Guest Editorial

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This issue of the *Journal of Defence Studies* is Part II of the Special Issue on "Atmanirbharta (Self-Reliance) in Defence and Aeronautics", comprising 12 articles, seven commentaries and a book review. India has set the goal of becoming self-reliant (*atmanirbhar*) in defence and aeronautics, and aspires to become a developed nation by 2047. India becoming self-reliant would require building capability to design, develop and manufacture defence and aeronautics systems, which has its own complexities, nuances and challenges. The indigenous defence and aeronautics design and development programmes are sensitive to import, Transfer of Technology (ToT) and license manufacturing of similar systems, which would need to be closely examined and monitored.

Self-reliance in aeronautics manufacturing has two elements comprising military and civil aircraft manufacturing. India has robust indigenous design, development and manufacturing programmes for military aircraft; however, it lacks robust ecosystem and time-bound civil aircraft design and development programmes with the involvement of civil users, which becomes a limitation in achieving Military–Civil Technology Fusion (MCTF).

India's military aircraft design, development and manufacturing comprises fighter, transport aircraft, helicopters and emerging military unmanned technologies. A fighter aircraft provides technological edge to a nation during war, which is essential for achieving a degree of aerial dominance over enemy skies. India's quest for indigenous fighter aircraft development programmes had a number of challenges, inconsistencies and deviations due to short-term

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requirements. A suggested pathway for India becoming self-reliant in combat aircraft manufacturing including fifth and sixth generation aircraft and unmanned combat aircraft development has been proposed in this special issue. India's indigenous fighter aircraft development programmes that comprise Light Combat Aircraft (LCA) Mk-1/ 1A and LCA Mk-2, Twin Engine Deck Based Fighter (TEDBF), Advanced Medium Combat Aircraft (AMCA), and afterburner and non-afterburner variants of Kaveri engines are at crucial phases of development.

The induction of fifth generation fighter aircraft and flight testing of two next (which are termed as sixth generation by some) generation fighter aircraft in December 2024, and unmanned aircraft development programmes of China and potential supply of its fifth generation fighter aircraft to Pakistan has changed the threat dynamics for India. These apprehensions are being leveraged to convince India to import advanced fifth generation fighters from global Original Equipment Manufacturers (OEMs) to meet its challenges. The offer of supply of Su-57 or potential acquisition of F-35 fifth generation fighter aircraft are being discussed, which creates a dilemma for Indian planners. The non-availability of corresponding next generation fighter aircraft in the global market and limitations of funding could reduce acquisition options for India in the times to come. Therefore, there is a necessity and urgency for India to become self-reliant in critical aeronautics and defence technologies.

The trajectory, challenges and uncertainties of current fighter development programmes is akin to one experienced during the Hindustan Fighter-24 (HF-24) or Marut fighter aircraft and Orpheus aero-engine development programmes of 1960s and 1970s. The development of advanced variant of HF-24 and upgradation of Orpheus engine was discontinued when advanced aircraft were imported and assembled in India, which was a setback to self-reliance.

India is again at the crossroads where it has to choose between indigenous development and import. The indigenous fighter aircraft and aero-engine development programmes are at a crucial phase needing handholding amid pressure to acquire fighter aircraft from foreign OEMs. On the other hand, delay in supply of GE-404 engines at the critical phase of scaling up production of indigenous LCA aircraft in 2024, highlighted vulnerabilities of dependence on imported defence and aeronautics equipment and critical systems. India will find itself at crossroads more often as its self-reliance initiatives in land, air, naval, space and other systems make progress and at all those junctures, the decisions, indecision, actions and inactions of policy-makers, stakeholders and even lower functionaries would be critical.

