July 2022

100 KNOTS

India's Premier Crew Magazine

Statistics
Pilot Training

Human Factors
Pilot Automation Interaction

Management
Quality Assurance

Vande Bharat
Largest repatriation mission in human history

People
India's Fastest Lady
Capt. Sneha Sharma

Meteorology
Indian Monsoons & Weather Avoidance

Operations
Polar Navigation

Editor
Preet Palash
Sakshi Shreya

Contributors
Capt. Vikas Nautiyal
Capt. Vijay Devdas
Capt. Amit Singh FRAeS
Capt. Kulbir Singh Chaudhary
Capt. Sneha Sharma
Capt. Rushikesh Someshwar

Correspondents
Radhika Bansal
Prashant Prabhakar
Jinen Gada

Photographer
Utkarsh Thakkar
Janam Parikh

Illustrator
Saurav Chordia

Creative Head
Ashiba Saeed

Knowledge Partner
Safety Matters Foundation

For Advertising, Queries and Suggestions
Mail: editor@100knots.com

EDITORIAL DESK

Preet Palash
Editor

Dear Colleagues,

Welcome to the July edition of the 100 KNOTS Magazine.

In this issue, we have brought together Industry experts from all domains who have written on critical subjects, both technical and non-technical that affect our daily operations. We explore the inspiring journey of Capt. Sneha Sharma as she becomes the fastest lady in India. Capt. Amit Singh FRAeS talks about Quality Control vs Quality Assurance regarding Flight Crew Training. Capt. Kulbir Singh Chaudhary explains to us Indian Monsoons and Weather Avoidance procedures. Senior Captain and Airbus procedural trainer, Capt. Vijay Macmilton Devadas gives us insights from his research on Pilot-Automation Interaction. Air India Capt. Rushikesh Someshwar talks about the interesting polar navigation, associated challenges, and how they are mitigated. Capt. Vikas Nautiyal writes about a fictional account based on the 'Vande Bharat mission', the largest repatriation mission in human history.

We are dedicating this edition to the Pilot training infrastructure in India. There are presently 34 registered pilot training schools in India with a combined total fleet of 219 aircraft. About 1000 commercial pilot licenses are issued by DGCA every year, comprising foreign conversions and home-trained students. With the growth of regional aviation, Indian aviation is forecasted to need at least 1,000 to 1,500 pilots every year. Ministry of Civil Aviation has taken serious steps in setting up new institutes for pilot training to curb the outflow of students and develop pilot training infrastructure in the country.

During the last couple of months, there have been numerous incidents and accidents at FTOs across the country. DGCA findings have shown that aircraft were being operated with faulty or unserviceable instruments and falsely logging hours in official documents. The emergency response plan, a critical component of the safety management system was not practiced at many FTOs. These findings can tarnish the industry's reputation, forcing potential students to look for alternative training options abroad. Through this message, I would like to request the FTOs practice strict quality control in pilot training processes. Indian aviation is seeing unprecedented growth and FTOs have a huge role to play by providing skilled manpower, who will take this industry to new heights.

I close this message by inviting everyone to submit their exciting ideas to 100 Knots. All papers are received with a high degree of enthusiasm and they will find a home in future issues. We are committed to publishing all discoveries, methods, resources, and reviews that significantly cover the Indian aviation sector at large.

Our sincere thanks to all the contributors for their support and interest.
We hope to hear from you soon!

100 KNOTS

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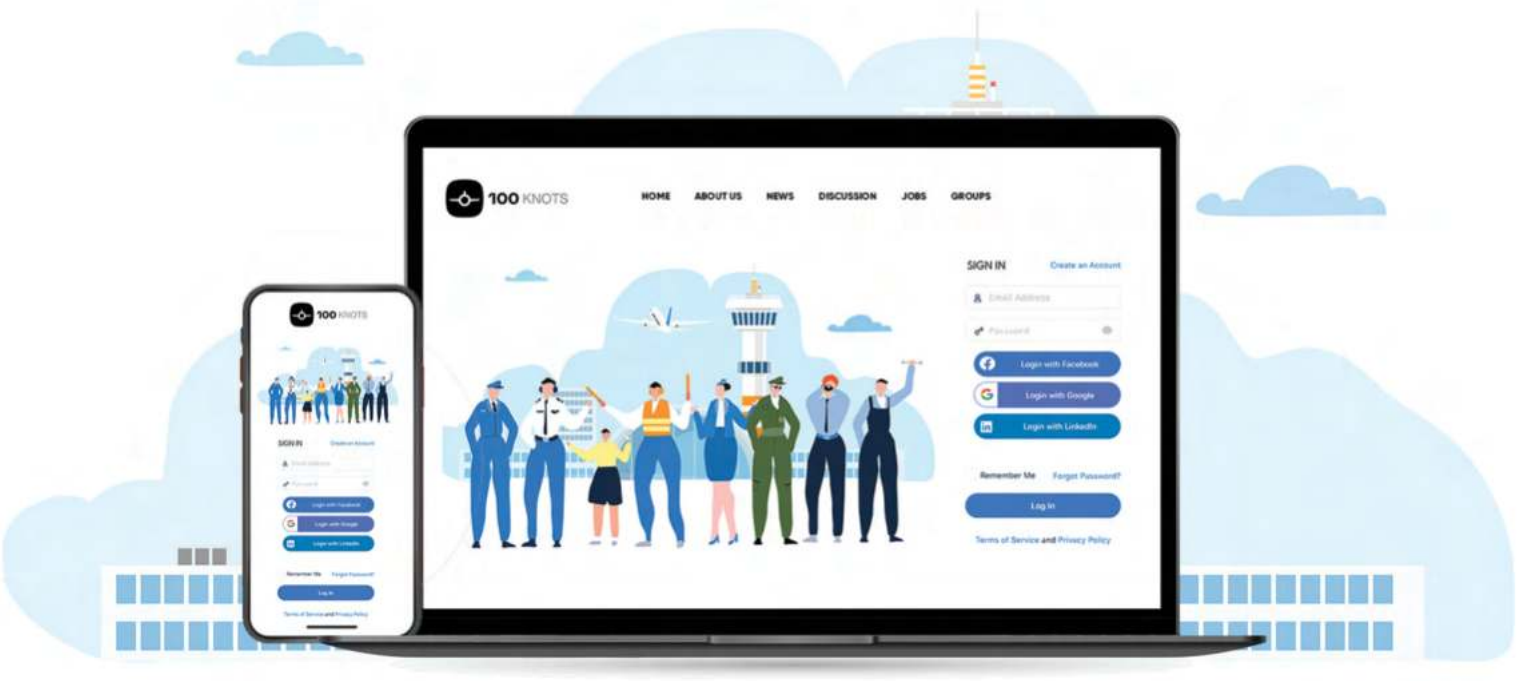
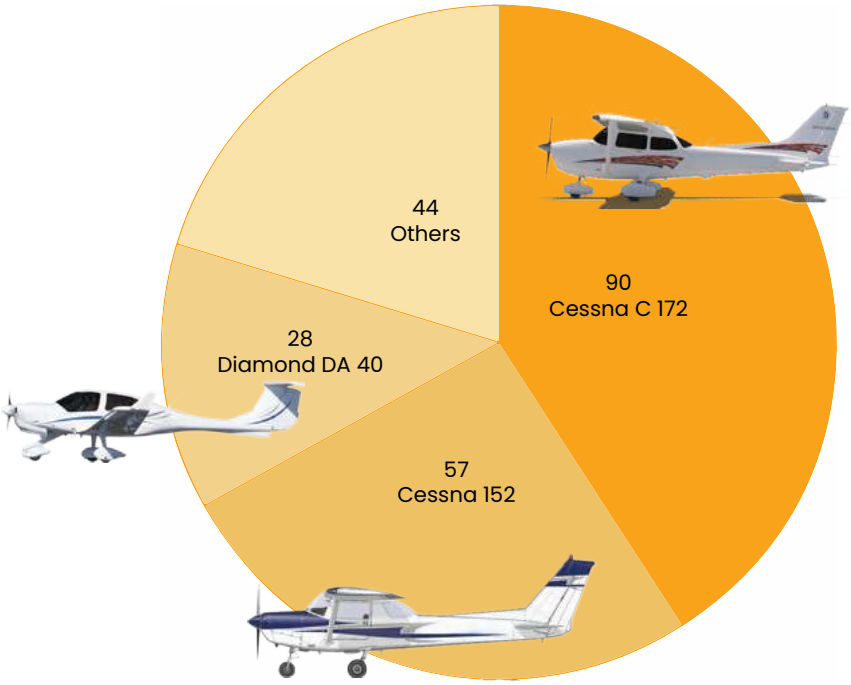


