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EXECUTIVE COMMITTEE

Agenda Item 16: Environmental Protection – International Aviation and Climate Change

ESTABLISHMENT OF INTERNATIONAL CERTIFICATION STANDARDS FOR THE INTEGRATION OF TS-1 FUEL WITH SUSTAINABLE AVIATION FUELS (SAF) IN KAZAKHSTAN

(Presented by Kazakhstan)

EXECUTIVE SUMMARY

This working paper proposes the development of certification standards for integration of TS-1 fuel with Sustainable Aviation Fuels (SAF) for use in civil aviation within Kazakhstan. TS-1 is the primary jet fuel in this region, yet there is no International Civil Aviation Organization (ICAO)-recognized protocol for integrating it with SAF, as exists for Jet A-1 under ASTM D7566. Establishing such standards is vital to facilitate regional decarbonization, ensure operational safety, and allow Kazakhstan to align with global sustainability goals. This initiative addresses technical, economic, and regulatory challenges and proposes an ICAO-supported path forward.

Action: The Assembly is invited to:

- endorse the development of global certification standards for TS-1 and SAF integration;
- encourage ICAO to establish a working group with Kazakhstan and fuel industry stakeholders; and;
- recommend Member States to support Sustainable Aviation Fuels (SAF) adoption through policy incentives and infrastructure readiness.

<i>Strategic Goals:</i>	This working paper relates to the Strategic Goal – <i>Aviation is Environmentally Sustainable</i> .
<i>Financial implications:</i>	None
<i>References:</i>	ASTM D7566

1. INTRODUCTION

1.1 The aviation sector is facing growing global pressure to decarbonize in accordance with ICAO's Long-Term Aspirational Goal (LTAG) of achieving net-zero carbon emissions by 2050. While Jet A-1 remains the predominant aviation fuel worldwide, TS-1 continues to be the standard specification in Kazakhstan and several other Commonwealth of Independent States (CIS) countries.

1.2 This regional reliance on TS-1 introduces distinct technical and regulatory challenges in advancing the transition to Sustainable Aviation Fuels (SAF). Notably, the absence of internationally recognized certification standards for the integration of SAF with TS-1 represents a substantive barrier to decarbonization in the region.

1.3 This issue is further compounded by the substantial capital investments and operational complexities associated with upgrading existing refuelling, fuel integration, and storage infrastructure to accommodate SAF. Addressing these gaps is essential to ensuring that Kazakhstan is not excluded from the global transition toward a more sustainable aviation future.

2. PROBLEM ANALYSIS

2.1 In alignment with the International Civil Aviation Organization (ICAO)'s Long-Term Aspirational Goal (LTAG) to achieve net-zero carbon emissions from international aviation by 2050, the global transition to Sustainable Aviation Fuels (SAF) has become a strategic priority.

2.2 While ASTM D7566 provides a well-established certification pathway for the blending of SAF with Jet A-1, no such internationally recognized protocol currently exists for the blending or integration of SAF with TS-1, which remains the standard aviation turbine fuel in Kazakhstan and several other Commonwealth of Independent States (CIS) countries.

2.3 This regulatory gap presents a significant barrier to the adoption of SAF in the region, effectively limiting the ability of these States to contribute proportionately to global decarbonization efforts.

2.4 Without a harmonized certification framework for TS-1 and SAF compatibility, regional fuel supply chains, refuelling systems, and operational infrastructures remain excluded from the broader sustainable aviation ecosystem.

2.5 Addressing this shortfall is essential to ensuring an inclusive global transition and enabling the equitable participation of all ICAO Member States in achieving environmental targets. The key issues include:

- a. Safety: Potential for combustion irregularities and material degradation.
- b. Efficiency: Unknown performance of blends in colder climates and older engines.
- c. Cost: Lack of regional subsidies and infrastructure to support SAF logistics and storage.

3. PROPOSALS FOR THE ICAO ASSEMBLY

3.1 To address the regulatory and technical challenges associated with the integration of Sustainable Aviation Fuels (SAF) into TS-1-based fuel systems, Kazakhstan proposes the establishment of a dedicated multi-stakeholder task force

3.2 This initiative would bring together technical experts from Kazakhstan, representatives from ICAO, SAF technology developers, refining and fuel distribution companies (including national actors such as KazMunayGas), and other relevant stakeholders.

3.3 The task force could operate in coordination with the Eurasian Economic Commission (EEC), serving as a regional platform to facilitate cross-border cooperation and alignment.

