INDIA'S AMBITIOUS ENTRY INTO THE CIVILIAN AIRCRAFT PRODUCERS' CLUB

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With effect from January 1, 2025, the new Act, "*Bharatiya Vayuyan Adhiniyam*, 2024"[1] has come into force. It replaces the 90-year-old British era "Aircraft Act, 1934". Earlier, in August, 2024, the Minister for Civil Aviation Shri Rammaohan Naidu had presented the Bill in the Lok Sabha and thereafter in the Rajya Sabha during the winter session. The passing of the Bill by a voice vote in the Parliament signifies its acceptance across the political spectrum. Indeed, it was a historic achievement for the Indian aviation sector, as, for the first time, the term *design and maintenance* was introduced in the legislature. It is believed that the new Act would promote indigenisation and encourage innovation in the civil aviation sector, which till date was dominated by foreign entities. However, will these initiatives of the ministry provide the required tailwind to design, develop and produce our own civil commercial aircraft? This article details the design

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1. Rohit Vaid, "New Act: Bharatiya Vayuyan Adhiniyam Replaces Aircraft Act of 1934", January 1, 2025, *The Hindu*, Businessline, https://www.thehindubusinessline.com/economy/logistics/new-act-bharatiya-vayuyan-adhiniyam-replaces-aircraft-act-of-1934/article69049173.ece#:~:text=In%20a%20gazette%20notification%2C%20the,Minister%20Kinjarapu%20Ram%20Mohan%20Naidu. Accessed on January 2, 2025.

requirements for the aircraft that the nation desires to produce under the Regional Transport Aircraft (RTA) scheme. It also examines the national vision on how to produce this aircraft and dovetail it to meet the emergent need of providing air connectivity under mission Regional Connectivity Scheme-*Ude Desh ka Aam Naagrik* (RCS-UDAN).[2]

AIRCRAFT MANUFACTURING IN INDIA

According to the International Monetary Fund (IMF) report of 2024, India is the fifth largest economy of the world. Fig 1 compares the size of the world's top ten economies[3] as in February 2024. India was ranked the fifth largest and, at the current growth rate, poised to soon reach the third position. However, it is very important to note that *India is the only nation amongst this elite club of top economies that does not have its own civilian aircraft*. Although, it has been producing indigenous fighters, transport aircraft, helicopters and other aerial platforms for the defence sector, it has never produced a passenger aircraft for the civil aviation sector.

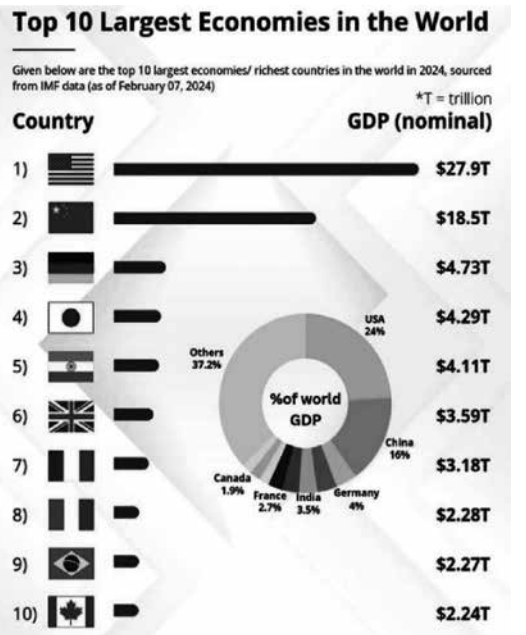
Historically, the strength of the Indian aviation sector has always been measured by the capabilities of its organisations like the National Aeronautical Agency [Council of Scientific and Industrial Research-National Aerospace Laboratories (CSIR-NAL)], under the Department of Science and Technology, Aeronautical Development Establishment (ADE), under the Defence Research and Development Organisation (DRDO), and Hindustan Aeronautics Limited (HAL), under the Ministry of Defence.

These establishments have, over the last few decades, designed, developed and manufactured world-class, cutting-edge aviation products for the Indian armed forces. Indigenously designed and developed aircraft

2. The Regional Connectivity Scheme-Ude Desh Ka Aam Nagrik (RCS-UDAN) is an offshoot of the National Civil Aviation Policy (NCAP), 2016. It was launched on October 21, 2016, https://civilaviation.gov.in/sites/default/files/migration/UPDATED-RCS-DEC-2016.pdf. Accessed on January 12, 2025.
3. Largest Economies in the World, 2024, Graphics Courtesy by datarep.tumblr.com. https://www.facebook.com/plugins/post.php. Accessed on October 5, 2024.

like the two-seater Pushpak[4] (year 1958), four-seater Krishak (year 1959) and single-seater Basant (year 1972) were hugely successful and also produced for the civil sector during the last century. However, in this decade, India's fixed-wing capability demonstrator aircraft like the Hansa and Saras have had limited acceptance in the civil aviation sector. HAL's rechristened 19-seater Hindustan-228 (Do-228) and 11-seater Advance Light Helicopter (ALH) Mk-I are today the only indigenous machines flying commercially under a civil licence. Although India had made reasonable attempts in the past to build its own commercial aircraft, it is still maturing seven decades later.