THIS ISSUE

Pilot Training Establishments
Statistics

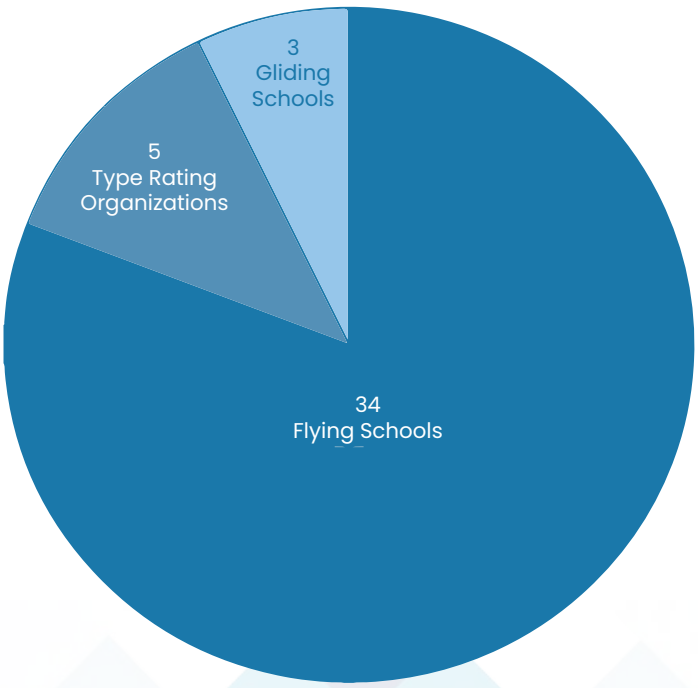


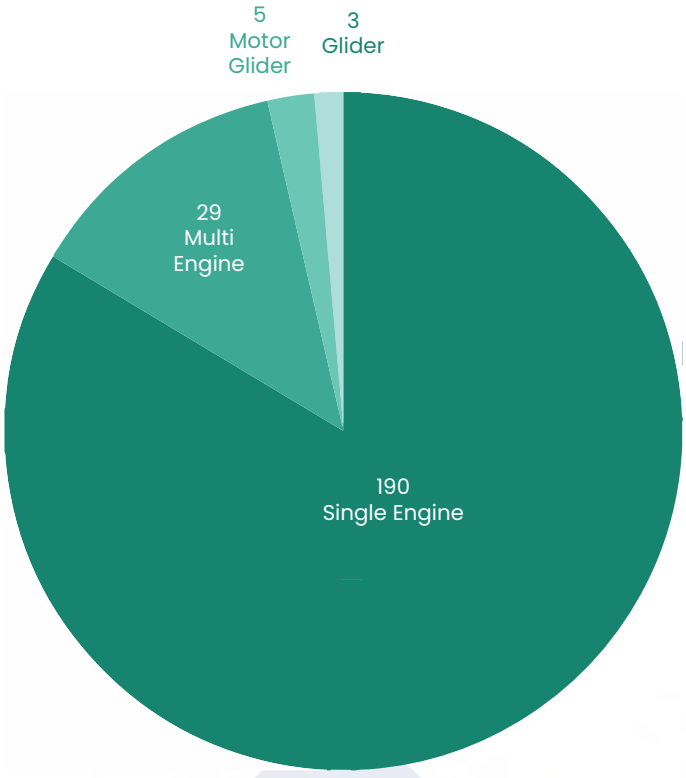
Number of Pilot Training Organizations

42

Total fleet

219





Most Popular Airplane (Single Engine)

Cessna C 172

Manufacturer	Textron
Country of Origin	USA
First flight	1955
Seats	4
Price	**US $** 200,000
Total in India (Training)	90
Biggest operator	Chimes Aviation Academy

Cessna C 152

Manufacturer	Textron
Country of Origin	USA
First flight	1977
Seats	2
Price (Used)	**US$** 30,000 (Used)
Total in India (Trainining)	57
Biggest operator	Falcon Aviation Academy

Diamond DA 40

Manufacturer	Diamond
Country of Origin	Austria
First flight	1997
Seats	4
Price	**US $** 500,000
Total in India	28
Biggest Operator	Indira Gandhi Rastriya Uran Academy

Most Popular Airplane (Multi Engine)

Diamond DA 42

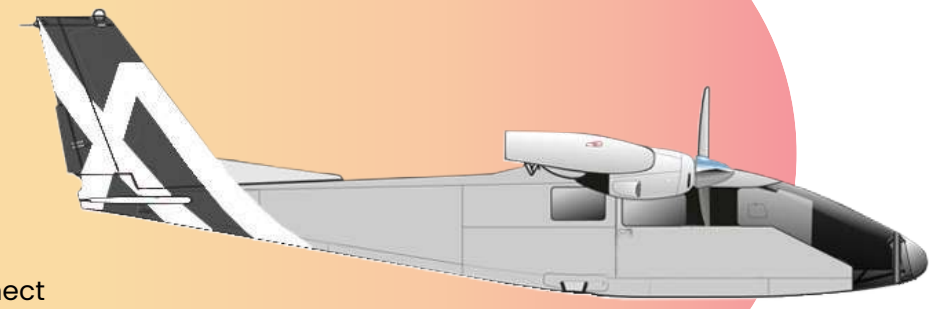
Manufacturer	Diamond
Country of Origin	Austria
First flight	2002
Seats	4
Price (Used)	US$ 620,000
Total in India (Trainining)	8
Biggest operator	Chimes, IGRUA, NFTI

Piper Seneca PA 34

Manufacturer	Piper
Country of Origin	USA
First flight	1971
Seats	6
Price	US $ 1.2M
Total in India	7
Biggest Operator	Falcon Aviation Academy

Partenavia P 68

Manufacturer	Partenavia
Country of Origin	Italy
First flight	1970
Seats	6
Price (Used)	US$ 1.2M
Total in India (Trainining)	6
Biggest operator	Global Konnect Aviation Services



Rare Airplanes

Piper Seneca PA 18

Registration	VT-DFR
Manufacturer	Piper
Country of Origin	USA
Operator	Bombay Flying Club
Total	1
Seats	2
Flying Since	1951

Zlin Z 42

Registration	VT-IGQ VT-IGR
Manufacturer	Moravan Otrokovice
Country of Origin	Czechoslovakia
Operator	Indira Gandhi Rastriya Uran academy
Total	2
Seats	2
Flying Since	2005

Socata TB 20

Registration	VT-IGB
Manufacturer	Socata
Country of Origin	France
Operator	Indira Gandhi Rastriya Uran academy
Total	1
Seats	2
Flying Since	1999

Most Popular Schools

Indira Gandhi Rastriya Uran Academy

Fursatganj, Rae Bareilly, UP
Established 1985
Owner : Ministry of civil Aviation, Government of India

	AIRCRAFT	TYPE	FLEET SIZE
	Diamond DA 40	Single Engine	13
	Diamond DA 42	Multi Engine	2
	Zlin Z 242	Single engine	2
	Socata TB 20	Single Engine	1

National Flying Training Institute

Birsi Airport, Gondia, Maharashtra
Established 2007
Owner AAI & CAE

	AIRCRAFT	TYPE	FLEET SIZE
	Diamond DA 40	Single Engine	12
	Diamond DA 42	Multi Engine	2

Chimes Aviation Academy

Sagar, MP
Established 2008
Owner Chimes Group

	AIRCRAFT	TYPE	FLEET SIZE
	Cessna C 172	Single Engine	12
	Diamond DA 42	Multi Engine	2

