IFALPA
The Global Voice of Pilots

Position

15POS14

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Safe and Sustainable Aviation

1. Executive Summary

This "green" position paper presents IFALPA's views on sustainable and environment-friendly aviation. The purpose is to enable a structured approach to environmental matters, i.e. on noise and emissions. Higher-level principles are included as well as specific statements and expert opinions on operational measures, certification, Air Traffic Management (ATM), technology development and economic measures.

The focus point of this paper is the pilot's perspective on safety and viability of operational measures, ATM improvements and fuel saving schemes. Specific positions on airport design and operations, maintenance, new technological advances in engine and aircraft design, general aircraft weight reductions and end-of-life recycling have been deliberately excluded. These topics play, of course, a major role in improving aviation sustainability and will be mentioned in the relevant sections of this paper, but do not require a particular position from pilots.

The current political and public emphasis lies with greenhouse gas reduction and the anticipated major role of biofuel. The scope of life-cycle assessments for industry processes reaches further: energy use, greenhouse gas emissions, recyclability potential and the use of hazardous material and possibly water use and material scarcity.

2. Background

The environment and the subsequent urge for sustainable aviation have gained much attention in recent years. Whereas efforts to reduce the impact of aircraft noise and local air quality on human life have been undertaken for the last 30 years, recent goals on greenhouse gasses (GHGs) have been added. These goals are very challenging and require an industry-wide effort whilst local air quality and noise concerns continue to increase.

Environmental issues in this context include noise impact, local air quality and greenhouse gas emissions. Interdependencies between these three components necessitate a comprehensive approach. Environmental policies and activities cover many subjects, ranging from climate research, aircraft technology, operations, land-use management, and biofuel to economic measures. These topics will be addressed here one by one. It should be noted that this position paper is a living document and will be adapted to current practices and evolving insights.

3. General

IFALPA believes that, while promoting the highest level of aviation safety world-wide, a viable and expanding air transport industry can only be achieved on sustainable grounds.

Every solution for environmental benefit should be weighed according to technological and operational feasibility, economic reasonableness and environmental benefit. Safety should be the overriding principle and should not be affected negatively.

These statements are in line with the current ICAO strategic objectives. Safety, sustainability and profitability have a close relationship and should be balanced wisely.

All relevant partners including manufacturers, airlines, aerodrome operators and Air Navigation Service providers should adopt an environmental policy in order to reduce the ecological footprint and cater for future growth. The environmental goals are very challenging and require an industry-wide, long-term and coordinated effort.

4. Environmental Performance

For environmental assessment of aircraft operations, the following environmental effects have to be considered:

- Greenhouse gasses (GHGs),
- Local air quality (LAQ) and
- Aircraft noise.

Life-cycle assessments can be used for the aircraft design and production. They include energy use, recyclability, water use and use of hazardous and scarce materials.

