大会 — 第 41 届会议

技术委员会

议程项目 33：拟由技术委员会审议的其它问题

开展监管安全评估和合作，实现安全可持续性

（由新加坡和飞行安全基金会提交）

执行摘要

本文强调了为应对气候变化而采取的行动，包括为保护环境而采取的行动对航空系统造成的安全压力，并建议各国和国际民航组织做出明确的监管安全评估和监管合作安排。

行动：请大会：

a) 要求国际民航组织研究本文件中确定的监管影响评估流程中的不足之处，并指派一个适当的工作组进一步探讨可能的改进措施，制定监管安全评估指南，并请各国予以实施；和

b) 要求国际民航组织促进整个航空界理解监管合作的必要性，以解决航空领域之外气候变化应对压力造成的潜在安全影响。

战略目标：	本工作文件涉及安全和环境保护战略目标。
财务影响：	不适用
参考资料：	飞行安全基金会“安全可持续性”安全论坛的会议记录和摘要，SKYbrary，2022 年 7 月

1. 引言

1.1 可持续航空的重要性以及采取紧急行动应对气候变化及其影响的必要性正在改变民用航空。航空一方面对全球经济、社会发展、包容性、公平性和基础设施发展具有长期积极影响，另一方面航空系统在管理其环境影响问题上面临着各种压力，保持这两者之间的平衡十分重要。如果不能正确识别和平衡航空系统承受的压力，就会导致安全裕度的降低。

1.2 为了解决气候变化应对行动（包括环保行动）给航空系统带来的安全压力，在制定和实施监管政策时，需要进行明确的监管安全评估，考虑潜在的目标冲突和权衡。此外，国际民航组织的工作方案应完善与安全管理相关的规定，以支持进行明确的监管安全评估，从而解决因不同目标之间的矛盾而产生的安全压力。

2. 讨论

2.1 ICAO 的战略目标对应着联合国 17 个可持续发展目标（UN SDGs）中的 15 个目标。航空系统是全球经济、互联互通、基础设施改善以及扩大贸易和旅游业的关键推动因素。通过这种方式，航空系统极大地支持着 UN SDGs。

2.2 为确保航空系统对全球可持续发展的整体积极影响，务必要在以下两方面取得平衡：一方面是航空对全球经济、社会发展、包容性、公平性和基础设施发展的长期积极影响，另一方面是航空系统在管理其环境影响问题上的各种压力。为了实现这一目标，行业应促进和发展一种涵盖安全、环境和社会的可持续性文化，这一点至关重要。这种文化的特点是一个具有足够安全裕度的系统设计，为前端专业人员提供信息和知识，并使他们能够根据实时风险管理做出平衡的决策。

2.3 2022 年 7 月，飞行安全基金会的“安全可持续性”安全论坛确定，航空系统面临的压力来自于气候变化、应对气候变化影响而采取的行动以及为环境保护而采取的行动。该论坛的结论是，如果航空系统没有足够的韧性来妥善管理这些压力，那么这些压力就会对安全产生影响。

2.4 目前确定了可能影响航空安全的四种压力：航空系统减少碳足迹的压力、航空领域以外的气候变化发展对航空系统造成的压力、气候变化对航空系统的直接压力以及航空系统管理航空器噪音和当地空气质量的压力。本文附录中描述了这些压力。

2.5 在制定和实施监管政策时，需要进行明确的监管安全评估，考虑潜在的目标冲突和权衡，以解决因气候变化应对行动（包括环保行动）而对航空系统造成的安全压力。此外，为了解决气候变化给航空系统带来的安全压力，有必要对气候变化的安全影响进行系统和持续的评估。

2.6 监管安全评估可以是监管影响评估的一个组成部分；一种收集、组织和分析相关数据以便了解监管政策选项的影响并促进循证决策的方法。这种监管影响评估提供了一种客观、公正的评估，是政策制定的重要组成部分。监管影响评估旨在确定最佳选项，以实现规则制定活动的目标，同时尽可能减少潜在的负面影响。

2.7 但是，监管影响评估并未在全球范围内得到一致实施，也未实现标准化。此外，监管影响评估，无论在哪里实施，并不总能解决监管政策对航空安全的潜在影响。为了有效解决监管政策和规则对航空安全的影响，建议监管安全评估做到以下几点：

a) 监管安全评估成为监管影响评估的一部分，并与政策和规则制定流程相结合；

b) 与相关利害攸关方进行磋商；

c) 查明所有可能的影响 — 安全效益、有害安全影响及其综合效应；

d) 进行定性或定量评估；

e) 处理监管政策和规则制定过程的所有阶段，包括初步安全评估、监管安全评估和事后安全评估；和

f) 不仅仅包括危害识别和风险缓解，将评估范围扩大到安全压力识别和安全考虑因素的阐述。

2.8 在航空领域之外为应对气候变化而采取的行动（例如，机场附近的风力涡轮机和光伏装置）所带来的压力要求航空监管机构与相关监管机构和实体合作，以确保影响航空安全的风险得到妥善解决。这包括建立一个风险评估框架，以确保在确定风险和制定风险缓解措施时采用一致的评估标准。关键是各国应促进相关监管机构和航空监管机构的这种监管合作和特定风险分析框架。