Gliding Training

Popular Gliders

Pipistrel Sinus 912

Manufacturer	Pipistrel
Country of Origin	Slovenia
First flight	1996
Seats	2
Price	US$ 115,000
Total in India	4
Biggest operator	Jharkhand Flying Institute, IIT Kanpur

Stemme S6

Manufacturer	Stemme
Country of Origin	Germany
First flight	2006
Seats	2
Price	US$ 340,000
Total in India	2
Biggest operator	IIT Kanpur

LET L-23 Super Blaník

Manufacturer	LET
Country of Origin	Czechoslovakia
First flight	1988
Seats	2
Price	US$ 100,000
Total in India	2
Biggest operator	Gliding Centre Pune

Gliding Centre Pune

Pune, Maharashtra

Manufacturer	LET
Model	Super Blanik L-23
Type	Glider
Fleet Size	2
Total	2

Jharkhand Flying Institute (Gliding Wing)

Ranchi, Jharkhand

Manufacturer	Model	Type	Fleet Size
LET	Super Blanik L-23	Glider	1
Pipistrel	Sinus 912	Glider	2
Stemme	S6-RT	Glider	1
Total			4

Gliding and Soaring Centre, IIT Kanpur

Kanpur, UP

Manufacturer	Model	Type	Fleet Size
Pipistrel	Sinus 912	Glider	2
Total			2

Type-Rating Training Organizations

Flight Simulation Technique Centre Gurugram


Airbus A320


Boeing B737-800


Bombardier Q400


ATR 72-600

CAE Simulation Training Greater Noida


Airbus A320


Boeing B737-800

Airbus India Training Centre Gurugram.


Airbus A320

Central Training Establishment Hyderabad


Airbus A320


Boeing B787


Boeing B777


Boeing B737-800


ATR 72-600

HATSOFF Helicopter Training Bengaluru


Airbus AS365 Dauphin


Bell 412


HAL Dhruv


QATAR

Indian Monsoons and Weather Avoidance

Kulbir Singh Chaudhary
Chief Ground Instructor
National Flying Training Institute, Gondia

What is monsoon? Rains...No. It is the wind pattern, and the word monsoon comes from the Arabic word Mausim meaning weather. Ramage had defined monsoon as a phenomenon when the wind direction from January to July changes by at least 120^0 and speed is at least 6 knots during the month. This phenomenon is basically linked to the annual oscillation of ITCZ which is Maximum over the Indian ocean. So, the monsoons cover an area of 30^0 West to 170^0 E and from 30^0 N to about 25^0 S where the ITCZ has the highest fluctuation.

Indian Monsoon or SW Monsoon

The monsoon circulation dominates the climate of India. In one half of the year, the wind blows from the cooler humid ocean to the warmer dry land, while in the other half there is a seasonal wind blowing from the cold dry Asian land mass to the warm Indian Ocean. There is a spectacular reversal of the pressure and wind patterns between the two halves, the change-over taking place in gradual stages. Therefore, in India, there are two main seasons: the summer southwest monsoon and the winter northeast monsoon. The transition between these two main seasons during which the gradual reversal of pressure and wind circulation takes place constitutes two other seasons.

Southwest Monsoon (Wet) Season

This is the summer monsoon period when the southwest monsoon holds sway over the country. The country (outside western and eastern Himalayas and southwest Peninsula), receives nearly 75% of its rainfall during this period. Southwest monsoon sets in at the extreme southwest tip of the Peninsula by the end of May and progresses inland in stages and extends to the northwest portions of the country by the middle of July. It starts retreating from the extreme northwest, by the beginning of September, progressively receding southwards. The period June to September is referred to as the southwest monsoon period and is the wet season. Often people refer to the southwest monsoon simply as monsoon.

The tropical depressions from the Bay of Bengal travel inland through central and northern India. The sub-tropical westerly jet stream shifts north of the Himalayas and the tropical easterly jet stream makes its appearance over the Peninsula. The main characteristics of the seasons are moderate to heavy rains, very low clouds, high humidity, and sultry weather. The southwest monsoon current sets in over the seas extending from the south of Sri Lanka to the Andaman Sea and Tenasserim by the middle of May. By the beginning of June, it extends further northwards as two distinct branches—the Arabian Sea branch and the Bay of Bengal branch, the former to Kerala and the latter to Burma, Bangladesh, and Bengal. In the next, two weeks the monsoon extends to the whole country outside northwest India. By the middle of July, the whole subcontinent comes under the sway of the monsoon flow.

Pressure Distribution

An intense low-pressure system (the deepest in the hemisphere) develops over the northwestern part of the subcontinent and adjoining Afghanistan, spreading eastwards as an extensive trough up to the northwest angle of the Bay of Bengal, covering the entire Indo-Gangetic plain. The pressure gradually increases southwards to the Indian Ocean, well into the southern hemisphere. The trough of low pressure in the Indo-Gangetic plain is usually referred to as the monsoon trough. This is often modified when depressions form in the northwest Bay of Bengal.

Salient Features

More or less general rain occurs throughout the country, though the intensity and duration of each rainy spell and the rainfall distribution are controlled by the strength of the monsoon, the orientation of the monsoon trough, and the tropical depressions.

The monsoon current meeting the Western Ghats yields heavy rain on the west coast due to the Orographic effect, the rainfall averaging 250 cm. To the east of the Western Ghats, there is a rapid decrease in rainfall due to the orographic desiccation. The Arabian Sea branch of the monsoon gives some rain in Gujarat and west Rajasthan. Here again, the maximum rainfall is in the Aravalli region due to the orographic effect. The Bay of Bengal branch causes heavy rains in the Burmese coastal belt and Eastern Himalayas. From Bengal, this branch is deflected westwards as easterlies, more or less parallel to the Himalayas. In north Madhya Pradesh, Uttar Pradesh, Punjab, Haryana, and Himachal Pradesh, the southwesterly Arabian Sea branch and the easterly Bay of Bengal branch of the monsoon meet along the monsoon trough and give rise to moderate to heavy rain. The axis where the fresh Arabian Sea monsoon air and the modified Bay monsoon air meet, is the monsoon front. The distribution of rain in the Indo-Gangetic plain is, therefore, naturally governed by the orientation of this monsoon front.

Break monsoon

The normal question posed to me by pilots is “Sir, when will be break monsoon” as every pilot wants to fly and needs a bit of clear weather which is provided by Break Monsoon. It has to be understood that break monsoon is a situation and there is no specific date for this. Break monsoon situation is established when a Moving WD causes the recurvature of traveling depression to eastward and the AMT is shifted along the foothills of Himalaya. So, the rainfall belt also shifts to the foothills of the Himalayas and NE India and there is a general decrease in Monsoon rains over the Indo-Gangetic plains. When, the monsoon front moves north and lies along the foothills of the Himalayas, the rainfall over the plains decreases and there is an increase in rainfall over the hills. This is termed break-monsoon. The monsoon revival subsequently occurs when another depression forms in the Bay and the monsoon front moves south again, its eastern end dipping into the head Bay. Southeast Tamil Nadu is a sheltered area.

Withdrawal

The southwest monsoon starts withdrawing by the middle of the third week of September from northwest India, bringing in its wake continental dry air and fine weather. The retreat of the monsoon air continues gradually and progressively southwards and eastwards. A rough pattern of the distribution of weather phenomena in this season is shown in the map.

