

## Guest Editorial

***R.K. Narang\****

India has set the goal of becoming self-reliant (*atmanirbhar*) in critical technologies including defence and aeronautics. It also aspires to become a global drone hub@2030 and a developed nation by 2047 (*Viksit Bharat@2047*). Achieving these challenging goals would require research-led self-reliance (*anusandhan se atmanirbhar*) approach. India has made significant progress in indigenous development of land systems, ship-building, space, manned aircraft, drones and other technologies. While at the same time, there are significant gaps between the policy pronouncements, reforms and their implementation. Also, technology development has its nuances and complex challenges that are less understood. These need to be deeply examined and corrective measures introduced. This special issue of the *Journal of Defence Studies* deliberates on trajectory, challenges, opportunities and way forward for making India *atmanirbhar* in defence and aeronautics technologies.

India has been one of the largest importers of defence and aeronautics equipment since independence in 1947. The import of defence and aeronautics equipment was a drain on the exchequer and also had underlying geo-strategic implications. The rapid military and economic growth of China, volatility and unpredictability of Pakistan, and potential of two-and-a-half front war creates new challenges for India. The persistent endeavours of China in developing niche and advanced defence and aeronautics systems is increasing its capabilities significantly. China's effort to bridge the technology

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gaps with global defence and aeronautics equipment manufacturing leaders could reduce options for India to acquire advanced systems from foreign manufacturers in the times to come. On the other hand, the emphasis of Indian government on the well-being of its people and growth of its economy reduces options to import advanced defence and aeronautics systems in large numbers. The upward technological trajectory and increasing belligerence of China on borders, Pakistan's persistence with grey zone operations, limitations of funding for import and reducing technology gaps has created new challenges for Indian planners. Therefore, *atmanirbharta* is no more an option but a necessity for India.

There is a realisation that Indian talent needs to be leveraged to develop critical technologies in India. The creation of defence corridors, launching of Innovation for Defence Excellence (iDEX), iDEX Prime and iDEX4Fauji initiatives of the Ministry of Defence, Mehar Baba Competition of the Indian Air Force, Technology Development Fund of the Defence Research and Development Organisation (DRDO), Delegation of Financial Powers to Defence Forces (DFPDS) and DRDO/Defence Services Centres of Excellence (CoE) in academic institutions provide an opportunity to leverage innovation potential of innovators, academia, start-ups and MSMEs for developing niche and futuristic technologies. These initiatives have helped in indigenous development of innovative technologies like Unmanned Aerial Vehicles (UAVs), Unmanned Surface Vehicles (USVs), Unmanned Underwater Vehicles (UUVs), Unmanned Ground Vehicles (UGVs) and autonomous systems, Artificial Intelligence (AI), Machine Learning (ML), etc. However, India's dependency on critical materials, electronics components, aero-engines, sensors and payloads creates undesirable vulnerabilities in critical technologies.

The creation of robust Research and Development (R&D) ecosystems comprising structures and initiatives for R&D, mechanisms for formulation of Indian standards for indigenously designed defence products, standardisation guidelines for manufacturing, establishing of testing sites and laboratories, and building robust and pragmatic certification mechanisms are the need of the hour. The R&D structures are the pillars of innovation and technology development. The policies and structures in the Ministry of Defence (MoD), Ministry of Civil Aviation (MoCA) and Ministry of Science and Technology (Min of S&T) need further reforms to stimulate and complement technology development. They need to create enabling organisational structures to launch, lead and steer R&D and technology development initiatives to achieve Military-Civil Technology Fusion

(MCTF). Indian defence forces including Headquarters Integrated Defence Staff (HQ IDS) creating R&D verticals and structures to steer and participate in R&D and co-development projects with Indian industry and global partners need due consideration. Similarly, MoCA needs to create R&D structures to support development of civil aviation and associated technologies.

The creation of testing sites, international accreditation of laboratories and 24x7x365 availability of these facilities are emerging expectations of Indian innovators. The lack of mechanism and designated authority for certification of indigenously designed products and indigenous content certification based on materials, components and software, lack of incentive for indigenously designed products are some of the key challenges to indigenous development and their validation.

