

CSIR-National Aerospace Laboratories – Propelling Indian Aerospace Industry



National Aerospace Laboratories (CSIR-NAL) is India's premier R&D establishment with the mandate for the development of Civil Aircraft and Aerospace Technologies. CSIR-NAL is a constituent of the Council of Scientific & Industrial Research (CSIR) under the aegis of the Ministry of Science & Technology. Currently, the laboratory has taken up major aircraft programmes like two-seater flying trainer (Hansa-NG) and Multi-Role Light Transport Aircraft (19 seat SARAS-Mk II) to enhance the air connectivity under Govt. of India's UDAN scheme. The aircraft programs aim to meet the country's civil aviation requirements and to synergize the multidisciplinary expertise of the laboratory meeting the objectives of Atmanirbhar Bharat. said Jitendra J Jadhav, Director, NAL in this interview.

Jitendra J Jadhav
Director, NAL

Could you please brief us on the latest developments of the SARAS-Mk II aircraft project?

SARAS-Mk II aircraft specifications have been evolved through the interactions with Airline Operators and Armed Forces to meet their current operational requirements. When I took charge as a Director in June 2016, we revived the SARAS programme by modifying the SARAS PT1 to comply with the safety requirements and improvements in handling qualities, engine asymmetry, Nacelle performance etc. The modified SARAS named SARAS PT1N had made its maiden flight on 24th January 2018. Subsequently, we made about 26 flights to collect the data which is being used for designing the SARAS-Mk II. Based on the Airline and Armed Forces requirement and the flight data, we carried out the feasibility study including the market survey of SARAS-Mk II and submitted the proposal to Govt. The Govt. of India sanctioned the project in June 2019.

SARAS-Mk II is a 19 Seat Light Transport Aircraft with multirole capabilities like Passenger transport, Troop transport, VIP

transport and Casevac (Air Ambulance). The aircraft is exclusively designed for operations from short runways, hot and high airfields, and semi-prepared runways for connecting Tier 1 & Tier 2 cities/towns. SARAS-Mk II is one of the unique aircraft where operational benefits are maximized through the Pressurised Cabin, Digital antiskid braking, Autopilot with Cat II landing, two lever engine operation, Lightweight materials etc., keeping cost minimum.

At present, the SARAS-Mk II programme has completed the wind tunnel studies

and preliminary design of all the systems. We also realized all high fidelity test facilities to reduce the flight test efforts where the majority of test points can be demonstrated on the ground. The design is carried out with extensive use of digital tools like 3D platforms, virtual reality, advanced Catia and PLM to reduce the design efforts. The aircraft has been designed for ease of manufacturing and assembly with the use of dynamic digital mockup tools (DMU) to reduce assembly and maintenance time. The establishment of a dynamic high fidelity simulator



to evaluate the aircraft performance including handling qualities, controllability, stability, autopilot, crosswind landing etc with the pilot-in-loop has aided to optimize & accelerate the design cycle time.

Armed Forces have already committed a few numbers for initial induction. The aircraft will be compiled to FAR 23 standards and will be certified by DGCA and CEMILAC for Civil and Military use. The first flight is likely to be in June 2024 and the production will be from 2026-27 onwards at HAL. The SARAS MKII will be a game-changer to boost air connectivity under the UDAN scheme.

It has been revealed that Hansa-NG aircraft is flying in Wings India 2022. What prospects do you foresee by participating in the premier air show?

HANSA-NG is one of the most advanced flying trainer powered by Rotax Digital Control Engine with unique features like Just-In-Time Prepreg (JIPREG) Composite lightweight Airframe, Glass Cockpit, Bubble Canopy with wide panoramic view, electrically operated flaps, etc. HANSA-NG is designed to meet the Indian flying club needs and it is an ideal aircraft for Commercial Pilot Licensing (CPL) due to its low cost and low fuel consumption. We have already received more than 80 nos. of Lols (Letter of Intents) from various flying clubs.