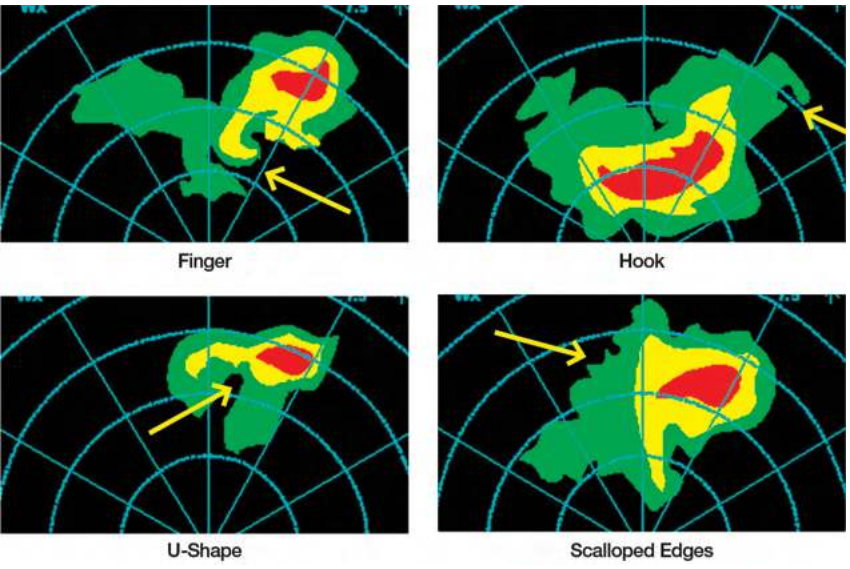
Aviation Weather Hazards

Low clouds
Stratus clouds lower usually to 150 to 200 m AGL under moderate to strong monsoon conditions. However, when depressions affect a place, the cloud base may lower to 30 to 60 meters AGL.

Strong surface winds
Under strong monsoon conditions surface winds are usually of the order of 25/30 kt. When depressions affect an area, surface winds may reach speeds of 40 to 50 kt.

Visibility
Visibility is generally good. However, in heavy rain, the visibility may deteriorate to a few hundred meters.

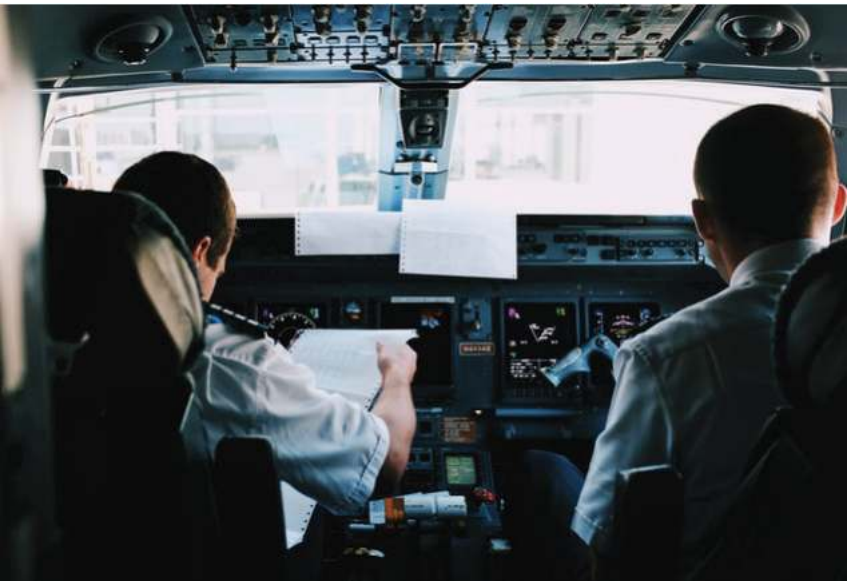
Easterly or tropical jet stream
During the monsoon season, the easterly or tropical jet stream lies between latitudes 10° and 15°N with its core between 150 to 100 hPa levels. The core speeds are on average 60 to 70 kt but occasionally reach 100 to 120 kt.



Weather Avoidance

Entering weather can be catastrophic and we have witnessed very unfortunate examples in the recent past. The crash of Air India Express B737 at Kozhikode airport was blamed on low visibility due to rain and sub-optimal performance of windshield wipers. This crash replicated the Mangalore crash of 2010. Bad weather was the reason behind the crash of the Tara Air Twin Otter last month in Nepal's mountainous Mustang district.

Flying through weather is sometimes unavoidable despite the best efforts to prevent this. The flight crew must use the recommended procedure to limit the impact of the weather on the aircraft's trajectory and limit the risk of injury to passengers and cabin crew.



Proper Planning

Flight crew must anticipate any potential route deviation and plan extra fuel to avoid any expected storms shown on the weather forecast analysis during their pre-flight preparation. The weather forecast should be regularly updated, especially during long haul flights, because meteorological conditions can change very quickly. The weather radar system installed on-board aircraft provides the pilot with the necessary information to avoid - not penetrate - adverse weather. To obtain the maximum benefit from the weather radar system requires the crew to carefully optimize its use. This relies primarily on a good meteorological knowledge of weather phenomena, along with a good understanding of the available radar functions.

Early Avoidance

Severe turbulence can be reportedly encountered up to 4 NM outside the boundary of the cell. As a rule of thumb, storm cells should be avoided by 20 NM laterally and preferably upwind to avoid risk of encountering hail. A storm cell must not be overflown by less than 5000ft separation. Avoiding the storm cell by flying around it is preferred because turbulence can extend well above the visible top of a cumulonimbus. High vertical expansion cells with top over 25,000 ft should not be overflown due to potential of strong turbulence.

Inform the Cabin

Efficient coordination and communication between flight crew and cabin crew is essential to safely manage weather penetration. The preflight briefing is a good opportunity for flight and cabin crews to discuss the forecasted weather and the possible effects on flight conditions together. The flight crew must inform the cabin crew of any expected weather events and provide the estimated flight times and locations of possible turbulence. Flight crew must switch the seatbelt sign ON and make an announcement to the cabin requesting passengers and crew to fasten seatbelts immediately using the PA system. Informs the cabin when the aircraft is clear so that cabin crew can check for passenger injuries, give first aid, if necessary, calm and reassure passengers and check for any cabin damage.

Manage Flight Path

It is recommended is to keep the autopilot ON and not be tempted to fight against turbulence. Consider descent to a lower Flight Level to increase the aircraft's margins before buffet onset. Do not use rudder as violent rudder inputs can cause additional aircraft trajectory destabilization and stress on the aircraft structure. The flight crew must not overreact to temporary overspeed excursion as the airplane design ensures sufficient margins to structural limits.

About the Author

Kulbir Singh Chaudhary hails from a remote village Sabuana on the Indo-Pak border in Punjab. He did his basic schooling from Fazilka, Graduation from Hyderabad, and master's from Chidambaram. He served Indian Air Force from 1984 to 2007 in Meteorology Branch on different assignments including Kargil and Siachen Glacier. Kulbir served as Senior ground Instructor in Ahmedabad Aviation and Aeronautics from 2007 to 2008. He, later on, became the founding member of the National Flying Training Institute, Joined NFTI. He is currently Chief Ground Instructor at NFTI and has trained more than 600 commercial pilots. He is a military man and famous for his discipline and turnout. Make sure to check your uniform and turnout if he happens to be roaming around in your vicinity.