The timely and assured procurement of indigenously designed products can be the single-most incentive for the Indian entrepreneurs indigenously designing and developing niche and innovative technologies. There are many challenges though.

India has made several policy reforms to stimulate design and development in the private sector. This has led to public sector entities enhancing collaborations with the private sector, start-ups and MSMEs, with start-ups taking lead in developing niche and innovative technologies and users increasing engagement with the industry and supporting innovations. The DRDO and Defence Public Sector Undertakings are increasing delegation of defence equipment manufacturing to the private sector. However, inability of start-ups in raising capital for scaling up manufacturing, challenges in acquisition of indigenously designed products and meagre investment on R&D by private sector companies need immediate attention.

India has signed collaboration agreements with global partners for co-development and co-production of critical and emerging defence and aeronautics technologies. These initiatives are yet to lead to development of innovative and niche technologies and co-development and co-production with global partners. Therefore, transforming these initiatives into mutually beneficial technological partnerships would require structural and policy reforms in India, Indian stakeholders taking lead in identifying co-development areas and Indian technology development partners; earmark funding, formulating IPR sharing and protection strategies and policy measures, identifying start-ups, academia and government entities that are best suited for collaboration with Indian entities. As a whole, Indian entities have to do much more to prepare and plan for co-development with minute

details. On the other hand, India could face reluctance to share technology, procedural and other challenges, which would require change of mindsets of partner countries. Also, Indian public and private sector entities obtaining Transfer of Technology or undertaking manufacturing in India lack roadmap for indigenisation of critical systems that would become impediments in leveraging these collaborations for capability development.

India becoming global drone, aeronautics and defence manufacturing hub would largely depend on the ability of its industry to export products in the global market. The ability to export products in the international market depends upon technological lead, quality, taxation, import/export policies and structures, diplomatic and political dynamics, support of the government and other factors. Therefore, there is a need to examine nuances and challenges in exporting defence products in the global market and take measures to improve structures, policies and mechanisms for their implementation.

Taking all these factors into consideration, the Manohar Parrikar Institute for Defence Studies and Analyses (MP-IDSA) has decided to publish a special issue of the *Journal of Defence Studies* on the theme “Atmanirbharta (Self-Reliance) in Defence and Aeronautics”. Director General, MP-IDSA Amb Sujan R. Chinoy as a special gesture permitted inclusion of commentaries from Indian defence, aeronautics and drone start-ups, innovators, academia and others to get first-hand perspective of the opportunities and challenges faced by the Indian industry. The response to the special issue was overwhelming and it has therefore been decided to publish the special issue in two parts. This is the first part of special issue; the second part would follow soon.

The research articles in the ‘Focus’ section delve deep into variety of issues while the ‘Commentaries’ provide first-hand perspective of practitioners, experts and analysts. The commentaries address diverse critical and emerging issues such as building defence technology ecosphere and techno-military industrial ecosystem; achieving atmanirbharta in critical and emerging defence including weapons technologies, introducing systems integration approach in defence projects, adopting human central design approach, formulating a roadmap for global drone hub by 2030, building bhartiya (indigenous) cyber physical stack for drones, overcoming advanced UAV batteries certification challenges, introduction of Defence Inflation Index and overcoming challenges of defence exports.

The commentaries have been authored by experts from industry, defence forces, DRDO, academia, start-ups, MSMEs and others, who provide deep, out-of-the-box, lateral as well as on ground perspectives. Their perspectives

would be useful in understanding challenges of stakeholders including start-ups, instituting structural reforms, articulating technology development and innovation roadmap, instituting advanced design and development mechanisms, developing and upgrading testing, standards formulation and certification ecosystem, introducing acquisition reforms and stimulating exports.

We hope that this special issue as well as the one which will be published subsequently, would become collector's editions for policy-makers, R&D and production entities, users, academia, researchers and others and contribute towards India's *atmanirbharta* trajectory.

