

PROBLEM STATEMENT AND BUSINESS OPPORTUNITIES – INDIAN AIR FORCE

Business Opportunities

1. The three presentations which has been shared with you pertains to the indigenisation requirement of IAF for sustenance of its existing fleets. The opportunity for Indian Industry is in support to IAF for self sufficiency by re-engineering and supply of credible indigenous product. The broad hierarchy of need for fleet sustenance are as follows: -

- (a) **Spares for Scheduled Maintenance.** A large quantum of low cost, high volume and low technology items has been indigenously developed in the past through trade. The arising for development of such spares will continue in future.
- (b) **Complex Items.** The need to indigenously develop complex components/ LRUs emerges as a logical step ahead. This requires innovative approach to evolve technology by means of black box concept and Modular open Source Architecture in the absence of technology.
- (c) **Manufacture.** The constraint of series production is low volume and technological complexity which requires assimilation of emerging manufactured techniques.
- (d) **Material.** Non availability of aviation grade raw material is compounded by low volume requirement. This can be addressed by rationalization and production of aviation grade materials.
- (e) **ROH.** In situation of ToT, it is essential for infrastructure set up and assimilation of technology. The need is to evolve technology for systems without any ToT.

Problem Statement

2. IAF has currently identified 12 problem statements which needs to be shared with Industry/Academia to work in collaboration and come out with effective/viable solutions. This program is designed to instill, create and grow a culture of collaboration between educational institutes, domain experts and industry leaders, driven by an Industry cell at Academia and an Academia cell at Industry. These projects/studies consist of proposing change in design, inclusion of newer technology, improvising measurement/testing techniques, development of software, reclamation/refurbishment of existing spares etc. The identified list of 12 problem statements is as **Annexed.**

DETAILED PROPOSED PROBLEM STATEMENTS

S No	Project	Objective/ Aim of the Project	Brief/ Tech Details and Justification
01	An-32 Aircraft Structural Design	To ensure better reliability / performance and enhance availability of aircraft in the An-32 fleet	<p>The following project/studies are proposed to be undertaken to ensure better reliability/performance and enhanced availability of aircraft in the fleet: -</p> <p>(a) Design Change in Guide Roller and Side Carriage Mechanism of Cargo Door System. The side carriage casing and guide roller are used in cargo door ramp system of An-32. Both are used to support the ramp during slide-in and slide-out operations. In micrometry checks, it has been observed that due to fair wear with usage, the guide roller and side carriage shaft get worn out that results in excessive play beyond limits. To avoid the same, it is recommended that the structural design of this mechanism be studied for suitable changes that would be more reliable and maintainable.</p> <p>(b) Requirement of Better Technology for Testing of Moving Rail. Moving Rail (LH/RH) is fitted in An-32 cargo door or ramp system. It facilitates the ramp lowering and lifting on ground. During ramp sliding in/out movement, moving rail act as a fixed rail to assist ramp sliding in/out operation. There have been snags related to ramp not closing by lifting due to mis-alignment of the moving rail. Such snags affect important missions or operations of aircraft. In these cases, it is found that the movable rail also fail during the hinge hole perpendicularity test done in the OEM supplied jig. There</p>

S No	Project	Objective/ Aim of the Project	Brief/ Tech Details and Justification
			<p>is need felt to devise better technology to test these moving rails so the chances of failure during missions is reduced.</p> <p>(c) Design Change in Wing Attachment Bolt Washers. It has been found that during aircraft levelling/rigging checks, the wing incidence and dihedral values are beyond laid down limits. Study on provision of tapered washers of varied thickness to be fitted with the wing attachment bolts may bring out changes in the aircraft levelling values.</p>
02	Injector measurement technique for spray cone angle of fuel injection system of TV-3 Engine	To develop an improvised injector measurement technique for spray cone angle and atomization quality check of the fuel injection system. Currently, it is done by manually aligning the outer edges of the spray with a ruler	<p>1. The limitations with current technique of manual measurement are: -</p> <p>(a) The spray coming out of the injector is very turbulent causing continuous fluctuation of the spray angle making It is difficult to perfectly align the spray's outer edges with the measuring ruler. Because of that the small effect of impurities in the injector may get unnoticed, eventually leading to a reduced performance or safety scare.</p> <p>(b) The spray cone angle is measured from one side only. However, the research has suggested that the cone angle may vary if looked from other side.</p> <p>(c) The current system measures the spray cone angle of the individual injectors, which is not only time taking, but also leads to significant fuel</p>