Pilot-Automation Interaction

Vijay Devdas
A320 Captain

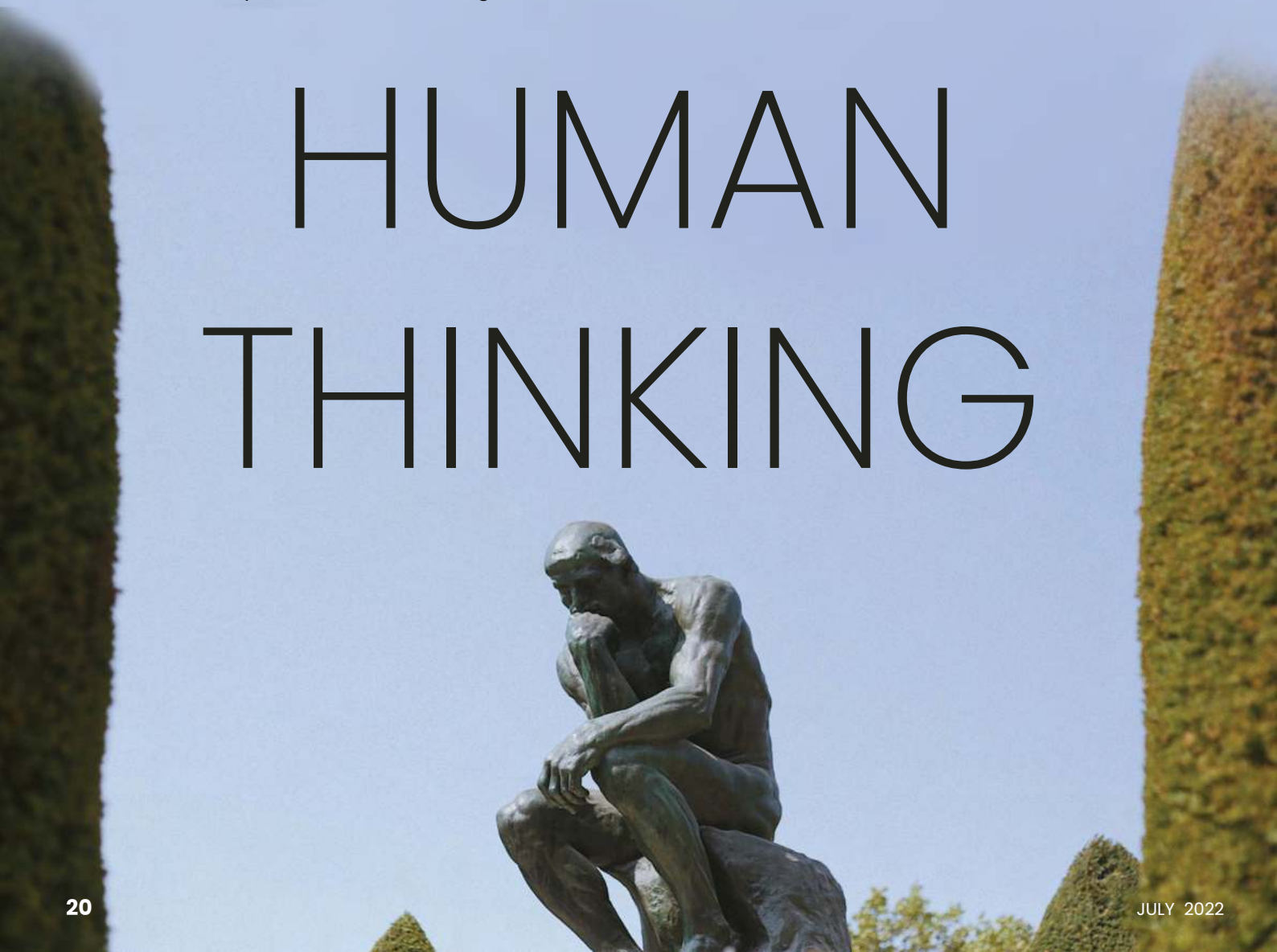
Commercial airplanes and their automation have evolved exponentially in the last few decades for the entire flight regime, including autonomous take-off and landing. The automation does a great job in meeting desired flight objectives with much reliability and predictability; and, in most cases, performs much better than a pilot. In the real world, there is always an unpredictable change in the operating environment; as automation can work well under defined conditions, pilots must be in the flight deck for a supervisory role as they can be more creative and work beyond the borders of logic and a defined framework by taking over. Even with such a synergetic team, many incidents frequently occur, such as level deviation, navigation errors, and traffic resolution advisory. How could it be possible that a highly automated aircraft and well-qualified pilots led to such an incident? Is it because of a pilot error or an automation error? Clearly, in most cases, neither it was the intention of the automation nor the pilots, then what is it still causing these incidents? First, we must understand the structural and functional difference between automation and a pilot's thinking; It is interesting to note that in a physiological sense, pilots have limited memory and processing speeds compared to automation, which is limitless. However, Humans are intuitive, insightful, and even logical in the cognitive sense, unlike automation's cognition, which strictly follows the codes, algorithms, and defined boundaries. In simple words, pilots think, and automation calculates. When the pilot and automaton are made to work together in a team environment, the difference in thinking could pose a gap and lead to pilot automation conflicts; and may lead to an undesired flight state.

Second, we must understand the information processing theory of pilots and automation through a human factors perspective on how they perceive, process and reason decisions on the information presented to them. Further, analyze how the pilot's thinking and automation's thinking causes some problems interacting as a team. Finally, propose some mitigation strategies to reduce the gap.

The pilot constantly processes information from the flight instruments in the flight deck to develop a schematic picture of the airplane's state. The perception of this information is highly influenced by prior experience or knowledge (Humphreys et al., 2020) (Brachman et al., 2004), which means each pilot could have a different perception of information among a sample of pilots. As (Goldstein, 2018) mentioned, information is perceived in the top-down and bottom-up approaches. In the top-down approach, the pilots seek relevant information from the flight instruments as desired by the brain by activating specific neural networks, something like a program or algorithm in the brain, which activates the sub-neural networks in retrieving from long-term memory the information on where to look for the desired information (Hunter, 2020). In the bottom-up approach, the airplanes draw the pilot's attention through various visual, aural, and sensory attention-getters; for example, if there is an altitude deviation, the graphic box on the altitude scale flashes along with an aural warning.

According to behavioral psychology (Goldstein, 2018), the visual and auditory stimulus causes the pilots to respond in a particular way, as reinforced during training. However, every individual does not attend to all the parts of the attention getters with a similar behavioral response (McIntyre & Graziano, 2016), which is majorly influenced due to the background knowledge, experience, goals, stimulus sensitivity, and varied perception of the stimulus (de Lange et al., 2018). Pilots are constantly developing a mental model or schematic representations called cognitive maps (Sammut-Bonnici & McGee, 2015) of the situation with the information through both approaches. The pilots process this information not in its parts rather than in chunks of Information (Konkle et al., 2010) in develop those maps and each pilot could be assimilating a different mental picture, as mentioned by (Kowialiewski & Majerus, 2020), and hence a varied perception of the situation.

Next, to act on the information, say speed deviation or altitude deviation information. In non-time-critical instances, a pilot can reason logically and make decisions; however, in novel and time-critical cases, the pilots' natural pathways could lead to a more heuristic approach through intuition, emotions, muscle memory, and taking actions that may not be appropriate for the situation, and this is because the human mind is very complex and evolving. In addition, we still do not understand how the neural network and its pathways work (Guastello, 2014).



HUMAN THINKING

AUTOPILOT THINKING

Autopilots are highly predictable and non-emotional machines that can perform highly repetitive, procedural tasks over a considerable timeline. Automation also uses the top-down and bottom-up approaches to information processing; however, they work differently from the human brain. Let us say the automation wants to check the current airplane's airspeed and its compliance; in the top-down approach, the automation's program code from memory would direct its input interface to pick up specific data through the sensors. The information is further processed through various algorithms in developing a perception of the accessed data, such as airspeed. Like the pilots' neural network, the automation network compares it with its vast memory to check for speed compliance. Unlike pilots, who would have different perceptions of the same information data, machines of the same type would perceive the same way as automation would use similar logical and probabilistic reasoning to aid decision-making (Bottou, 2013).

In the bottom-up approach, salient stimulus from the sensors spikes certain areas such as speed or altitude deviation in the program codes, which in turn would enable a different subset of the network which has fixed schematic modules enabling required decisions network to command for appropriate actions, it is like speed deviation stimulus leads to activation of speed deviation network, which activates speed control network, and subsequently activating thrust and flight control networks. This process reiterates until the speed stimulus disappears. However, there are some limitations to automations' information processing, especially in the novel or contradictory situations. Automation algorithms have defined boundaries, and they cannot afford to phantom any situation beyond it. Moreover, in some time-critical situations requiring creative or insightful thinking, the automation would still approach it algebraically (Bottou, 2013), whereas a pilot could be much quicker and more intuitive to react and save the day. Automation works perfectly fine in the predictable operating environment and within programmed instructions with minimal flexibility.

Pilot Automation Interaction

The difference in the information processing theory by pilots and automation would always cause a difference in the mental model (Sammut-Bonnici & McGee, 2015) adopted by the human brain and automation algorithms. This means the two pilots (human and automation) are thinking differently to some extent at any given time, and when working together, there could be quite a separation in the situational awareness (SA) of the system's state. The SA could further lead to different paths chosen by the pilot and automation in problem-solving and, subsequently, decision making. When there are differences in a mental model, especially during failure situations, there could be a surprise element to the pilot of what the automation is trying to do and vice versa, which in isolated cases could lead to intuitive reactions by the pilot or unexpected behavior by the automation leading to undesired flight states. Another exciting factor is the effect on information load between pilot and automation; by now, we know that there is constant information exchange between the pilot and the automation. However, due to the slower and smaller memory of a human brain, (Goldstein, 2018) mentions that a human (pilot) can only handle only a certain amount of information at any given time. This means if the automation presents the pilot with too much information at any given time, either the pilot would discard less salient and less important ones to work efficiently, or there could be severe cognitive overload, leading to impaired information processing, reasoning, and subsequent decision making (Castro et al., 2019). Subsequently, something gets traded off, which is undesirable in flying commercial airplanes.

