55th CONFERENCE OF DIRECTORS GENERAL OF CIVIL AVIATION ASIA AND PACIFIC REGION

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AGENDA ITEM 7: AVIATION AND ENVIRONMENT

SUSTAINABLE AVIATION FUEL AND INDIAN CIVIL AVIATION

Presented by India

INFORMATION PAPER

SUMMARY

This Information Paper deals with the first demonstration flight in Indian civil aviation using sustainable aviation fuel. The paper describes about the entire process of deriving such biofuels from the raw material to having a successful flight, its environmental benefits and challenges.

SUSTAINABLE AVIATION FUEL AND INDIAN CIVIL AVIATION

1. INTRODUCTION

1.1 Aviation plays a key role in the economic prosperity of a nation, besides providing a worldwide rapid transportation network. It facilitates tourism by taking persons from one country to another and contributes significantly to world trade. However, it also poses challenges due to adverse impact on the environment. The emissions from aircraft engine are similar to that of any ground vehicles, however, it is different from other emissions as the majority of emissions occurs at high altitude and their influence on the atmosphere can be highly localized.

1.2 Owing to the fluctuation in the price of ATF, the decreasing stock of conventional fossil fuel and its adverse impact on environment, aviation industry is working to have an alternate solution for propelling the aircraft that can substitute the conventional fossil fuel with minimum impact on environment. Sustainable aviation fuels or biofuels have shown promising future in substituting conventional fossil fuel used in aviation.

1.3 Biomass-derived jet (biojet) fuel has become a key element in the aviation industry's strategy to reduce operating costs and environmental impacts. Researchers from the oil -refining industry, aviation industry, government, biofuel companies, agricultural organizations, and academia are working toward developing commercially viable and sustainable processes that produce long-lasting renewable jet fuels with low production costs and low greenhouse gas emissions. Additionally, jet fuels must meet ASTM International specifications and potentially be a 100% drop-in replacement for the current petroleum jet fuel. The combustion characteristics and engine tests demonstrate the benefits of running the aviation gas turbine with biojet fuels.

1.4 ASTM certification is required before airlines can use a fuel for commercial flights. As of May 2016, the American Society for Testing and Materials (ASTM) had certified four different technology pathways to produce bio-jet fuels, which are:

- Fischer-Tropsch method (FT), using municipal solid waste (MSW) or woody biomass as feedstock.
- Hydroprocessed Esters and Fatty Acids (HEFA bio-jet), using oleochemical feed stocks such as oil and fats.
- Synthesised Iso-Paraffinic fuels (SIP), formerly known as the direct sugars-to-hydrocarbon route (farnesane).
- Alcohol-to-jet based on isobutene (ATJ).

1.5 Using biofuels for commercial aviation is not an easy job and possesses significant technical challenges. The fuel has to be of high performance fuel that can withstand a range of operational conditions, can directly substitute traditional jet fuel, can meet the stringent aviation requirements and does not compromise with the safety aspects as well. Safety being the top priority, testing of potential new fuels for aviation purposes is particularly rigorous. Biofuels testing is imperative to determine its suitability for aviation purposes through testing in laboratories, in equipment on the ground and under extreme operating conditions through flight tests.

2. DISCUSSION

2.1 Indian Institute of Petroleum (IIP), a Dehradun based CSIR laboratory (Government owned) is the first institute in India to produce high quality biojet fuel from jatropha curcas oil for aviation purposes. This fuel has been found to meet all specifications as per ASTM D 1655 and ASTM D7566 for Jet A-1 fuel (ATF).

2.2 IIP has developed a single-step catalytic process for conversion of plant-based non-edible, waste, low-cost oils to produce drop-in biofuel for aviation purposes. Plant derived oils including used cooking oil, jatropha, karanja, algal, etc, are deoxygenated, selectively cracked and isomerized over a single catalyst to produce aviation fuel with 25-75% yield and with properties and composition exactly same as those required for aviation fuel. It is a unique single-step process to produce aviation fuel from a renewable source.

2.3 DGCA India identified SpiceJet Airlines, a Low Cost Carrier, operating a mix of Bombardier Dash8 Q400 and Boeing 737 aircraft to collaborate with IIP and allowed operation of one of its Q400 aircraft using a 25% blend of biofuel manufactured by IIP on one engine. The non-revenue flight was operated on 27 Aug 2018 from Dehradun Airport (VIDN) to Delhi Airport (VIDP) at 1,154 hours.

2.4 The aircraft and the engines behaved immaculately. The engine ran smoothly and all the engine parameters viz. ITT, torque, Np, Nh, NL, maximum operating pressure, maximum operating temperature, etc. were observed normal during the flight that took around 54 minutes and no adverse performance was noticed.

3. ACTION BY THE CONFERENCE

3.1 The Conference in invited to note information contained in this paper.

a) States shall encourage using of biofuels from the ASTM approved process as sustainable aviation fuel to reduce carbon emissions from aircraft operations,

b) Sustainable aviation fuels can potentially reduce GHG emissions compared to the fossil-based jet fuel.

c) ICAO may establish specific policies to promote bio-jet in order to achieve its 2020 and 2050 targets for GHG emissions reductions.

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