S No	Project	Objective/ Aim of the Project	Brief/ Tech Details and Justification
			<p>wastage (considering 16 injectors in a fuel injection system).</p> <p>2. The current method does not provide any information on the atomization quality of the fuel injection system. Considering all these limitations, there is a need to develop an improved measurement technique that can provide detailed information on the spray quality of the complete fuel injection system.</p>
03	Development of Predictive Maintenance Technologies such as Digital Twins for VK-2500-03 aero engines of IAF to improve reliability and facilitate total technical life extension	To develop software/ associated mechanism for predictive maintenance on VK-2500-03 engine type with the help of the digital engine model/digital twin. The developed simulation programs to aid in reduction in down time of fleet/effective supply-chain management like the aggregates which are likely to fail in the future (as per simulation results). The scope of the project also includes development of predictive maintenance and Residual Utility Life / Residual life Assessment calculations of the engines.	Mi-17 V5 helicopter of IAF is fitted with twin VK2500-03 aero engines generating a maximum SHP of 2700 each. The aero engine has 12 stage axial compressors with first stage of variable inlet guide vanes and three stages variable guide vanes with air bleed valve located on 7th stage of compressor. The compression ratio of the aero engine is 9.55:1. The combustion chamber is can-annular with EGT up to 750 degree centigrade. There are two stages of turbine and two stages of free turbine. The total technical life is 6000hrs. The detailed technical specification will be shared with the Institute subsequently.
04	Development/	To fabricate / manufacture/	Development / fabrication of Honeycomb seals.

S No	Project	Objective/ Aim of the Project	Brief/ Tech Details and Justification
	Reclamation of HFRA/ Critical Aggregates of TV-3 117 Series & VK-2500 aero engines using Additive Technology / 3D Printing	<p>reclaim following HFRA / Critical aggregates of TV-3 & VK-2500 engines using Additive Technology which are otherwise procured from OEM sources.</p> <p>Honey comb seals Housing I Housing II NGV I NGV II NGV III NGV IV Cover Plates II & III Inner holder</p>	Honeycomb seals work as a labyrinth between rotor and stator parts to prevent leakage of mass air flow across compressor and turbine stages of aero-engine. Common Defects encountered are erosion of honeycomb cells/material during engine operation, thus reduction in overall diameter and damage to honeycomb cells.
05	Indigenization/Substitution of INS/GPS of Aerostat	<p>INS/GPS is an integral and critical sub assembly of Aerostat radar.</p> <p>The INS/GPS in Aerostat provides a GPS time source as well as the position, movement and acceleration data of the aerostat relative to the earth as well as pedestal angle measurement (pitch, roll and yaw data) which are used by the RCU (Radar Control Unit) to apply compensation.</p>	It is intended to understand the INS/GPS system design, finalise system requirement specification for latest generation DCS, define the scope of work for achieving obsolescence management and dependency on foreign OEM.

S No	Project	Objective/ Aim of the Project	Brief/ Tech Details and Justification
06	An-32 Alternator rewiring. SGO-12 alternator are being used in An-32 fleet. Subject alternator has stator and rotor windings. During cold checks, rotor winding was found burnt at 3-4 sections thus leading to shorting.	Feasibility study for Rewinding of An-32 alternator.	With usage it has been observed that many of the An-32 (SGO-12) alternator develop defect (burnt) of its rotor winding, though the stator winding is serviceable. In absence of related documents, data sheets and complete wiring diagram for rotor assembly requires the assessment/development of required data/necessary drawings/test schedules and to undertake the rewinding task.
07	Expansion of Radar Emulator Functionalities being currently developed through M/s Bhumi Entech Equipment Pvt Ltd, New Delhi	It is intended to engage Industry partner and academia in system design for enhancing the functionalities of Radar emulator as Phase-II of the existing project.	Upgradation of Radar Emulator project by expanding the frequency band to X band and adding LPI signature with mono pulse tracking in Phase-II of the project.
08	Testing Facilities for Spark Plug of aero engines.	Spark Plugs are used to ignite aerosolized fuel within the engine combustion chamber through a high voltage spark across the gap between its core and ground electrodes, thus making it a critical item. The objective of the project is to establish testing facility for indigenised Spark Plug in a controlled environment.	Indigenous development of Spark Plug is required to meet high demands as the item is designated as Automatic Replenished Spare (ARS). Spark plugs are presently being imported leading to considerable time delays & high import cost. It is important to develop and prove the developed spark plug for airworthiness. Depot has approached GTRE and NFTDC for development and testing of the spark plug. Following tests are required to be carried out before inducting indigenised Spark Plugs for Defence Aerospace application. Functional Tests. These tests should be comparable with same test carried out on CAT 'A' sample provided during development. 1. Threshold voltage 2. Fuel Fouling 3. Gas leakage 4.

