Sustainable Aviation Fuels
Fact Sheet 2

SAF Technical Certification

Safety is the aviation industries top priority. SAF must have the same qualities and characteristics as conventional jet fuel in order to substitute it. This is important to ensure that manufacturers do not have to redesign engines or aircraft, and that fuel suppliers and airports do not have to build new fuel delivery systems. At present, the industry is focused on producing SAF for a “drop-in” replacement to conventional jet fuel. Drop-in fuels are combined with the petroleum-based fuel either as a blend or potentially, in the future, as a 100% replacement.

Taking into consideration that aircraft can be fueled in different States, international specifications have been adopted for jet fuels. The two most widely utilized standards to ensure jet fuel is fit for purpose is American Society for Testing Materials (ASTM) standard number D1655 and DEF STAN 91-91, setting requirements for criteria such as composition, volatility, fluidity, combustion, corrosion, thermal stability, contaminants, and additives, among others.

The ‘drop-in’ condition is a major requirement for the aviation industry. Any aviation alternative fuel that doesn't meet this condition would present safety issues associated with risks of mishandling, and would require a parallel infrastructure to be implemented in all connected airports, creating unnecessary risks and costs. The standard regulating the technical certification of SAF is ASTM D7566. This evaluates which technologies, under which circumstances and characteristics, can be used for producing fuels that are considered compliant with ASTM D1655 (standard Jet A1) and therefore with DEF STAN 91-91, indirectly.

Practically, a SAF is produced in a bio-refinery, then blended up to the maximum certified blending limit and upon release from blending is certified to ASTM d1655 and from this point is regarded as conventional Jet A or Jet A1 kerosene.

Figure 2 shows the five technologies or pathways that can currently produce drop-in SAFs. These technologies are Fischer-Tropsch (FT), Fischer-Tropsch containing aromatics (FT-SKA), Hydroprocessed Esters and Fatty Acids (HEFA), Direct Sugars to Hydrocarbons producing Synthetic Iso-Paraffins (SIP), and Alcohol-to-Jet (ATJ) which includes isobutanol and ethanol. Many additional technologies are under evaluation by ASTM.

<table>
<thead>
<tr>
<th>Technology</th>
<th>Maximum blend (%v/v)</th>
<th>Feedstocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>FT &amp; FT-SKA</td>
<td>50</td>
<td>Wastes (MSW, etc.), coal, gas, sawdust</td>
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<tr>
<td>HEFA</td>
<td>50</td>
<td>Vegetable oils: palm, camelina, jatropha, used cooking oil.</td>
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<tr>
<td>Synthesized Iso-Paraffin</td>
<td>10</td>
<td>Sugarcane, sugar beet</td>
</tr>
<tr>
<td>ATJ (Isobutanol and Ethanol)</td>
<td>50</td>
<td>Sugarcane, sugar beet, sawdust, lignocellulosic residues (straw)</td>
</tr>
</tbody>
</table>

Figure 1: Current technologies, maximum blend allowed and most common feedstocks for drop-in SAFs as defined under standard ASTM D7566. Source: Adapted from ICAO CAAF/2-WP/7.
SAF technical certifications pathways

At present, the key criteria for industry is the ability of the SAF to be dropped-in to conventional jet fuel, with a maximum limit of 50% of the blend.

Fischer Tropsch synthesized isoparaffinic kerosene (FT-SPK) was approved by ASTM for incorporation into ASTM D7566 in September, 2009. In the FT-SPK process, coal, natural gas, or biomass feed stocks are gasified into a syngas comprised of hydrogen and carbon monoxide. This syngas is then catalytically converted to a liquid hydrocarbon fuel blending component in the FT reactor. And Fischer Tropsch synthesized kerosene with aromatics (FT-SPK/A) was approved by ASTM for incorporation into ASTM D7566 in November, 2015. FT-SPK/A is a variation of the FT process where a fully-synthetic alternative aviation fuel containing aromatics is produced.

Synthesized iso-paraffins (SIP) was approved by ASTM for incorporation into ASTM D7566 in July, 2014. The SIP process utilizes a fermentation to convert a sugar feed stock into a hydrocarbon molecule that can be blended into conventional jet fuel.

Hydroprocessed fatty acid esters and fatty acids (HEFA) was approved by ASTM for incorporation into ASTM D7566 in June, 2011. In the HEFA process, lipid feedstocks such as plant or algae oils, tallow (animal fats), or waste greases such as cooking oils are deoxygenated and then hydroprocessed to produce a pure hydrocarbon fuel blending component.

Alcohol to jet (ATJ) was approved by ASTM for incorporation into ASTM D7566 in April 2016. The ATJ process utilizes dehydration, oligomerization, and hydro processing to convert alcohol feed stocks to a pure hydrocarbon fuel blending component. In April 2018 Ethanol was included as an ATJ feedstock with a blend limit of 50%.

For further information or additional clarification please visit website: https://www.iata.org/whatwedo/environment/Pages/sustainable-alternative-jet-fuels.aspx
Or contact Robert Boyd (boydr@iata.org)