Pilot Automation Solution

The good news is that airplane manufacturers have designed various defenses and safety algorithms in handling many such interaction ambiguity issues; however, there is still some gap and the occurrence of repeated incidents and deviations; First, let us address the information representation; a pilot's brain sees what the receptors see well, which in turn aids in creating a more enhanced and accurate world picture in the pilot's mind. The display units could be designed to display the airplane and its various parameters in a three-dimensional, third-person perspective, as this makes the assimilation and processing of information much closer to reality, as mentioned (Goldstein, 2018). Second, communication through buttons and switches can get ambiguous due to various factors (Shetty et al., Oct 2017), such as intent and action being different, designing conversational automation aids in simple aviation English as to "is this what you mean" just like how two humans would talk in grasping the contextual and overall meaning (Piantadosi et al., 2012). In improving the language processing by the automation with the addition of the human-machine language dictionary, where the dictionary directs "definitions for concepts" (Piantadosi et al., 2012) to get to the real meaning and also the urgency of a message through various speech rate modulation rate, just like how we perceive urgency in a conversation by the rate at which it is spoken (Gašić et al., 2017). However, machines and humans have a massive difference in conversational reasoning in understanding the intention; hence this area is still open to future research in developing better speech processing software (Gašić et al., 2017).

Another area is training the pilot and automation together as a team. The current practice is that the pilot learns from the automation and not the other way around; a team grows stronger when both sides learn from each other and evolve by building upon each other's weaknesses and banking on the other strengths. The AI coupled to the automation is feedback with the pilots' behavioral response in developing insightful neural networks much closer to human thinking and better than the pilot. To take this further, if we can include a bigger sample size of pilots and automation interaction in real-time and simulated time, the neural network could continuously reiterate learning from the pilots. A recent technology that has been making a buzz is adaptive automation. Here the automation adapts its inputs dynamically as the pilot requires, including and excluding itself; it works through a trust system of transparency and consistency for pilots and automation to incorporate this suggestion. As (Xiong et al., 2022) mention, autopilot should be able to communicate through interfacing with humans why the disagreement in judgment, like "cognitive bias, information gap," so that the pilot operator is convinced that the automation understands them precisely.

SUMMARY

Pilots and automation have evolved their interaction methods with every generation of airplanes making their entry. Automation has shown exponential growth in the last few decades due to inventions in material science and data science together in developing supercomputers that are fast and moving in an insightful direction. However, we always have some scope for development to enhance the pilot-automation team's safety, reliability, and predictability. However, there is work to do; we have a good potential for developing the information processing system between pilots and automation. Next, we also need to work on finding technology and processes to keep the information load at an optimum level to avoid cognitive overload for the pilots. In terms of training, industry training departments need to come together in working across and below in developing new training methods where the pilot and automation both learn through interaction. Finally, through adaptive automation, team building, and developing trust through transparency, pilot automation could fill the present gaps and head to a new era and scope of operations.

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ABOUT THE AUTHOR

Vijay Macmilton Devadas is a line training captain and an Airbus procedural trainer with an airline in India. He also works with the CRM team as a pilot and cabin crew facilitator. He has formerly worked with various airlines, including Indian Airlines, Air India, and Emirates flying A320, A380, and B787. In his educational background, he has a bachelor's in Mechanical engineering and Post Graduate Diploma in Business Administration, and currently a student with Embry Riddle Aeronautical University in the Master of Science – Human Factors.

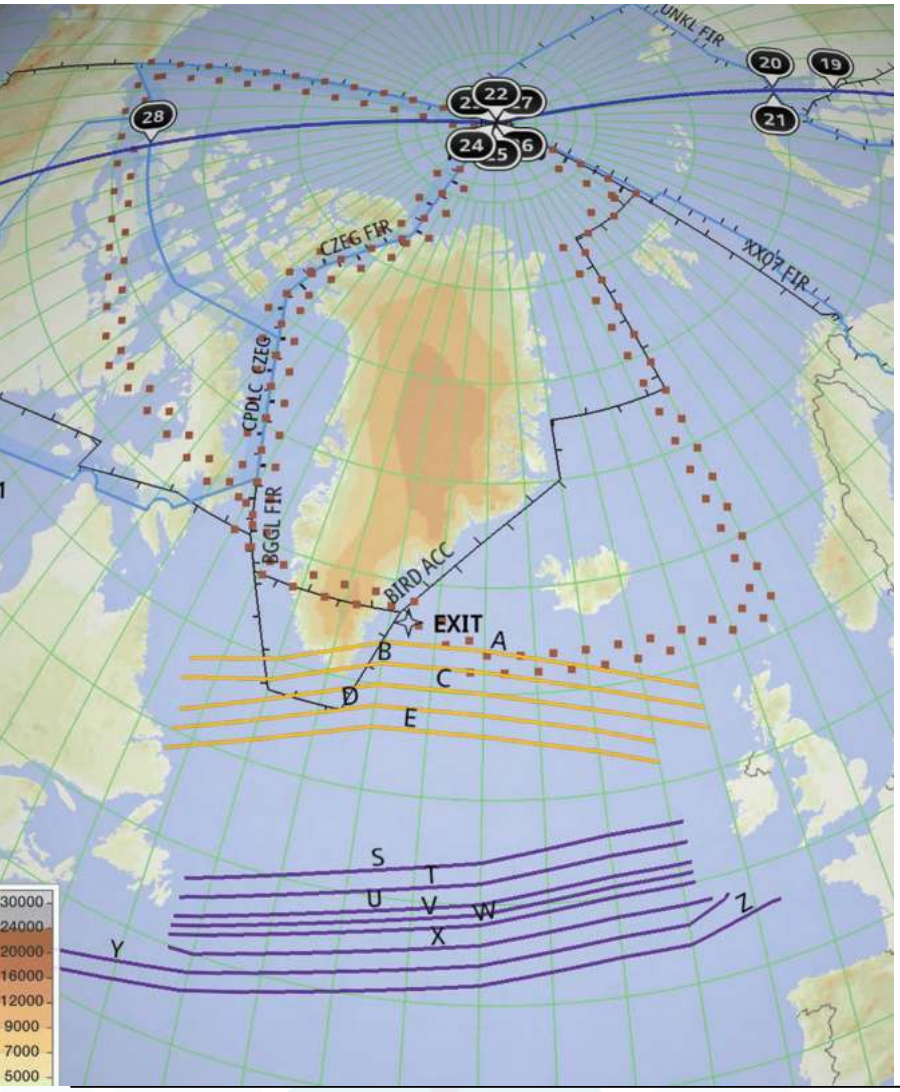
His motivation is to understand "why we think the way we think" and apply them to the commercial aviation environment of human psychology and bring awareness to the industry and public.

In his personal life, he mostly enjoys reading various disciplines of science, philosophy, and psychology. His hobbies include motorcycle riding and bodybuilding. He also enjoys having different coffee as a beverage, which helps him think with insight and penning down his thoughts.