Fig 1: Size of Top 10 Economies



Source: IMF data.

GROWTH OF INDIAN CIVIL AVIATION SECTOR

India's aviation sector has witnessed phenomenal growth and is presently evolving as one of the largest and most dynamic markets. Globally, it is the fastest growing aviation market, and, presently, the third largest by volume in the domestic segment. In the last decade, the number of aircraft in India has increased from 400 to over 800, and airports have grown exponentially from 74 to 157.[5] The government's ambitious initiatives like the RCS-UDAN

4. The Airworthy Hindustan HUL-26 Pushpak G-AVPO is displayed at Chester Airfield, Wales, UK, courtesy RuthAS. Accessed on October 21, 2024.
5. Ministry of Civil Aviation, press release on September 10, 2024, "India to Host 2nd Asia Pacific Ministerial Conference on Civil Aviation", https://pib.gov.in/PressNoteDetails.aspx?NoteId=152118&ModuleId=3&reg=3&lang=1. Accessed on October 5, 2024.

have enhanced regional connectivity by expanding airport infrastructure. These efforts have integrated remote areas with the international aviation network, thus, creating a healthy ecosystem for economic development, innovation and job creation. The efforts of the policy changes are reflected in the fact that the domestic airlines ordered over 1,000 aircraft during Fiscal Year (FY) 2023-24. The confirmed orders for new aircraft placed by domestic carriers are as tabulated in Table 1. India's aviation landscape is definitely poised for an exciting future, marked by sustainability, collaboration and technological advancements.

Table 1: Confirmed Orders Placed by Indian Operators with AirBus[6], Boeing[7] and other Original Equipment Manufacturers (OEMs)

Sl No	Seating Capacity	Aircraft Type/ Model	Operators (New Orders)	Total
1.	400-480	A350-900/ 1000 (XWB)	Air India	40
2.	350-400	B777-9	Air India	7
3.	240-250	B787	Air India (20), Vistara (2)	22
4.	220	A321 Neo	Air India	70
5.	180-210	B737 Max	Air India (190), Air India Express (7), Akasa (53), Spicejet (2)	252
6.	140-170	A320 Neo	Air India (140), Air India Express (27), Indigo (500), Go First (18), Vistara (8)	693
7.	40-50	ATR-42-600	Alliance Air (2)	2
8.	9-19	DHC-6, Twin Otter	Flybig, India One Air (3)	3

From Table 1, it emerges that the favourite new order inventory amongst the operators are the narrow bodied, highly fuel-efficient A320/321 and B737 aircraft. These have a seating capacity 140-220, depending on class

6. AirBus, "Commercial Aircraft 'Orders and Deliveries' Deliveries in August 2024", https://www.airbus.com/en/products-services/commercial-aircraft/orders-and-deliveries. Accessed on October 6, 2024.
7. "Boeing: Orders & Deliveries, Unfilled Orders, India", https://www.boeing.com/company/general-info#orders-deliveries. Accessed on October 5, 2024.

configuration, and fuel-efficient range of 1,000-1,200 km. *However, when seated at full capacity and depending on the altitude of the airfield, they would require a runway of over 2.5 km to operate.* According to the Original Equipment Manufacturer (OEM)[8], the aircraft-airfield compatibility requirements for these aircraft are as tabulated in Table 2.

Table 2: B737/A320 Can be Operated Only From 4C or Better Airports

Aircraft Type	Wing Span	Main LG Wheel Span	Max Take-Off Weight	R/W Length	ICAO Ref Code
Airbus 321/320 Neo	35.8m	8.97m	97.0T	2.3-2.8 km	4C
Boeing 737 Max	35.9m	7.0m	82.6T	2.5-3.0 km	4C

AIRCRAFT FOR UDAN

UDAN is a highly acclaimed scheme of the Indian government for the Indian aviation sector. The term was coined on April 27, 2017,[9] by Prime Minister Shri Narendra Modi, while inaugurating the first flight between Delhi and Shimla under this scheme. Domestic operators, regulators and the media regularly deliberate on the generous incentives under this scheme.