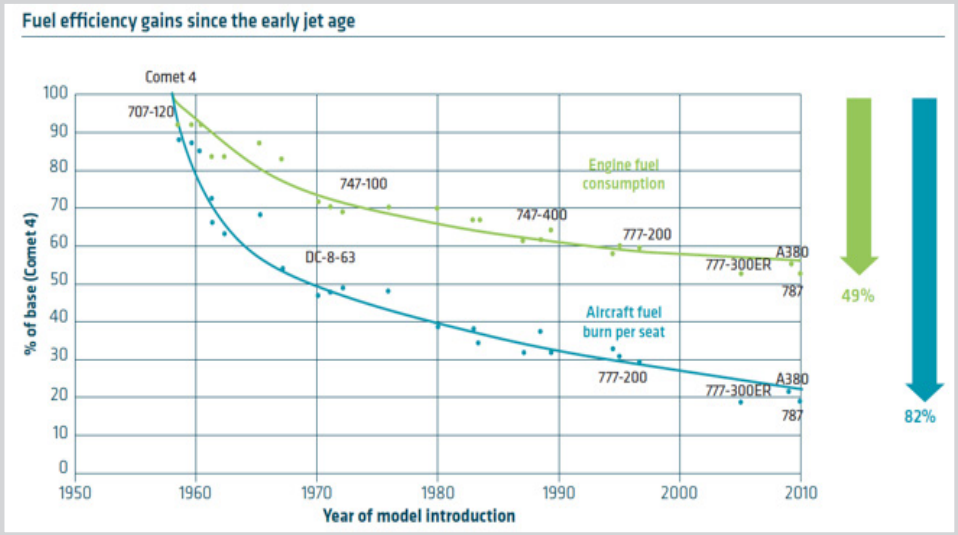

Fig. 1. ICAO Environmental Report 2010. (Source ICCAIA)

Whereas safety increments should keep track of the increase in traffic volume, the environmental performances should exceed/outnumber the increase of traffic for the mid-term predictions.

Management and policy makers should use environmental performance indicators in order to assess environmental benefits in an objective way. The target level of these indicators is subject to local and political preferences. **GHG targets should be set with international agreement.**

Fuel efficiency has increased significantly over the years. The rise in fuel prices and environmental pressure have translated into significant fuel efficiency gains over the last 4 decades. In 2012 ICAO Contracting States adopted collective goals to increase annual fuel efficiency by 2% and to limit CO_2 emissions by 2020.

For aircraft noise issues, nuisance to population within established noise contours should be the basis for any policy. This is a better indicator than contour areas alone. Health effects and annoyance impact should be further examined to accomplish an objective scheme. The impact of aircraft emissions on local air quality should be related to health and nuisance effects as well. Stringent smoke and NOx Standards already exist in ICAO and local regulations. Stringent Particulate Matter (PM) Standards are to be expected in 2016.

5. Greenhouse Gases

According to the Intergovernmental Panel on Climate Change (IPCC), aviation produces around 2% (IPEC 2001) of global, man-made, carbon emissions. As aviation grows, the IPCC forecasts that its share of global manmade CO_2 emissions will increase to around 3% by 2050.

In 2010, the ICAO Assembly adopted an overarching policy to address climate change. It sets aspirational goals for CO2 reductions for mid and long term together with the international aviation sector. All elements mentioned below will be used in a basket of measures. Standards, guidance material and the facilitation, harmonization and endorsement of State Action Plans will help to achieve these goals.

All aviation industry stakeholders – airport operators, airlines, aircraft and equipment manufacturers and ANSPs – should collaborate and share information, experience and knowledge in order to reduce GHG emissions.

The 2009 United Nations Climate Change Conference has agreed that ICAO is, indeed, the correct body to manage a framework for emissions. The global aviation sector believes that emissions from aviation should be addressed through ICAO adopting a global sectoral approach that does not distort competition among airlines, treats aviation as one indivisible sector rather than by country and takes a global approach to emissions reduction.

Efforts to reduce GHG emissions can take place in several areas:

- Technology
- Operations
- Infrastructure
- Biofuel
- Economic Measures
- Adaptation

The expected effects of these measures is depicted in Fig.2 below.

