aircraft than for freighters, but there are countries with no distinction.

There is no significant direct correlation between an aircraft's age and safe air operations. There is no methodology for implementation of age restrictions and each regulator tends to be arbitrary in applying these rules. Sometimes they are implemented only for political reasons.

Regardless, the implementation of age restrictions is a handicap to the aviation sector. They restrict the tradeability of assets and reduce an aircraft's useful economic life. In addition, the introduction of an age restriction increases the cost of procuring and funding aircraft. This is detrimental to the development of air transport in jurisdictions with booming demand for air travel, but weak regulatory capabilities. The introduction of age restrictions is compounded when a country is not a signatory of the Cape Town Convention because access to credit is harder, even through ECAs. Age restrictions affect all types of operators, depending on the country in which they are based. Age restrictions are not the right approach to safety, and can in fact undermine it, since regulators rely on age as an index for safety, and maintenance may not be properly carried out. **AC**

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