The UDAN initiatives are granted under this flagship programme of the Ministry of Civil Aviation (MoCA) to contribute towards regional growth. As per the International Civil Aviation Organisation (ICAO), the aviation sector is perceived to have an economic growth multiplier of 3.25, and a employment generator multiplier of 6.1.[10] Promoting small aircraft operations was the rationale behind the RCS and the key element to reach out to over 400 small remote area airports. The regulators understood that

8. "ICAO/ EASA Aerodrome Reference Code and Airplane Designs", https://aircraft.airbus.com/sites/g/files/jlcbta126/files/2023-02/NEW-AI~1.PDF, https://www.icao.int/MID/Documents/2022/Airport%20Master%20Seminar/AMP%204%20-%20Aircraft%20and%20Airport%20Compatibility_updated.pdf. Accessed on October 12, 2024.
9. "PM Launches UDAN – Regional Connectivity Scheme for Civil Aviation - From Shimla", April 27, 2017, https://archive.pib.gov.in/archive2/pmreleases.aspx?mincode=3. Accessed on October 12, 2024.
10. "The RCS-UDAN-Small Aircraft Sub-Scheme ('SAS') Version 1.0", Ministry of Civil Aviation, March 2022. Accessed on October 21, 2024.

Since its launch in 2016, the UDAN scheme has encouraged airlines to operate on regional/ remote routes through enabling policies and financial incentives.

connectivity to small/tier-3 cities having a stage-length route below 350 km from big cities would typically have a traffic density of below 20 passengers. Therefore, the concessions under the scheme were typically designed as per the seating capacity of the aircraft: Category-1a for below the 9-seater, Category-1 for the 9–20-seater, Category-2 for the 20–80-seater and Category-3 for the >80-seater. Since its launch in 2016, the UDAN scheme has encouraged airlines to operate on regional/ remote routes through enabling policies and financial incentives.

The first list of airports under UDAN 1.0 was released in December 2016. It included 16 underserved airports and 398 unserved airports, totalling 414 airports. By March 2017, over 128 routes were awarded to five airlines. Viability Gap Funding (VGF) on airfare was also provided by the ministry to the operators, which was about 1.5 to 2 times the maximum chargeable airfare to the passengers. The operators' preferred aircraft were the 72-seater ATR and 78-seater Q400 under Category-2, and 18-seater Do-228 and18-seater M-28 helicopter under Category-1. The routes connected 36 newly operationalised airports with metro cities across India.[11] Later, the MoCA added another 73 airports to the list, including helipads, seaports for seaplane operations, tourist hotspots in coordination with the Ministry of Tourism, etc. The aircraft size criteria for VGF were also relaxed. However, until the launch of UDAN 4.0, only 26 RCS routes were served by small Category 1/1a aircraft and connecting just 12 small/remote airport/cities.[12]

In August 2023, six years after its launch, the Comptroller and Auditor General (CAG) of India tabled the audit report on the RCS-UDAN scheme

11. "RCS-UDAN Completes 6 Successful Years", Ministry of Civil Aviation, PIB Delhi, October 26, 2023, https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1971506. Accessed on October 20, 2024.
12. "Small Aircraft Operator under Category-1a Awarded 26 RCS Routes In UDAN 3.0 and 4.0", Ministry of Civil Aviation, Press Release, February 4, 2021, https://pib.gov.in/PressReleasePage.aspx?PRID=1695186. Accessed on October 20, 2024.

before the Parliament. It brought out that as in March 2023, only 174 routes out of 774 awarded by the MoCA under UDAN were operational.[13] It also highlighted that although operations started on 371 routes, only 112 routes (30 per cent) completed their full concession term of three years. Out of these 112, only 54 routes which connected 17 RCS airports could sustain operations beyond the concessional term. *Thus, projecting a success rate of only 7 per cent i.e. 54 out of 774 routes operational in six years, signifying the economic non-viability without VGF*. Similar underutilisation was also observed in respect of helicopter operations. Of the 83 routes connecting 31 heliports identified and awarded, operations could commence only on 34 routes (41 per cent) connecting nine heliports. Later, within less than three years, operations were discontinued on 14 routes and four heliports, signifying, that in spite of bold initiatives, the government found limited eagerness amongst operators to reach out to new/small airports with commuter aircraft.