S No	Project	Objective/ Aim of the Project	Brief/ Tech Details and Justification
			<p>Spark intensity.</p> <p><u>Environmental Tests</u></p> <p>. 1. Temperature and Altitude 2. Temperature Variation 3. Operational Shock/Crash Safety 4. Vibration 5. Sand & Dust 6. Salt Spray 7. Lightning induced transient susceptibility 8. Over Temperature In order to achieve self reliance, it is proposed that DRDO/IITs/DPSU or Pvt industries to develop testing facilities for the Spark Plug</p>
09	Development of Gun Control Unit of Mirage-2000 aircraft.	Gun control device is the heart of the 30mm DEFA gun. The cost of Gun Control Device is 1,09,76,478.00/- Approx and Turn Around Time (TAT) is very high since it can be repaired by OEM only. With subject technology developed in house, it will not only reduce the cost / TAT but will help us enter into the league of countries having subject technology.	<p>Details of existing system and its use. Gun control Device is part of 300mm DEFA automatic gun. The device comprises of following spares:</p> <p>(a)Electronic control box. The control module with miniature electronics performs the main function of the control unit. This comprises of radio frequency interference filter, two printed circuit boards, shunting plug.</p> <p>(b)Drum indexed safety switch. The switch provides a firing safety feature by only closing the electrical circuit when the operating slide is at 10mm from its fully forward position, with the drum in an indexed position.</p> <p>(c) Connecting cable firing block. This cable connects the control unit attaching block to the electronic control box. The cable is contained within a flexible metal court which is covered by a heat shrunken plastic sheath.</p> <p>(d)Firing block. Firing block contains the insulated electrode designed to apply positive polarity potential to</p>

S No	Project	Objective/ Aim of the Project	Brief/ Tech Details and Justification
			<p>the centre of the service cartridge primer. The firing blocks contains the firing pin and firing pin extension. The firing pin slides with the guide and is spring loaded by the action of spring which allows a slight travel.</p> <p>(e)Leaf spring and leaf spring holder. This component is flexible cam which causes the switch tongue bolt to rotate when the operating slide reaches the rearmost point of its travel. The flexibility of this cam is essential to avoid breakage of the switch tongue bolt.</p> <p>(f)Leaf spring and leaf spring holder. This component is flexible cam which causes the switch tongue bolt to rotate when the operating slide reaches the rearmost point of its travel. The flexibility of this cam is essential to avoid breakage of the switch tongue bolt.</p> <p>(g)Electrical equipments. The electrical equipment mainly comprises of a control unit, and firing block. The electrical equipment serves to fire the cartridges, set the duration of the burst of fire, allow a reduced rate of fire and perform the complete gun control and firing circuit test procedure.</p> <p>Justification: Presently, device that is not recoverable at second line is rendered as 'Beyond Economical Repair'. Procurement is possible with OEM only, which reduces mission readiness and cause higher procurement cost.</p>
10	Repair and Overhaul Facilities for Cabin Super Charger for Avro aircraft	Cabin Super Charger is presently being Repaired/Overhaul through	The cabin Super Chargers provide the air supply for cabin pressurisation and ventilation. To prevent the ingress of foreign matter a filter is fitted to each Super Charger inlet.

S No	Project	Objective/ Aim of the Project	Brief/ Tech Details and Justification
		<p>HAL while actual work is undertaken by OEM abroad leading to considerable time delays & higher foreign repair cost. It is important to develop ROH technology within India. In order to achieve self reliance, it is proposed that Private firms need to study and develop ROH facilities for the Cabin Super Charger.</p>	<p>The output from each Super Charger is ducted to the remainder of the system via a silencer and nonreturn valve. Downstream of the non-return valves the ducts join to form common supply duct to the system. In the event of an engine or Super Charger failure the other available Super Charger is capable of supplying sufficient air for air conditioning pressurisation, and ventilation requirements, the associated non-return valve preventing a loss of system pressure. Super Charger output in excess of system requirement is discharged to atmosphere by two spill valves.</p>
11	<p>Repair and Overhaul Facilities for Flap Actuator of Dornier aircraft.</p>	<p>NLG Steering Actuator is presently being Repaired/Overhaul through HAL while actual work is undertaken by OEM abroad leading to considerable time delays & higher foreign repair cost. It is important to develop ROH technology within India. In order to achieve self reliance, it is proposed that Private firms need to study and develop ROH facilities for the NLG Steering Actuator.</p>	<p>The NLG Steering Actuator is an electrically controlled hydraulic actuator mounted on the Nose Landing Gear leg and connected to the Nose Wheel Steering pivot mechanism by bell cranks and rod. The NLG Steering Actuator is used for Nose Wheel Steering of the aircraft while taxiing and landing</p>
12	<p>Weapon System Test Set (Store Management System) for Hawk aircraft.</p>	<p>SMS tester is electrical/ electronic equipment utilized to check serviceability of all the systems involved in</p>	<p>Requirement: (a) Indigenous replacement. (b) Repair capability for existing Std to overcome OEM dependency.</p>

S No	Project	Objective/ Aim of the Project	Brief/ Tech Details and Justification
		Weapon System suite of Hawk aircraft (incl loading stations and Pylons).	Remarks: (a) On-site visit (AFS Bidar/ 5 Wg) by SMEs would be required for detailed study as OEM has not shared Tech Specs and circuit publications. (b) Reverse Engg approach would be most prudent way to meet the requirement.