India has made significant progress in design, development and manufacturing of helicopters with its Advanced Light Helicopter (ALH), Light Utility Helicopter (LUH) and Light Combat Helicopters (LCH). In the military transport aircraft manufacturing, India is at the nascent phase with slow development of Saras light transport aircraft. The Transfer of Technology (ToT) of Airbus C-295 transport aircraft to Tata Advanced Systems Limited (TASL) has several loose ends and a roadmap is needed for local manufacturing of critical systems as well as for modification, upgradation and development of future variants of C-295. The proposed acquisition of Medium Transport Aircraft (MTA) should have a roadmap for local manufacturing of critical systems as well enabling provisions for manufacturing, modification, upgradation and development of its future variants by the Indian partners. In addition, a roadmap with funding and timelines is needed for the indigenous development of medium and heavy transport aircraft.

In the civil aeronautics manufacturing, India has developed Hansa trainer aircraft, however, programmes for the development of Saras Mk-2 light transport aircraft and Regional Transport Aircraft (RTA) are yet to be approved. As a whole, India needs robust civil transport aircraft design and development programmes to complement military transport aircraft development programmes to achieve MCTF in aeronautics manufacturing.

India has made significant progress in the naval, land, space and autonomous systems. In the naval systems, it is indigenously developing ships of different capabilities, submarines, aircraft carriers and other naval systems. In the land systems, it is indigenously developing tanks, artillery guns, Armed Personnel Carriers (APCs), missiles, rockets, arms and ammunition. India has also made progress in missile, drone, counter-drone technologies however, it would need to reduce dependence on import of critical systems, components and payloads, which is a limitation and vulnerability. Indian industry would need to move towards design, development and production of advanced, miniaturised and niche air, land, naval, space, cyber and autonomous systems, sensors, weapons and payloads.

Indian government initiated reforms in Defence Public Sector Undertakings (DPSUs), reorganisation of Ordnance Factories, review of DRDO functioning and reforms of policies to stimulate self-reliance. The DPSUs, private sector entities, Micro, Small and Medium Enterprises (MSMEs), start-ups and academia are playing a greater role in indigenous design, development and manufacturing of defence and aeronautics technologies. However, there are some policy, structural, ecosystem, funding and other gaps that need to be addressed. Indian defence R&D ecosystem

needs to be strengthened by creating advanced testing facilities, standards, standardisation and certification mechanisms for new, emerging and innovative defence equipment and technologies that are conceptualised, designed and developed in India ahead of global leaders. This would require a reorientation of its technology certification approach by moving away from 'following the world in certification' to 'taking the lead in formulation of standards and certification' especially in emerging technologies.

The reforms undertaken by the Indian government have stimulated innovations, indigenous design and development and creation of Intellectual Property Rights (IPR) in India. Indian policy-makers and stakeholders would have to prepare for new realities and challenges. The Public–Private Partnership (PPP), Joint Ventures (JVs) and Transfer of Technology (ToT) have certain limitations. However, quest for control over defence technology and IPR by global leaders has its own geopolitical dynamics and pressures that would need to be factored in India's self-reliance strategy.

India's SAGAR doctrine (Security and Growth for All in the Region) necessitates that it achieves self-reliance in defence, aeronautics and critical technologies to be able to make contribution to this initiative. It will have to take measures not only to become self-reliant but also to become an exporter of reliable and quality defence and aeronautics equipment.

The transformation from follower to becoming self-reliant and a leader of defence and aeronautics technologies requires a leadership with new outlook at all levels and in all entities and departments. This leadership should be able to take ownership, decisions and risks in the larger interest of the nation. This would require revisiting, reviewing and reforming existing policies, structures, mechanisms and norms, and adopt new ones that are progressive and futuristic while remaining connected to ground realities.

Indian policy-makers and stakeholders need to understand new realities, recalibrate their approach and institute course corrections, where required. India must do everything that is needed to become *atmanirbhar* (self-reliant) and a leader in defence and aeronautics technologies in pursuance for its larger goal of becoming a developed nation by 2047.

A number of issues concerning *atmanirbharta* in defence and aeronautics have been deliberated in the articles and commentaries in this special issue of the *Journal of Defence Studies*. The subjects discussed in this issue would be useful for the policy-makers, research scholars, defence forces, DRDO, DPSUs, industry, academia, analysts and other readers. This would help them in understanding the trajectory, challenges, limitations and way forward for India becoming self-reliant in defence and aeronautics.