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Later, under UDAN 5.0, the Government of India (GoI) decided to provide greater impetus to Category 2/Category 3 aircraft rather than Category 1/1a aircraft. It also removed the cap on the stage-route distance of 600km and prioritised connection to already operational airports. With this, the GoI expected to enhance connectivity to smaller towns. Concurrently, special additional benefits were also provided to small aircraft operators (<20 seats) under UDAN 5.2 and 5.3 to achieve last mile connectivity from places of tourist interest. The ministry also provided opportunities to small regional airlines like Flybig, Star Air, India One Air and Fly91 to scale up their businesses, in order to meet their expectations under the RCS.

13. CAG Compliance Audit Report No 22/ 2023 on UDAN, Ministry of Civil Aviation, https://cag.gov.in/uploads/download_audit_report/2023/Report-No.22-English-064d5dc4be9bf67.48739275.pdf. Accessed on October 12, 2024.

However, in order to serve these RCS routes, the operators require small aircraft/helicopter like the ATR 42, Bombardier Q400, DHC-Twin Otter, Tecnam P2006T, Cessna 208B, Grand Caravan EX, Dornier 228, Airbus H130, Bell 407 helicopter, etc. Unlike the big jets produced by Airbus and Boeing, the rate of production for regional jets/small aircraft is very limited. According to media reports, ATR (*Avions de Transport Regional*) currently has a backlog of over 2-3 years on new deliveries due to production and supply line constraints.[14] While the DHC-6 Twin Otter would take over two years to fulfil orders for its new Series 400 variant.

RELATIONSHIP AMONG AIRPORTS, AIRCRAFT TYPE AND VGF UNDER UDAN 5.3

UDAN 5.3 was launched in January 2024, and is a much-refined version of the original scheme. It is a well-researched policy built over the experience of seven years, and addresses most of the limitations of the earlier policies. The MoCA rightfully acknowledged that different aircraft operated over the same stage lengths can have a different cost of operations, due to differences in the inherent economics of the aircraft types.[15] The scheme includes 28 underserved and 281 unserved airports, 23 water aerodromes and 482 heliports. However, out of 309 airports, over 263 airports bear ICAO reference code 1C/2B and, thus, are capable of handling small commuter aircraft having below 20 seats. Similarly, 22 out of 23 water aerodromes would require to be served by small seaplanes.

By design, small Category 1/1a (below 20-seater) aircraft are low on acquisition and maintenance cost, but very high in terms of operating cost. A 19-seater Do-228 uses three times more fuel per passenger per kilometre than a 180-seater Airbus A320neo, under similar operating conditions. Therefore, the VGF provided to both these aircraft could not be same. Considering this

14. Judson Rollins, "Outlook 2024: Can ATR Finally Achieve its Production Target?" January 15, 2024, https://leehamnews.com/2024/01/15/outlook-2024-can-atr-finally-achieve-its-production-target/. Accessed on October 21, 2024.
15. "Regional Connectivity Scheme Version 5.3", Ministry of Civil Aviation, January 2024, https://www.aai.aero/sites/default/files/rcs_udan/Scheme.pdf. Accessed on October 22, 2024.

specific distinctiveness of operations, for the first time, the rate of VGF for Category 1/1A and Category 2/3 aircraft over the same stage length has been varied. Table 3 tabulates the variation in VGF for different categories of aircraft operating over the same distance/route length.

Table 3: Variation in VGF as per Aircraft Type on the Same RCS Routes (UDAN 5.3)

Stage Length	Cat 1/1A Aircraft	Cat 2/3 Aircraft
1 -50	2,265	3,023
51-75	4,044	3,420
76-100	5,229	3,680
101-125	6,440	3,941
126-150	7,625	4,203
151-175	8,811	4,464
176-200	9,855	4,602
201-225	10,902	4,740
226-250	11,931	4,864
251-275	12,974	5,082
276-300	14,022	5,455
301-325	15,051	5,814
326-350	16,097	6,186
351-375	17,142	6,559
376-400	18,171	6,917
401-425	18,171	7,290
426-450	18,171	7,664
451-475	18,171	8,022
476-500	18,171	8,395
501-525		8,890
526-550		9,248
551-575		9,605
576-600		9,964
>600		9,964

It is expected that these subtle changes in the VGF policy would provide a positive and sustainable impetus to small regional carriers operating with small aircraft to offer better fares and services to regional commuters. In view of these positives, it is implicit that small highly efficient regional jets operable from small runways, would be an ideal choice for providing affordable connectivity to Indians residing at, or visiting, remote locations under the UDAN scheme.

