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‘SWADESHI’ BIO-JET FUEL PROJECT - A SUCCESS STORY OF THE IAF

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Background

The use of Bio-jet fuel in military and civil aviation is now a tested and accepted concept across many nations. For instance, the United States Air Force has been using Bio-jet fuel since 2010. Their aim is to replace 50% of the kerosene-based Aviation Turbine Fuel (ATF) with synthetic fuel, across its major fighter and transport fleets. Likewise, many other countries like Brazil, Mexico, Germany, Australia, Singapore and China have tested their own versions of Bio-jet fuels on commercial aircraft.

In the wake of the adverse impact of an increasing carbon footprint to the environment, it should be the endeavour of every country to reduce its carbon footprint. The International Civil Aviation Organisation's (ICAO) Carbon Offset and Reduction Scheme for International Aviation (CORSIA) scheme is currently voluntary for all countries till 2026. Thereafter, all aircraft operators would have to declare their carbon emissions and pay a carbon tax as penalty for the damage caused to the environment.

Necessity of Embracing Bio-jet Fuel

In 2016, the Hon'ble Prime Minister had directed all energy-consuming Ministries to reduce their energy consumption by 10% by the year 2022. Based on the consequent directions from the Ministry of Defence, the Bio-jet fuel project was conceived by IAF in January 2018. In May 2019, the IAF leadership took a decision of holistically implementing the green fuel technology in the IAF. The IAF became a torchbearer and a guiding light for the country when it embraced the Bio-jet fuel project as a technology

demonstrator. A high level Executive Committee has been formed in the IAF to monitor the timebound progress of this prestigious project.

Given the quantum of flying carried out by the IAF, its ATF consumption is quite large. If we include the nonmilitary ATF requirement of the country (5,35,900 tonnes in 2021 and 6,15,400 tonnes in 2019), with the military's requirement, the net consumption of ATF by the country is quite high. This annual ATF consumption is growing every year due to the increasing demands of the aviation sector.

Conceptualisation of Bio-jet Fuel Project

The project was conceptualised in January 2018 by the IAF as a technology demonstrator project to showcase that this technology can be gainfully utilised by the country to cut down on its carbon emissions, while reducing its dependency on fossil fuels. To assist the IAF in its endeavour, a technologically-capable partner was found in CSIR-IIP (Council of Scientific and Industrial Research – Indian Institute of Petroleum) Dehradun. To strengthen the partnership and take first step towards accomplishment, a contract was formally signed in October 2018, to produce 8,700 Ltrs of Bio-jet fuel.

Technology in Use at CSIR-IIP

The present technology can be used with multiple feeds like used cooking oil, Jatropha plant, Pongamia, Sapium, etc. The technology to produce Bio-jet fuel entails a two-step process involving Isomerisation (changing physical and chemical properties) and Cracking (breaking hydrocarbons into

smaller useful substances). The Indian technology used to produce Bio-jet fuel is a single step process wherein multiple reactions take place inside a single reactor. The typical yield of Bio-jet fuel on an average is 25-35%, with other useful by-products like green diesel and naphtha (used for boosting octane in R and D studies).

The gainful utilisation of the by-products of this process can be appreciated by the fact that the green diesel so-produced has been successfully utilised by CSIR-IIP to run a passenger car for more than 4,000 kilometres till date, entailing carbon reductions to the tune of 30%.

Flying Trials on AN-32 Aircraft

For the evaluation of aviation Bio-jet fuel, an AN-32 aircraft was shortlisted and a task force having expertise in diversified applications was handpicked. Detailed qualifying procedures were then chalked out. The procedures included ascertaining the effect of Bio-jet fuel on the rubberised seals and fuel-related components of the aeroengine. After obtaining positive results, the aero-engine was then subjected to engine test-bed runs following which a detailed performance evaluation was carried out. To build confidence prior to the first flight, elaborate ground runs were undertaken. The results of the ground run were satisfactory which ultimately gave confidence for the successful flight trials.

Successful Milestones

An important milestone for the IAF was attained when the lead AN-32 aircraft flew with one engine using 10% Bio-jet fuel during the flypast of 26 January 2019. Another milestone was the landing at Leh airfield on 31 January 2020, wherein both engines utilised 10% Bio-jet fuel. Till date, the AN-32 aircraft has successfully flown approximately 65 hours on the Bio-jet fuel. After extensive checks in labs, the 10:90 blend mix of Bio-jet - ATF was found to be meeting IS-1571:2018 specifications (Defence) which is equivalent to the conventional ATF specifications. The IAF has obtained a provisional clearance for utilisation of this 10:90 mix from the Centre for Military Airworthiness and Certification (CEMILAC) which is valid till November 2023. The aircraft and aero-engine operating parameters that were obtained during flight trials were similar to those obtained when the AN-32 aircraft is flown purely with ATF. The Hon'ble Prime Minister made a specific mention of the landing at Leh during the "**Mann Ki Baat**" episode aired on 31 January 2020.

Futuristic Implementation

After successful trials on the AN-32 aircraft, the endeavour of the IAF is to test the Bio-jet fuel on other weapon platforms like ALH, Mi-17, LCA Tejas, MiG-29, etc in a phased manner. After clearance of the 10:90 ratio of the Bio-jet fuel and ATF in multiple platforms, the IAF plans to further enhance the experimentation with a higher blend mix of up to 50:50 ratio. All experiments and testing done by the IAF has thus far been utilising the indigenously produced Bio-jet fuel from CSIR-IIP, Dehradun. The future schedule of testing has been paced according to the rate of production of the Bio-jet fuel.

Operationalisation of First Mass Bio-jet Fuel Manufacturing Plant

After the success of the IAF's Bio-jet fuel project, a need was felt to fast track the setting up of the first mass production Bio-jet fuel plant. The IAF has assisted the Govt of India towards accomplishing the following:

- Successful transfer of technology for production of Bio-jet fuel from CSIR-IIP, Dehradun to MRPL (Mangalore Refineries and Petrochemicals Ltd).
- The IAF and MRPL were given an opportunity to give presentations to members from the Ministry of Petroleum and Natural Gas and members of the Civil Aviation Industry in a Seminar organised in September 2022 on the advantages of the country's first mass Bio-jet fuel plant coming up at Mangalore.

It is understood that the country's first plant would be operational by the second quarter of 2025. The plant would have a capacity of producing 20 KL per day or about 600 KL/ month. This would be a huge achievement for the country but would require convergence of all stakeholders. It is heartening to add that the Indian Oil Corporation, has given a commitment to set up a refinery at Panipat for Bio-jet fuel by 2026.

Way Ahead

After having successfully demonstrated the IAF's capability in the Bio-jet fuel project, the following is recommended to expand the usage of Bio-jet fuel in the country:

- A national level committee be formed which should be entrusted to look after the timely

roll out of the first mass production plant at Mangalore.

- Availability of raw material i.e. feed stock would be of paramount importance for the long term sustenance of Bio-jet fuel plants in the country. The national level committee should work towards the promotion of the same in the agricultural sector wherein timely availability of feed stock at a reduced cost could be addressed.

- To derive maximum benefits of this technology, more mass production Bio-jet fuel plants would need to be set up in the country.

If we take into account the carbon offsets that would be achieved, the actual savings would be significant for the nation. Let us all be aligned to this national cause and together do our bit sincerely to make this national vision a reality soon...

"The day will not be far when we finally see India as becoming a global exporter of 'Swadeshi' Bio-jet fuel".

-Jai Hind!!!