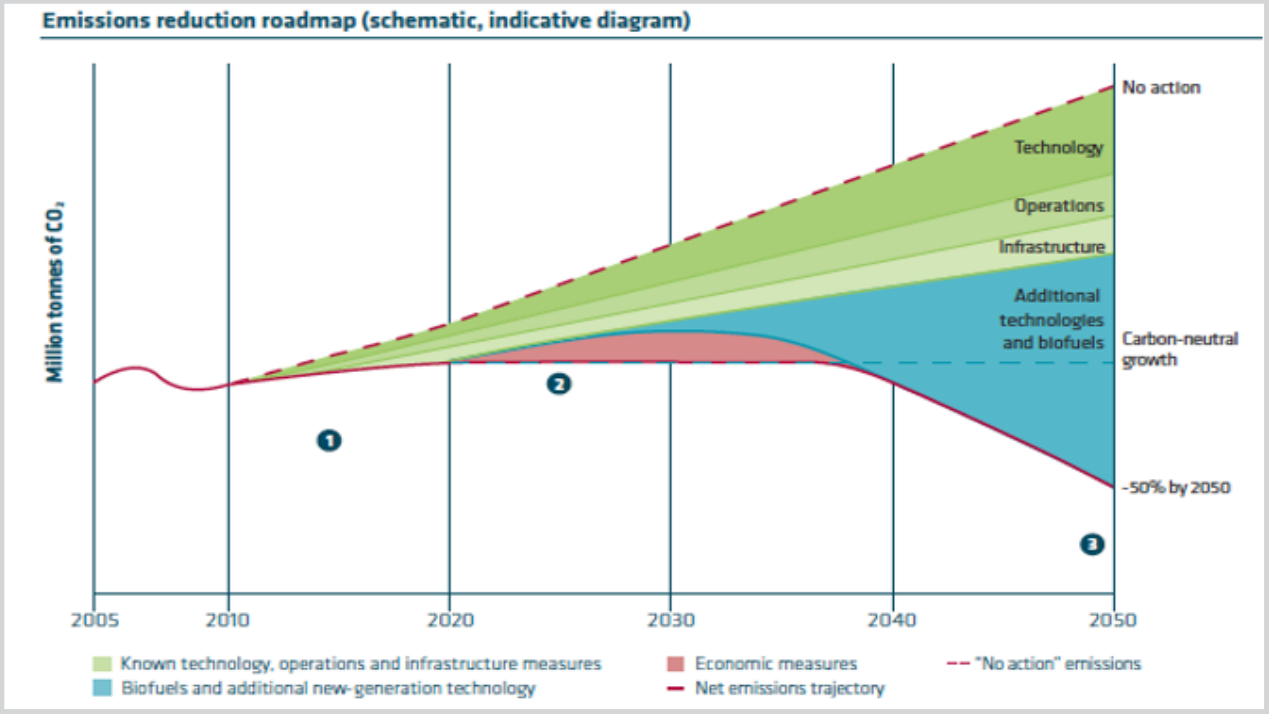

Fig. 2 Emissions reduction roadmap, source ATAG 2010.

5.1 Technology

Technology is expected to make a significant contribution to the mid-and long-term reduction of GHGs and preservation of natural resources. Examples include new production methods, end-of-life recycling, new materials and advanced aerodynamic and engine design, such as open rotor and variable geared turbofan engines. Reinforced composites have already been introduced in the airframe structure. Safety and health risks of the implementation of composites in the airframe structure, insulation or aircraft secondary parts should be assessed. Special attention should be put on cases where these composite components are or can be damaged, fractured or exposed to heat. Links between aircraft emissions and potential climate change impacts are depicted in a schematic Fig. 3.