HISTORY OF INDIAN REGIONAL TRANSPORT AIRCRAFT

The pioneering idea of developing an indigenous transport aircraft was made public in early 2007. It was reported that Hindustan Aeronautics Limited (HAL) and National Aerospace Laboratories (NAL) were planning to jointly design and develop a 70-seater civil regional aircraft. The transport aircraft was to be developed within six to seven years and have a range of 600-800 km. The engine could have been supplied by Pratt and Whitney (Canada) or General Electric (US). It was estimated that given the trajectory of growth of air travel in India, over 400 new aircraft would be required over the next 15-20 years. The HAL-NAL designed Regional Transport Aircraft (RTA-70) was meant to ply short-haul routes and compete with French-Italian aircraft maker *Avions de Transport Regional* (ATR). Later, on February 29, 2008, Dr Kota Harinarayana, from NAL presented an overview of the RTA programme to an august gathering of senior functionaries from CSIR, DRDO, and the Department of Atomic Energy (DAE), etc. The RTA programme caught national attention in August 2008, when Dr APJ Abdul Kalam said that India could produce its own 70-seater passenger jets by 2020.[16]

The computer-generated image of the Indian RTA as conceived in the Detailed Project Report submitted to the GoI in the year 2011-12, is as shown in Fig 2. However, a few months later, Defence Minister A.K. Antony directed

16. Dr APJ Kalam, "India can Produce 70-Seater Passenger Aircraft by 2020", Address to students of Amity University, Noida, August 11, 2008, https://economictimes.indiatimes.com/industry/transportation/airlines-/-aviation/india-can-produce-70-seater-passenger-jets-by-2020-kalam/articleshow/3351962.cms?from=mdr. Accessed on October 21, 2024.

the state-owned HAL to undertake the project with foreign collaboration. It was also decided to increase to seating capacity from 70 to 110, and the range from 800 km to 3,000 km. Notwithstanding the constant deviations on the desired/design specifications, NAL worked on the conceptual design and launched the Project Definition Phase for a 90-seater RTA in April 2022. And in April 2024, NAL presented a Detailed Project Report on its proposal to the MoCA, concluding 15 years of exhaustive discussions and research studies. Since then, scientists, designers and aeronautical engineers have been speaking, and presenting their ideas, about the Indian RTA but the dream of the former president is yet to become a reality.

Fig 2: Artificial Intelligence (AI) Impression of CSIR-NAL's RTA

Source: NAL.

SATISFYING NATIONAL ASPIRATION: DESIGNING RTA FOR RCS

Minister for Civil Aviation Shri Kinjarapu Ram Mohan Naidu, while addressing an industry event organised by the PHD Chamber of Commerce

India may need a blend of the talent of Dr Vikram A Sarabhai and Nambi Narayanan to manoeuvre its way into the elite club of countries capable of designing, developing and manufacturing passenger aircraft.

and Industry (PHDCCI) said that his ministry is in the process of creating the Special Purpose Vehicle (SPV) for which industry stakeholders will work on the development of an indigenous passenger aircraft in the country. He elaborated that the government would like to engage with the private sector towards the development of this aircraft. Global aerospace majors have also expressed a strong inclination to partner with Indian firms for the development of such aircraft.[17] This statement by a dynamic ministry from a go-getter government could be considered as a serious relaunch of an idea which is over two decades old. However, the core issues still remain: what to produce and how to produce it. India may need a blend of the talent of Dr Vikram A Sarabhai and Nambi Narayanan to manoeuvre its way into the elite club of countries capable of designing, developing and manufacturing passenger aircraft.

WHAT TO PRODUCE? PERFORMANCE REQUIREMENT FOR INDIAN RTA

Roger Béteille, mentor of aviation industries' most successful revival programme, the Airbus 320, said, before commencing the work, "I wanted to try to understand what the customers really wanted[18] before developing the aircraft". During the early 1970s, Airbus was in a tough competition with American giants Boeing and McDonnell Douglas. To beat this, Airbus decided to design a versatile single-aisle narrow body airframe, lighter and more efficient than its American competitors. By 1977, a consortium

17. "SPV to be Formed with Stakeholders for Development of Indigenous Passenger Aircraft: Aviation Minister", September 4, 2024, https://infra.economictimes.indiatimes.com/news/aviation/spv-to-be-formed-with-stakeholders-for-development-of-indigenous-passenger-aircraft-aviation-minister/113059025aircr. Accessed on October 21, 2024.
18. "An Obituary to the Founding Father and Visionary, Roger Beteille", Airbus Commercial Aircraft History, https://www.airbus.com/en/our-history/commercial-aircraft-history/first-order-first-flight-1970-1972. Accessed on October 21, 2024.