3.4 Its mandate would include the conduct of rigorous compatibility testing for the blending of SAF—such as HEFA-SPK, ethanol-to-jet, and other approved pathways—with TS-1 fuel. In parallel, the group could evaluate engine performance, material compatibility, storage and distribution impacts, and environmental outcomes to identify safe and operationally viable blending thresholds, potentially ranging from 30% to 50%.

3.5 The task force’s findings could support the development of a harmonized, evidence-based certification framework tailored to TS-1 fuel environments, enabling Kazakhstan to advance SAF adoption without compromising safety, infrastructure integrity, or environmental ambition.

3.6 Establishing Certification Parameters

Attribute	TS-1 + SAF	Jet A-1 + SAF
<i>Certification Status</i>	Lacks formal standards	ASTM D7566 (e.g., HEFA/FT up to 50%)
<i>Chemical Stability</i>	Higher oxidation risks	Certified for HEFA-SPK, ATJ
<i>Cold Temperature Resistance</i>	Superior (~–50°C)	~–47°C
<i>Engine Compatibility</i>	Requires region-specific testing	Compatible with global engines

3.6.1 Jet A-1 SAF blends are certified and reliable. TS-1 SAF blends may offer advantages in cold environments but require further validation.

3.7 Efficiency Considerations

Criteria	TS-1 + SAF	Jet A-1 + SAF
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<i>Energy Density</i>	~43.1 MJ/kg	~43.5 MJ/kg
<i>Deposit Formation</i>	Higher (due to TS-1 aromatics)	Lower (SAF has cleansing properties)
<i>Engine Wear Data</i>	No regional data available	Validated on engines like CFM56, LEAP

3.7.1 Jet A-1 + SAF efficiency is proven. TS-1 blends require regional lab and engine tests to ensure safety and longevity.

4. ECONOMIC AND INFRASTRUCTURE FEASIBILITY

4.1 A comparative analysis of TS-1 and Jet A-1 when blended with SAF reveals significant disparities in cost, infrastructure readiness, policy support, and market integration.

4.2 These differences highlight the unique challenges faced by Kazakhstan in aligning with global SAF deployment trends and underscore the importance of developing tailored solutions for TS-1-based fuel systems.

4.3 The following table outlines key differentiating factors impacting the feasibility and scalability of SAF adoption in TS-1 versus Jet A-1 environments:

<i>Factor</i>	<i>TS-1 + SAF</i>	<i>Jet A-1 + SAF</i>
<i>Cost (30% Blend)</i>	15–20% higher than TS-1	20–25% higher than Jet A-1 (in EU/US)
<i>Logistical Needs</i>	Refinery upgrades in KZ/RU	Existing chains, but adjustments needed for CIS
<i>Government Incentives</i>	Absent	Up to \$1.5/L subsidies (EU/US)
<i>Market Reach</i>	Regional (CIS only)	Global (CORSIA, IATA-compliant)

4.4 Jet A-1 SAF blends are more economical due to scale and subsidies. TS-1 SAF blends could become feasible with dedicated CIS policy support.

5. LOGISTICS & SUPPORT MECHANISMS

5.1 The integration of Sustainable Aviation Fuels (SAF) into TS-1-based fuel systems necessitates specialized logistical solutions and support mechanisms tailored to the unique chemical and physical properties of TS-1. Unlike Jet A-1, TS-1 exhibits higher volatility and is more susceptible to oxidative degradation, particularly when blended with bio-based SAF components.

5.2 This increases the risk of fuel instability, contamination, and shelf-life reduction if not properly managed.

5.3 Currently, no internationally harmonized technical standards exist for the storage, blending, or pipeline transport of TS-1/SAF mixtures. This regulatory and infrastructure gap presents a substantial challenge for the safe and efficient distribution of SAF within TS-1-dependent regions.

6. CONCLUSION

6.1 ICAO is kindly invited to support and promote the establishment of internationally recognized certification standards for the blending and use of TS-1 aviation fuel with Sustainable Aviation Fuel (SAF), ensuring compatibility, safety, and regulatory alignment across global aviation systems.

6.2 ICAO is also invited to support the establishment of an ICAO-led international working group that includes technical experts and representatives of the Republic of Kazakhstan, fuel producers, aviation authorities, and other relevant stakeholders, with the objective of jointly addressing technical, regulatory, and logistical aspects related to the integration of Sustainable Aviation Fuel (SAF) and TS-1 fuel within the global aviation framework.

6.3 ICAO is further invited to encourage Member States to actively promote the adoption of Sustainable Aviation Fuel (SAF) by implementing supportive policy frameworks, including financial incentives, tax relief, and regulatory measures, while simultaneously investing in the development of necessary infrastructure to enable efficient production, storage, and distribution of SAF within national and regional aviation systems.

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