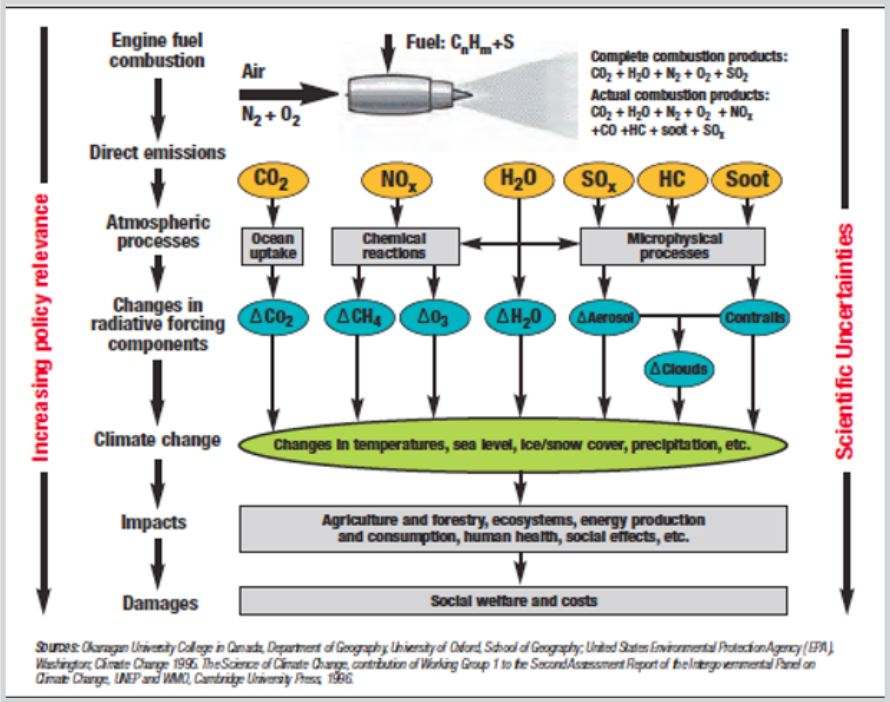

Fig. 3 Schematic representation of aircraft emissions and potential climate impacts. ICAO Environmental Report 2010.

The uncertainty of present-day radiative force from all aviation emissions should be further reduced.

A global NOx and CO_2 standard will be set through ICAO. The CO_2 metric system is a measure of aircraft fuel burn performance and therefore represents the CO_2 emissions produced by an aircraft.

A new CO_2 standard should reward fuel efficiency brought up by technological improvements in the type design of an aircraft/engine combination. The new standard should be implemented globally. The process of end-of-life aircraft recycling should be further developed.

5.2 Operations

Ground and in-flight operations can be optimised to minimize fuel use and CO_2 emissions. This should be done in a coordinated manner and should not compromise safety. ICAO Doc 10013 (Operational Opportunities to Reduce Fuel Burn and Emissions) should be used for an effective and safe approach to fuel-efficient operations. Proposed measures address weight reduction, maintenance, flight planning, ATM and operational improvements.

The following general principles should be adopted when considering operational measures to reduce aircraft fuel use and emissions (in line with ICAO Doc 10013)

- **Safety should not be affected negatively;**
- **Operational procedures should be certified and incorporated in daily operations;**
- **Actual flight procedures should be developed in accordance with the appropriate manufacturer's and operator's capabilities;**
- **Proposals should be considered within the context of the entire flight trajectory and the trajectories of other flights;**
- **Consultation and/or collaboration with the relevant stakeholders, including operational line pilots, should be part of the process from an early stage;**

- **Unacceptable, disproportionate, or adverse trade-offs should be avoided to the maximum possible extent;**
- **Opportunities to optimise the performance of the initiative through positive impacts other than fuel use and emissions (i.e. synergies) should be considered, such as flight safety, flight predictability and capacity;**
- **Appropriate assessment methods, tools, data and assumptions should be used.**

5.3 Infrastructure/Air Traffic Management

Significant fuel and emissions savings can be realised by an efficient ATM system especially in the mid-term.

The joint development of ATM should be aimed at having an interoperable, global ATM system. In 2003, the ICAO Global ATM Concept is released. The ICAO Aviation System Block Upgrades (ASBU, 2010) initiative should ensure a framework that enables a coordinated set of ATM solutions or upgrades with measurable environmental benefits.

To ensure environmental and operational efficiency, the three basic elements of ATM should be addressed and optimised: airspace management, air traffic services and air traffic flow management.

New and established technologies and concepts of operations in Communications, Navigation, and Surveillance (CNS), such as data link, Performance-Based Navigation (PBN), Automatic Dependent Surveillance (ADS), flexible use of airspace and Advanced Collaborative Decision Making (CDM) provide opportunities to improve the efficiency of ATM.