Polar Navigation

Rushikesh Someshwar
B777 Captain
Air India

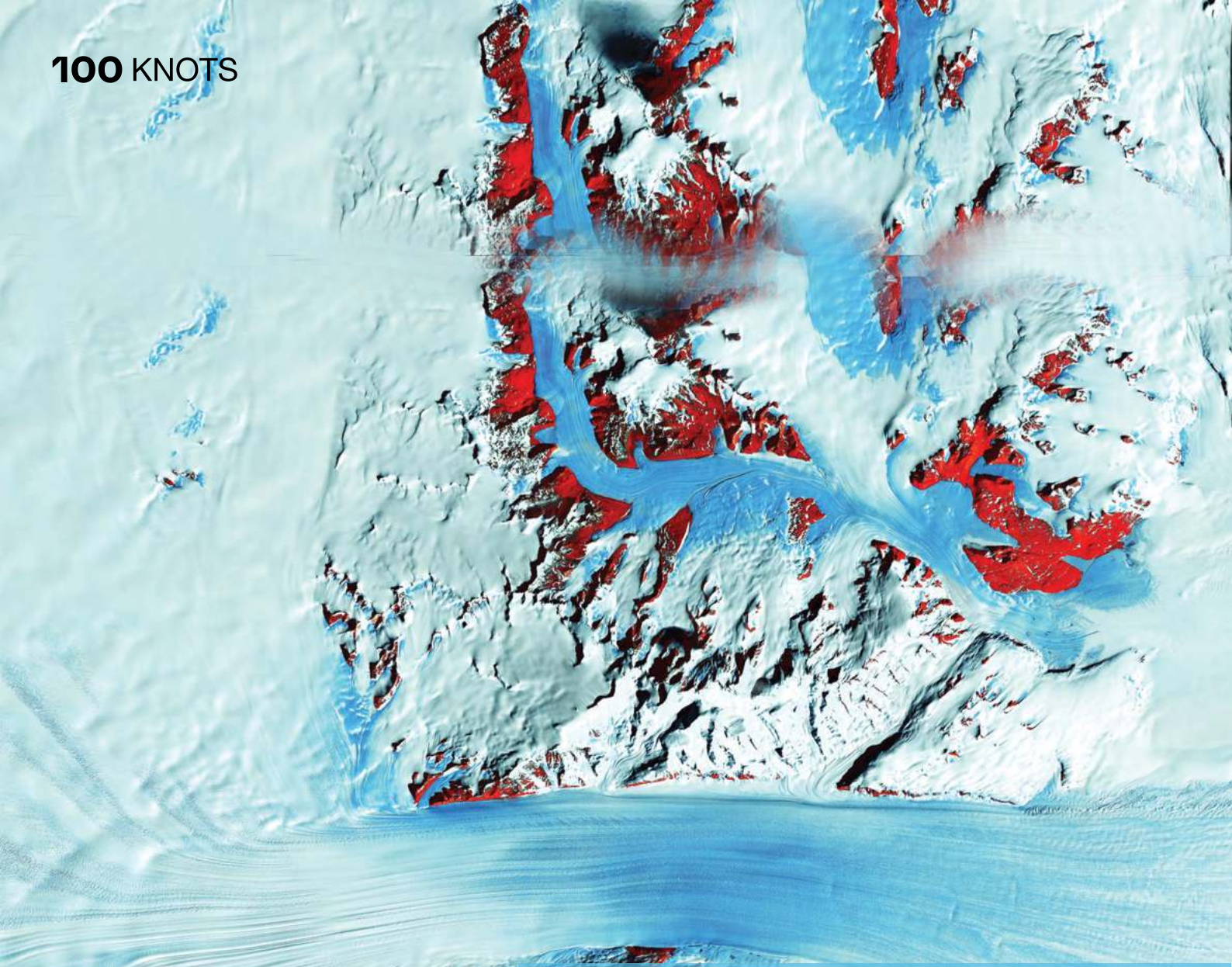
Navigation, the science of flying from point A to B has evolved with time & technology. From flying with reference to maps & charts to current satellite-based navigation, technology has helped immensely in simplifying & improving accuracy & flying time between two points. In today's world, where the economics of commercial flying derives its success from flying more direct routes over remote polar regions, FAA defines an area north of 78°A latitude as a north polar region. These operations, however, are economically fruitful and come with their own set of challenges and limitations. Pilots flying these routes have to factor in limited aviation infrastructure at remote arctic airports, degraded communication, GPS unavailability, polar weather, and solar activity.



HISTORY

Commercial airlines were flying north of the Arctic Circle before the jet age. The first recorded flight via the north pole was accomplished by soviet pilot Valery Chkalov and his crew who flew non-stop from Europe to the American Pacific Coast, via the North Pole on a Tupolev ANT-25 single-engine plane. Polar navigation has come a long way since then. Since late 1998, NAV Canada, FAA of Russia, several Airlines & FAA have coordinated efforts to develop new international routes over both Canadian & Russian Airspace. Extensive Route analysis has demonstrated significant advantages in flight time reduction & fuel savings by use of great circle routes to various destinations in Asia & Pacific regions.

Today, Arctic polar routes are very common between airlines connecting Asian cities to North American cities. Non stop flights between India and USA and return, between New Delhi and San Francisco, flies over the Atlantic and sometimes overflies the North Pole.



PLANNING

Airlines need to take special approval for ops in the polar region from the regulator after demonstrating various aspects of the planning & recovery plan. As safety is paramount in airline operations, emphasis on operational plan, training, preflight planning, in-flight ops, monitoring, and operational control ensure a safe & efficient polar operation. The operator's plan includes, but is not limited to

- Selection & validation for suitability of diversion airports.
- Passenger recovery plan.
- Fuel freeze monitoring, management program & training of staff.
- Serciveability of Aircraft communication & navigation equipment i.e., preparing MEL.
- Having programs for gathering, dissemination & flight following with regard to space weather and data for each operating flight.
- Agreement with handling agents at airports to handle their operations in case of diversion.

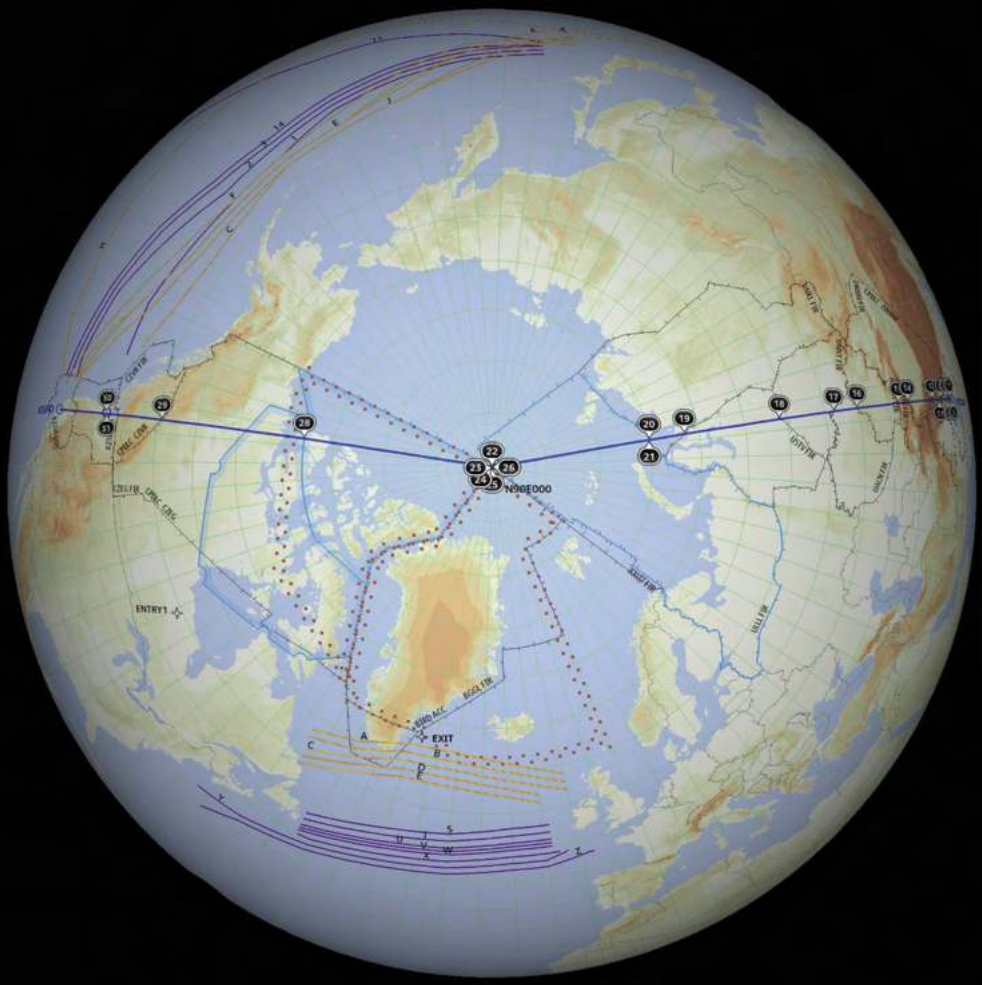
COMMUNICATIONS

VHF & HF Communication along with Satcom complete the need to provide long-range communications in polar operations. SATCOM generally is not available above 82°N. A typical polar flight has routine VHF and datalink communication with ATC until Russian airspace. As flight leaves the continent, aircraft transition to the Edmonton control center & Arctic Radio, a general-purpose communication provider that handles the interface between the airplanes & ATC controller of the Anchorage & Edmonton control centers. Arctic Radio which has both HF & VHF frequencies provide coverage, all the way to Russian FIR. Arctic Radio also relays messages between aircraft & airline dispatch departments.