Hansa-NG aircraft had a successful maiden flight on 3rd September 2021. The aircraft has completed 38 flights including sea-level trials at Puducherry; over 50 hours of flying is completed and a few more flights will be conducted before getting Type Certification by DGCA.

CSIR- NAL will be demonstrating the flying display of indigenous Hansa-NG in Wings India 2022 to benefit Indian Flying Clubs as well as other customer applications like bird reconnaissance at airfields, cadet training, coastal surveillance, and hobby flying.

We will be showcasing the HANSA-NG with a fully loaded cockpit with comfort hosiery, Bubble canopy with wide panoramic view, digital glass cockpit including flight demo so that the flying club instructors/owners can get a feel of the aircraft and we are looking forward to the conversion of existing Lol into firm orders. We have established the partnership



Hansa -NG First Flight

model with industries to provide end-to-end solutions to our launch customers like sales, leasing and support after sales till the production partner gears up. We will also look for some export avenues during this event.

NAL is also the lead agency for the country's Regional Transport Aircraft (RTA) what are your plans?

CSIR-NAL is working on the feasibility

class BVLOS (Beyond Visual Line of Sight) multi-copter UAV. The UAV is made out of a lightweight carbon fiber foldable structure for ease of transportation and has unique features like autonomous guidance through dual redundant MEMS-based digital Autopilot with advanced flight instrumentation systems. DGCA, Ministry of Civil Aviation, Govt. of India has granted conditional permission to CSIR-NAL for conducting BVLOS flight



Indian RTA model

of the development of Regional Transport Aircraft since 2018. The requirements are evolved through interactions with Airline Operators and Armed Forces. The aircraft will have 90 seat capacity and can be adaptable to military transport aircraft by modification in the rear fuselage. The proposal has been submitted to the Government and we are expecting in-principle approval to initiate the project definition phase shortly.

Tell us about the UAV programs of NAL.

CSIR-NAL has developed a medium-

trials on 13th Sept 2021. Subsequently, the NAL drone has completed about 50 hrs of flying to verify the performance parameters and the report is being submitted to MoCA for type approval.

NAL's octocopter can carry a payload up to 20 kg with a hovering endurance of 40 minutes. It can fly at an operational altitude of 500 m AGL and a maximum flying speed of 36 kmph. Its regulatory compliance includes DGCA-NPNT, Geo-fencing, and digital sky with 360 degrees Collision avoidance making it one of the best UAVs in its class.



The uniqueness of this UAV is its higher payload and higher endurance which is perfect for last-mile delivery, floriculture mapping, geo exploration, precision agriculture pesticide spraying and medical transport at remote places. NAL has demonstrated these capabilities to Govt. authorities all over India. Technology is being transferred to private industries to build about 100-200 drones per month.

Could you tell us about other major path-breaking research in aerospace technologies by NAL?

NAL currently has taken major steps in deep technology innovations like intermediate modulus grade carbon fiber, carbon prepreg, special coatings for aerospace applications, Cf-SIC composites,

Just-In-time-Pre-preg, thermoplastic composites, ARINC 818 IP core, etc.

NAL has also taken up the development

of High Altitude Platforms (HAP) for applications like broadband communication, surveillance, earth observation, climate research etc. HAP is a solar-powered UAV with Beyond Visual Line of sight operation capability. The subscale model will fly by Aug 2022 to evaluate the Reynold Number effects, flight mechanics, stability and control as well as avionics & autopilot performance. The functional subscale model prototype is being demonstrated at Wings India 2022. The Proof-of-Concept of full-scale HAP will be demonstrated at a height of 20km with 2 hrs endurance by March 2024.

HAP will be a game-changer to work as a pseudo satellite for telecommunication applications in the 5G & 6G spectrum with advantages like low data latency, high bandwidth, the flexibility of launch and low cost.



CSIR-NAL's High Altitude Platform Vehicle