Continuous Descent Operations (CDOs) are enabled by airspace design, procedure design and facilitation by ATC, in which an arriving aircraft descends continuously, to the greatest extent possible, by employing minimum engine thrust, ideally in a low drag configuration, prior to the final approach fix/final approach point (FAF/FAP). An optimum CDO starts from the top-of-descent (TOD) and uses descent profiles that reduce controller-pilot communications, tactical ATC interventions and segments of level flight. Operational interference with Continuous Climb procedures is to be examined.

The execution of a CDO will be facilitated by ATC and is subject to pilot's discretion. The CDO cannot be mandated. Proper airspace design and ATM are essential prerequisites for efficient and safe CDO.

Standardization of CDO procedures is important for flight safety and need to be designed and presented in an unambiguous manner.

Key objectives of CDOs are: reducing noise, fuel burn/emissions and controller-pilot communication and increasing flight safety, predictability of flight path and airspace capacity. All these objectives, as well as aircraft capabilities, should be taken into consideration when designing a local flight profile.

The onboard navigation capabilities and the autoflight system should support CDOs, preferably without the need for pilot intervention during the profile descent. Ideally, the flight management computer and the navigation database should enable flight along a pre-programmed approach profile. Clearance to fly an arrival via a profile should be clearly defined and communicated (cleared via...).

Runway assignment should be in accordance with ICAO PANS-ATM, taking into account steady winds and gusts.

5.4 Biofuel

Alternative jet fuels produced from renewable sources may have reduced life cycle greenhouse gas emissions (GHG) relative to jet fuel. A lifecycle analysis (LCA) should demonstrate a net reduction in GHG emission. As such, alternative fuels could play a central role in mitigating aviation's contribution to climate change.

Main challenges are: identifying appropriate feedstocks (such as algae, jatropha, and halophytes), scaling production and assuring sufficient supply and quality.

Alternative fuel should be "drop-in" fuel and resemble conventional jet fuel characteristics and quality. Specific type, blend and characteristics of the fuel should be notified to the flight crew.

Alternative fuel should have the potential to serve as a direct replacement for conventional jet fuel, requiring little or no modification to existing infrastructure or aircraft engines.