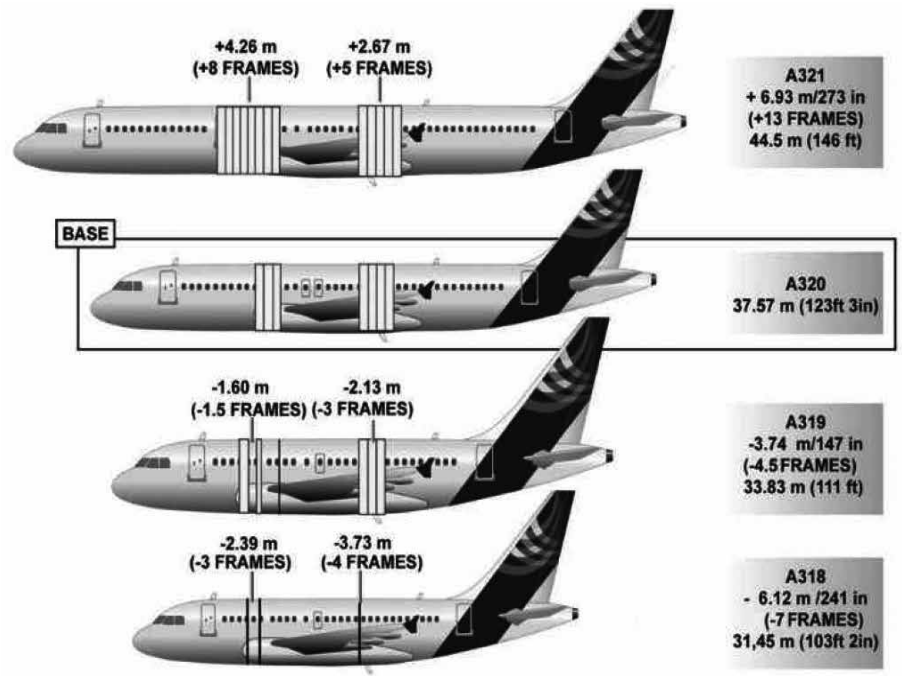
of European aircraft makers commenced the JET (Joint European Transport) programme. Sweden's Saab, Germany's MBB (Messerschmitt-Bölkow-Blohm), British Aircraft Corporation (now British Aerospace), Aerospatiale, Dornier, Fokker, and Spain's Construcciones Aeronauticas SA (CASA) were active stakeholders to develop a 180-seater aircraft. The group designed many variants: the smaller versions, A318 and A319, the most fuel efficient A320neo, and the long range A321LR, A321XLR. These derivatives could be designed, certified and produced rapidly because the initial design of the 320 was highly adaptive and flexible as regards changes in the length of the fuselage and the choice of the onboard engines. The market variants of the basic airframe are illustrated in Fig 3. Incorporating subtle changes to the basic structure, Airbus could deliver an aircraft satisfying customers' requirement of range and seats, without major changes in the cockpit layout and design of wings.[19] A similar concept was adapted by ATR for their 42/72-seater variants.

Drawing a leaf out of the success story of the A320 and the emergent desire to provide low-cost regional connectivity under UDAN, it is suggested that the country adopt a staircase approach to aircraft design.

Drawing a leaf out of the success story of the A320 and the emergent desire to provide low-cost regional connectivity under UDAN, it is suggested that the country adopt a staircase approach to aircraft design. To start with, the designers could aim at developing an aircraft which is capable of reaching out to all the 332 airfields and water aerodromes listed under UDAN 5.3. For this, the design requirements catering to limited availability of real estate at such airfields could be drawn from the following Tables 4 and 5. Table 4 defines the aircraft size restrictions on the airfield for

19 "A Detailed Analysis on Marketing Strategies of Airbus", The Brand Hopper, April 7, 2024, https://thebrandhopper.com/2024/04/07/a-detailed-analysis-on-marketing-strategies-of-airbus/. Accessed on October 21, 2024.

Fig 3: Design Variants of Airbus A320



Source: Egypt Air, Training Academy.

safe handling. The ICAO reference code[20] is assigned to an airfield based on the length and width of the airstrip. The location of the airfield also limits the type of aircraft that can use the airfield. The aircraft category is assigned according to its manoeuvrability, rate of climb/descend, approach speed, etc which are integral parts of its design/performance parameters. Table 4[21] also tabulates the ICAO code assigned to an aircraft and is based on its design performance at maximum stated payload and at standard pressure altitude.

20. Airbus Airport Operations reference document dated July 6, 2020, Subject: ICAO/EASA Aerodrome Reference Code, FAA Airplane Design Group and Aircraft Approach Category for Airbus Aircraft, https://aircraft.airbus.com/sites/g/files/jlcbta126/files/2023-02/NEW-AI~1.pdf. Accessed on October 31, 2024.
21. Ibid.