————————

APPENDIX

POTENTIAL SAFETY EFFECTS ARISING FROM DIFFERENT PRESSURES ON THE AVIATION SYSTEM ORIGINATING FROM CLIMATE CHANGE, FROM THE ACTIONS TO COMBAT CLIMATE CHANGE'S IMPACT AND FROM ACTIONS TAKEN TO PROTECT THE ENVIRONMENT

A. Pressures on the aviation system to reduce its carbon footprints with potential safety effects are:

i. Single-engine aircraft taxi-out that could affect the safety of operations by disrupting the flight crew's normal task flow and contributing to the chance of aircraft misconfiguration and lack of or loss of critical situational awareness for the subsequent takeoff and departure;

ii. the use of sustainable aviation fuel (SAF) that could contribute to an increased chance of flame out when used by uncertified or technically unfit aircraft;

iii. pressure to reduce the fuel reserves, which could lead to reduced safety margins and increased operational pressure and workload, which, in turn, could affect decision-making and increase the likelihood of diversion, low fuel situations and associated emergencies;

iv. pressures to have most efficient flight trajectories, which could affect air traffic complexity;

v. pressure to save fuel in flight, which could lead to increased risk of turbulence encounter or increased risk of loss-of-control events;

vi. pressures to save fuel on approach; for example, by landing with idle reverse thrust, use of minimum landing flaps or late gear selection and use of continuous descent approaches that could affect the most optimal landing performance, especially if combined with other pressures like poor weather or performance-limited runways;

vii. pressures to save fuel by reducing the total lift required through aft center of gravity (CG) loading (load aftward) that could increase the risk of degraded stall recovery performance, tail tipping and tail strike;

viii. pressures to save fuel by increased takeoff and climb thrust that could increase the risk of engine wear, greater asymmetry in case of engine failure, affected contaminated runway minimum control speed and increased foreign object debris (FOD) damage on the runway;

ix. pressures to reduce aircraft-generated condensation trails (contrails) that could result in air traffic control (ATC) operational procedures to provide instruction to avoid specific contrail inductive airspace that could impact air traffic controllers' workload and increase the risk of aircraft encountering significant weather;

x. all-electric flights that could introduce pressures related to problems such as battery fire and thermal runaway, motor failure, toxic fumes, personal exposure to high voltage or current, battery energy uncertainty, battery charging safety, energy regeneration hazards, common mode failures, battery aging, and battery performance variability with temperature; and

xi. hydrogen-powered flights that could introduce pressures related to new types of fires, new infrastructure with associated procedures and technologies, fuel cell fires or explosions, new cryogenic hazards and new fueling procedures.

B. Pressures on the aviation system stemming from climate change developments outside aviation are:

xii. wind turbine installations that could create hazards for aircraft operations or for air traffic management system (ATM) – e.g., impacts on visual and instrument flight procedures; turbulence/aerodynamic effects; obstacle limits; and effects on communication, navigation and surveillance (CNS) equipment (e.g., Doppler VHS omnidirectional radio [DVOR]);

xiii. increased use of electric ground service equipment (GSE) that could change the fire vulnerability at the airport;

xiv. photovoltaic installations (PV) at buildings and on the ground within or close to the airport premises that could create hazards for aircraft operations (e.g., safety clearances on the ground, obstacle limits, effects on CNS, risk of glint and glare, runway safety and impacts on rescue firefighting services and emergency planning and management);

xv. increasing the photovoltaic installations at buildings and on the ground within or close to the airport premises that could affect firefighting tactics, equipment and reaction times when installed on the ground; and

xvi. pressure to improve biodiversity at and around airports that could increase the risk of airport wildlife hazards.

C. Pressures on the aviation system stemming directly from climate change are:

xvii. sea level rise and storm surge that could increase the risk of airports flooding and runway contamination;

xviii. temperature changes that could make more airports performance-critical in terms of current certification assumptions, affecting the required runway length, the aircraft payload and the existing safety margins;

xix. temperature changes (both cold and hot) that could lead to more frequent damages to runway surface;

xx. larger/more intense convective systems that could affect multiple hub airports and impose risk in case of mass diversions;

xxi. larger/more intense convective systems that could increase the likelihood of lightning strikes;

xxii. larger/more intense convective systems that could increase the risk of operational disruptions, including delays, re-routings, route extensions, trajectory management, flight efficiency, increased fuel burn and emissions;

xxiii. increase in both the frequency and strength of moderate and severe en route clear-air turbulence that could increase the risk of passenger and crew injuries and aircraft damage;

xxiv. more frequent significant weather phenomena such as heavy rain or more intense thunderstorms that could increase the risk of runway excursions or aircraft damage; and

xxv. changing wind patterns that could increase the possibility of runway crosswinds.

D. Pressures on the aviation system to manage aircraft noise and local air quality are: pressures to reduce aircraft noise around airports that could increase the likelihood of runway excursions, in particular in relation to operations on wet, slippery or contaminated runways, or the likelihood of bird strikes due to prolonged flight at low level or difficulties in achieving standard instrument departure (SID) procedure design gradients (e.g., with significant tail wind component aloft).

— 完 —