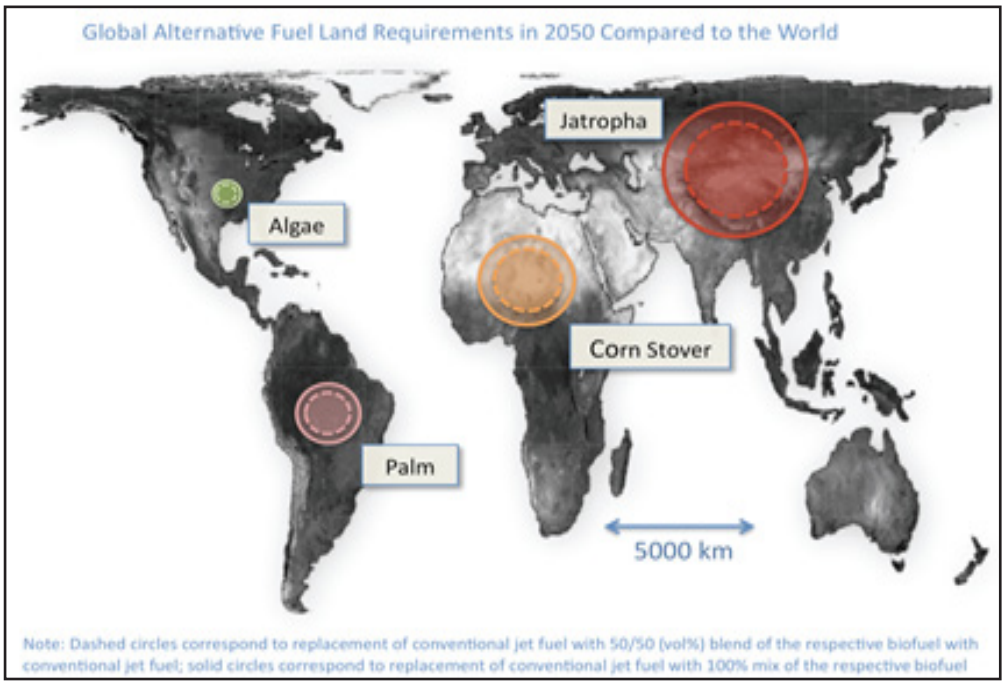

Fig 4. Land area requirements for different bio fuels to replace global conventional jet fuel use in 2050. IATA 2010.

The entry of new manufacturers, new processes and products, off-refinery blending and the relative immaturity of the aviation biofuel industry means that airlines and the aviation system will need to ensure stringent standards of quality control remain in place.

5.5 Economic Measures

The aviation industry agrees that economic measures may be necessary to close the gap to achieve the environmental goals in the mid-term. These market-based measures consist of emission trading, voluntary measures and offsetting initiatives. IFALPA notes that these economic measures should not discourage other improvements.

Exploration of the feasibility of a global Market Based Measures (MBM) scheme is not finished yet in 2012; cost effectiveness and economic distortions are to be studied. In the meantime the EU has introduced the aviation EU ETS from 2012. Other transport modalities should define similar aspirational goals and stringent Standards for GHG reduction.

Market based measures should be addressed through ICAO in a global sectoral approach that does not distort competition. Aviation is truly international. Local market distortions should be prevented.

MBM's should be effective, transparent, cost-effective, non-duplicative and economically viable.

5.6 Adaptation

Air transport should adapt to the expected variations in weather linked to global warming. Scientists generally agree that the global temperature will rise. The global goal is to limit this rise to 2 degrees Celsius. Weather patterns will change, with local precipitations, thunderstorms and cold weather storms (IPCC) all expected to intensify.

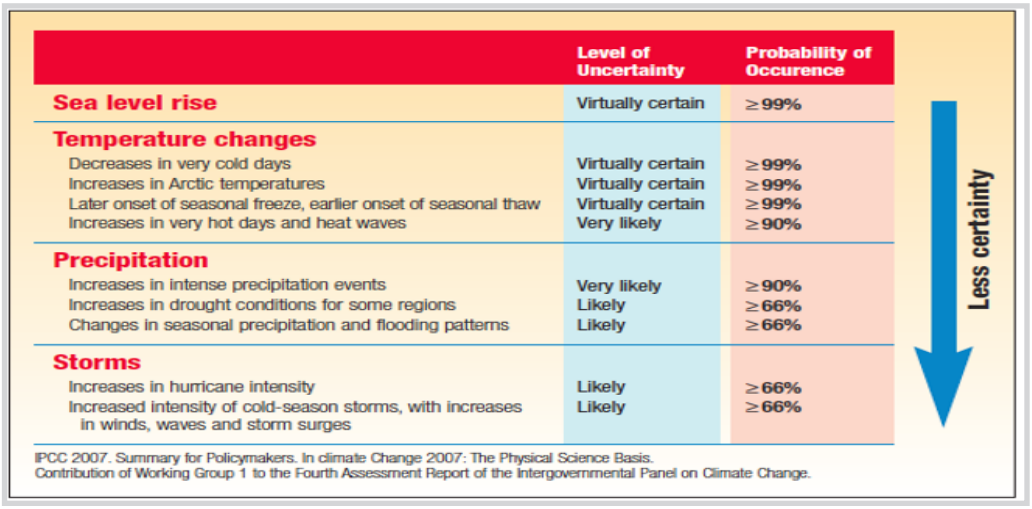

Fig 5. Impact of climate change, IPCC 2007.

6. Local Air Quality

Local air quality in the vicinity of airports should be addressed in an integrated approach for sustainable aviation.

Proven health consequences and nuisance to people should be the basis for any policy on Local Air Quality.