Table 4: ICAO Aerodrome Reference Code Table

First Element			
Code (number)	**Aeroplane reference field length**		**Typical aircraft type**
1	<800 m		Piper PA-44, DHC-6 Twin Otter
2	800 m to <1200 m		Dash-8, ATR-72
3	1200 m to <1800 m		Canadair Regional Jet
4	>1800 m		Airbus A321, Boeing 747
Second Element			
Code (letter)	**Wingspan**	**Outer main gear wheel span**	**Typical aircraft type**
A	<15 m	<4.5 m	Piper PA-31, Cessna 206
B	15 m to <26 m	4.5 m to <6 m	CRI-200, DHC-6 Twin Otter
C	24 m to <36 m	6 m to <9 m	Boeing 737, Airbus A320 series
D	36 m to <52 m	9 m to <14 m	Airbus A300, Boeing 767
E	52 m to <65 m	9 m to <14 m	Boeing 777, Airbus A330
F	65 m to <80 m	14 m to <16 m	Airbus A380, Boeing 747

Source: ICAO.

From Table 4, the following can be inferred as regards the design parameters and capabilities for the proposed RTA.

(i) It should be capable to land/take off from an airfield of length below 1.2 km.

(ii) Airstrip length restriction with maximum payload and from pressure altitude of upto 4,600ft Above Sea Level (ASL), for example, Pakyong, Sikkim.

(iii) Wing span below 25 m.

(iv) Tail height below 5 m.

(v) Indicated Air Speed (IAS) at approach below 224 kmph (120 knots)

(vi) Rate of climb above 800-1,000 metres per minute (Mpm).

Additional desirable operational features to capitalise on potential capability gaps in the market, and features currently not offered by similar aircraft from established OEMs, are given below:

(i) Ability to operate from water aerodromes (availability of floatation device) amphibious capability.
(ii) Pressurised and airconditioned cabin for passenger comfort, use for Medevac and high altitude flying.
(iii) Flexibility in the design of main fuselage, and extendable central section.
(iv) Lightweight glass cockpit, with essential avionics for Instrument Flight Rules (IFR) capabilities.
(v) Flexible seating capacity with variable size cargo compartment.
(vi) Light weight composite wing design.
(vii) Integrated height lift devices on the wings for Short Take-Off and Landing (STOL) capabilities.
(viii) Ability for optional use of engines and propellers from various OEMs, including the indigenous turboshaft engine.
(ix) Minimum cabin height 1.8 m and width 2.0 m.
(x) Design variants/changes (to length of fuselage) as per industry standards and regulatory requirements.

The Maximum Take-Off Weight (MTOW) and seating capacity for differed variants could be designed considering the following:

(a) MTOW below 8,618 Kg (19,000lb) with a seating capacity up to 19 passengers as per "EASA CS-23 Certification Standards for Normal Category Aeroplanes".
(b) MTOW below 8,618 kg (19,000lb) with above 19 seats.
(c) Avionics/navigation equipment and Cockpit Voice Recorder/ Flight Data Recorder (CVR/FDR) recorders as per requirements of "ICAO Annex 10/annex 6" for MTOW below 5,700 kg/19-seats and
(d) Avionics/navigation equipment and CVR/FDR recorders as per requirements for MTOW above 5,700 kg and below 27,000 kg.

WHAT TO PRODUCE? RTA FOR CIVIL VS MTA FOR MILITARY

According to the Flight Global, 2024 World Air Force Directory[22], there are over 53,400 aircraft in active use with the armed forces of 161 nations. Out of these, about 4,273 are fixed-wing transport aircraft and 805 tankers. A closer look at the global inventory of military aircraft suggests that the share of civil transport aircraft design in military aviation is just 1.8 per cent (980/53400) which includes old and refurbished airframes (Table 5).

Table 5: Inventory of Fixed Wing Transport Aircraft from World's Air Forces

Sl No	Fleet	Role	In Active Use
1.	All World Air Forces	Fighter, Transport, Tanker, Trainer, Helicopter, Spl Mission, etc	53,400
2.	Fixed Wing Transport	Troop Transport, Trainer	4,273
3.	Refurbished	Tanker	805
Fleet-wise Strength of Civil Utility Transport Variants in Military FWT			
(i)	King Air	Surveillance & Marine Recognisance	220
(ii)	King Air	VIP Transport and Training	288
(iii)	B-737	Spl Mission (AEW/ MPA)	177
(iv)	B-737	VIP Transport	30
(v)	B-747	Tanker	3
(vi)	B-767	Tanker	83
(vii)	A-330	Tanker	51
(viii)	A-310	Tanker	2
(ix)	DC-10	Tanker	20
(x)	Do-228	Communication duties/ MRP	106
Total			**980**

Source: Flight Global.

From the above table and detailed analysis of the inventory of aircraft by type held with air forces across the world, it is evident that the operational

22. Flight Global, 2024 World Air Forces Directory, https://www.flightglobal.com/reports/2024-world-air-forces-directory/156008.article. Accessed on October 31, 2024.

Therefore, considering the Indian armed forces as the anchor customer for the RTA programme could have limited commercial success. The RTA design should be dedicated to meet the requirements of the civil commercial market.

requirements for air forces do not necessarily align with those for the civil aviation sector. Militaries prefer to use small and light category (i.e. below 8,618 kg) aircraft for surveillance/intelligence purposes and VIP transport duties. Whereas, for special mission/airborne early warning and long-haul VIP roles, militaries prefer to use medium/heavy lift aircraft with wide-bodied/large cargo compartment, rear loading ramp and STOL capabilities. From the above, it can be inferred that the design and performance requirements for military and civil aircraft are widely different and, thus, very few commercial aircraft ever get inducted into military fleets. Therefore, considering the Indian armed forces as the anchor customer for the RTA programme could have limited commercial success. The RTA design should be dedicated to meet the requirements of the civil commercial market.

HOW TO PRODUCE?

Henry Ford had once said, "Coming together is a beginning, working together is success." History is filled with inspirational examples of groups of ordinary people delivering extraordinary results due to great teamwork. From the Apollo 11 Moon landing in 1969 to the Chandrayaan-3 landing in 2023, we realise how the collaborative efforts of selfless, non-attention seeking, dedicated teams of people could transcend boundaries and achieve success. Similarly, the India RTA programme also needs a dedicated team of selfless people to achieve success.

Recently, the minister of civil aviation had announced that the government is contemplating the formation of a Special Purpose Vehicle (SPV) for taking forward the RTA project. The constituents and scope of work of the SPV are yet to be announced. This could be a landmark decision towards realising India's dream to design and produce its own

civil aircraft. However, the success of the project may be fathomed from the strength of its team members and the perseverance of its mentor. In the interest of the nation, the deliverables should be time-bound, therefore, all the participants should have considerable revenue stakes in the SPV. All the members should commit by contributing equally to the project and sharing responsibilities. A suggested list of shareholders could be as follows:

Support from domestic and international research/test agencies can be taken for designing, developing and testing of specific elements/ components/assemblies.

(i) Entities/organisations currently engaged in the manufacture of aircraft structure like HAL, Tata Advanced Systems Limited (TASL), Mahindra Aerospace, Dynamatic Technologies Limited, etc.
(ii) Entities/organisations currently engaged in civil aviation operations.
(iii) Entities/organisations currently engaged in the design/development and manufacturing of aircraft avionics and major components/ assemblies.
(iv) Non-banking sector financial organisations involved in leasing and marketing commercial aircraft.
(v) The Government of India/ministries could be a major contributors with proportional equity.
(vi) State governments and large ministries/departments of the GoI like Home, Highways, Railways, National Disaster Management Authority (NDMA), etc., alongwith participating customers, should act as anchor customers for suitable variants.

Further, consultancy services could be hired for a limited period and role. Support from domestic and international research/test agencies can be taken for designing, developing and testing of specific elements/ components/assemblies. The team may work in mission mode with declared schedules and targeted deliveries. All efforts should be made to ensure that

the design should be ready within three years and the prototype in the fourth to fifth year.

THE WAY FORWARD: SYNERGISING R&D TOWARDS FULFILLING UDAN DREAM

India has set the goal of becoming a developed nation by 2047 (*Viksit Bharat*@2047) and is emerging as the world's largest user market for commercial aircraft. Domestic operators have placed orders for over 1,000-1,200 passenger aircraft and are expected to acquire about 1,000 more in the coming 20-25 years. Despite having a booming aviation sector, India has not been able to develop its own aircraft to meet the aspirational needs of the nation. The country has been discussing the development of its own "Regional Transport Aircraft" for over 20 years, with CSIR-NAL being in the driving seat, but it has achieved limited success.

It is time India captures the customers' need and dovetails it with the national vision for a truly indigenous commuter aircraft. The project should be designed, developed and manufactured using a Public-Private Partnership (PPP) model. The base design should also be scalable like the Airbus 320 programme. Multiple options for the use of foreign and indigenous engines should be integrated into the design. Concurrently, a strict timeline which matches the expectations of the market forces is necessary for the success of the RTA programme.