ICAO certification standards have been set in the past for HC (unburned hydrocarbons), CO (carbon monoxide), NOx (oxides of nitrogen) and smoke. The contribution of aircraft emissions during the landing and take-off (LTO) cycle to the overall emissions in a typical urban area is relatively small and should not be overestimated. The Standards set by ICAO are designed to ensure that they remain that way.

Standards set by ICAO, coupled with investments in technology and improved operational procedures have resulted in the near elimination of some pollutants from aircraft engine exhaust in the last decades and are allowing aviation's local air quality emissions footprint to grow at a rate much slower than the air travel growth.

Airport operations, airport layout, use of ground service equipment and ground transport offer many opportunities to reduce emissions (ICAO Circular 303). **In addition to aircraft operations, all airport-related emissions should be assessed for their environmental performance.**

A non-volatile Particulate Matter metric is developed by ICAO and a Standard for certification will be introduced in 2016.

7. Noise Abatement Measures

Environmental measures for noise abatement can be divided into four categories:

1. Reduction of noise at the source
2. Operational noise abatement procedures
3. Land-use planning
4. Operating restrictions

If local noise hindrance is being perceived, a set of balanced measures should be adopted in accordance with the ICAO Balanced Approach policy (ICAO Doc 9827).

Any one element of this set of noise abatement measures should be assessed. The resulting set should be designed to local needs, prove to be efficient and balanced. Focus on operational measures will in general lead to encroachment, noise concentration, further-out noise and less-efficient measures.

Interdependencies with fuel use and emissions are to be expected and should be assessed.

All operational stakeholders should be involved in the design and the planned execution of a local noise policy.

Aircraft operating procedures for noise abatement should be developed in consultation with the operators and all other parties, such as operational line pilots represented by IFALPA or a local Pilot Association, that use aerodrome concerned.

Authorities, operators and manufacturers should clearly identify the procedures, which are designed solely for noise abatement purposes.

Runways should not be selected for noise abatement purposes for landing operations unless they are equipped with suitable operational instrument glide path guidance, e.g. ILS, and a visual approach slope indicator system.

Regarding established operational, training and technical standards, flight safety is adversely affected by allowing increased glidepath angles for noise abatement reasons, compared to the very well standardised 3 degrees path. In order to meet the goals for a safe and consistent landing profile within all parameters longitudinally, laterally and vertically, the aircraft should be flown on a stabilized approach path that the flight crew has been trained for. The operator should specify the criteria for such stabilized approach in the operating manual.

Engine-out taxi, ie taxiing with one (or two) engine(s) shut down, can help to reduce noise, emissions and fuel use. However, aircraft were never designed for such operations, and **IFALPA opposes any mandatory Engine-out taxi (EOT) procedure,** due to the multiple safety, efficiency and operational factors that vary for every aircraft, aircraft status, airport lay-out, weather condition, surface condition and traffic load. EOT should only be carried out at pilot-in-command's discretion.

If perceived acceptable by the pilot-in-command, the EOT procedure should be conducted according approved, standardized procedures in the Operating Manual. The EOT procedure should clearly identify and address any area of potential confusion such as applicability of the MEL, responsibilities and task allocation during start up and shutdown, training items and operational considerations.

Similarly, IFALPA opposes:

- **any operating restrictions on the use of full reverse thrust for noise abatement reasons, especially on non-dry runways.**
- **Missed approach procedures that incorporate noise abatement procedures or routings.**
- **the use of a displaced start of take-off or displaced touchdown zone for noise abatement purposes alone, unless there is no degradation in the level of safety**

IFALPA supports the introduction of "soft" noise curfews instead of hard operating restrictions. Airport curfews are global or aircraft- specific partial operating restrictions that prohibit planned take-off and/or landing during an identified time period. Curfews should be tightened from the evening to the night and in reverse softened from the night to the morning to avoid the time pressure on the flight crew.

8. References

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