Communications on the Russian side begin well before the aircraft enters the Russian FIR as it's mandatory to be in touch with ATC, before entry to Russia. In Russia, the call sign with the HF radio designator is an actual ATC center, unlike Arctic Radio. SATCOM & Datalink supplement the communication navigation.

NAVIGATION

Due to the high variation angle between the true and magnetic north pole, navigating the polar airspace is when compared to routine airspace. This variation creates a region called Area of Magnetic Unreliability (AMU); in plain words, the magnetic compass cannot be trusted. GPS, GPS updated position, and Inertial systems are the most accurate & reliable sources of navigation in the polar regions. Another interesting region is the Key Hole masking area where even the GPS signals are masked. That's when we go completely below the radar, including any airline dispatch communication.



Random Route structures exist in Anchorage, Edmonton, Iceland & Bodo oceanic FIRs. Four fixed polar routes have been established within Russian airspace as well. Onboard Flight Computers or FMCs have their own built-in defined polar region or area of magnetic unreliability (AMU) that automatically programs the navigation guidance based on location. In this AMU, magnetic heading & tracking information are not reliable as a result of large magnetic variations, therefore navigation in this area is referenced to True north. Modern Automation takes care of this on its own and reverts back to magnetic reference when out of polar region under normal circumstances. As a backup, pilots are also required to do a position plotting on polar charts 10 mins after passing a waypoint.

Having said that, flying directly over the North pole is avoided due to the possibility of the auto pilot reacting aggressively due to a 180° change in Orientation of the compass.

COLD FUEL MANAGEMENT

The fuel freezing point is the temperature at which wax crystals, which form in the fuel as it cools, completely disappear when warming a fuel, that has previously been cooled. Because of extended flight durations & the prevalence of very cold masses on the polar routes, the potential exists for fuel to approach the freezing point. However, airlines have built-in fuel temperature prediction programs into their flight planning software to ensure the fuel will not reach the freezing point along the planned route.

Airplanes are often refueling airplanes at different locations, creating a blend of fuel in the tanks, and having unique freezing points in each tank. Boeing has established a procedure for estimating the freezing points of blends based on concentrations. Nevertheless, as a part of the procedure, before any polar flight, the freezing temperature of the fuel is provided to the operating crew. During the flight, the fuel temperature is maintained at least 3 degrees above the freezing point of the fuel.

However, if the actual fuel temperature decreases 3°C above the freezing point, the crew must take action to avoid further fuel cooling. This is done in consultation with Airline dispatch & ATC where the crew can fly to warm air masses through a change of route or can descend to a lower altitude. In the polar region, due to lower tropopause, the temperature may decrease at lower altitudes. The flight crew can also choose to increase the airspeed. However, all these techniques require extra fuel burn, so the best way to avoid is proper planning.

The polar climate is characterized by persistent cold & relatively narrow temperature change. Winter is characterized by continuous darkness and cold whereas summer is characterized by continuous daylight and damp and foggy weather. There is a mass of cold, dense arctic air permanently stationed over the north pole that creates the high-pressure system. This involves an extraordinary inversion of temperature with warmer air at altitudes of a few hundred meters than at ground level.

The term space weather refers to the condition created in the earth's atmosphere by the activity of the sun and follows in a 11 year cycle, also called the solar activity cycle. Sun's electromagnetic radiation may black out the use of radio signals for HF Communications. In addition to radio magnetic waves, the sun ejects clouds of matter in form of atomic and subatomic particles. The collective terms for these particles are solar wind. During the period of increased solar activity, solar wind speed increases, which changes the strength and direction of the Earth's magnetic field. These changes are concentrated & most noticeable in the polar region. Increased levels of radiation may go beyond recommended dosage for human exposure. National Oceanic & Atmospheric Administration's Space Environment observes conditions between the earth & sun by broadcasting space weather every three hours.

POLAR SPACE AND WEATHER

These space weather forecasts include

- Geomagnetic Radiation - It affects the accuracy of the GPS navigation system, rated G1-G5 on a severity scale.
- Solar Radiation - It affects humans physiologically, rated S1-S5 on a severity scale.
- Electromagnetic radiation - It affects HF Radio communications, rated R1-R5 on a severity scale.

Generally, at the flight planning stage if any of the Radiation levels are above 2, then the flight is not planned via Polar Routes.

In addition to providing the crew with forecasts, flight dispatch regularly monitors space weather. In event of an unanticipated solar activity exceeding level S2 while en route, dispatch alerts the crew. Rerouting or diversion may be considered before entering into Polar region. If already in the polar region, then descent below 31,000' is recommended.

While no practical means exist to limit cosmic radiation levels during flight, airlines adopt scheduling practices to limit polar flight for the crew during a 30-day cycle.

Conclusion

While flying shorter polar routes may serve easy but requires a lot of preparations starting with Airline getting approval from the regulator, the study of recovery plan at remote polar airports, 180 Min ETOPS approval along with approved MEL. Dispatch has to plan the route keeping in mind the fuel temperature & space weather.

Finally, the flight crew has to keep the big picture in mind, study alternate airports with very limited facilities, communication & navigation along the route, and keep crew & dispatch informed about flight status & handle any eventuality in consultation with the company.

About the Author

Rushikesh has traveled a journey starting from Kutch in Gujarat where he first dreamt of becoming a pilot. The journey took him to Hyderabad where he first got his PPL. The turning point was his selection to the prestigious IGRUA flying school. His dreams started taking shape when Air India selected him in 2004. After CO-Piloting Airbus A310 & B777, he now commands Air India B777 around the globe on ultra-long-haul flights. He says “Give wings to your dreams”

India's Fastest Lady

Capt. Sneha Sharma


SNEHA
IndiGo
IndiGo
ALS
ROTHIT KHANNA O+Ve
JKTYRE

Carrying the title of the fastest woman in India on four wheels, it's inspiring how Sneha Sharma reached here while maintain her flying career as an Airbus A320 captain. Her mother could've never imagined when she took 16-year-old Sneha for go-karting at a local track in Mumbai for the first time, just 15 years later, she would become 'India's fastest female driver' hitting astonishing speeds of 270 kmph. Today Sneha is one of only four female racing drivers in India and boasts an impressive CV that includes being shortlisted for the 2015 Volkswagen Vento Cup and the Toyota Etios Cup in India. She has also had six race victories and 14 runner-up positions and currently the only Indian female racing driver competing outside India.

Roadblocks & Destiny

Like all success stories, getting here was not easy. Given the nature of sport, her parents were the first amongst many roadblocks in the course of her ambitions. The obvious concern was her safety, after all she was the daughter and this was a male dominated sport saddled with injuries and accidents. Forced to lie to pursue her passion for car racing, Sneha would visit the karting track twice a week, and carried her schoolbooks around with her to study.

Racing is also a physically demanding sport that requires spending long hours under the sun and surrounded by men, one of the reasons why women drivers shy away from it. Another big factor is the lack of popularity, leading to limited knowledge and infrastructure in this segment. Even today, most Indian drivers prefer to travel abroad for better training environment, experience, facilities and support.

Destiny had it and in just two weeks after starting, Sneha started clocking the quickest times on the track. In a sponsored race, where she secured a podium finish, Sharma was asked to join the Rayo Racing national championship team. "I was in my 12th and it was a tough call, but I decided to join them," she remembers. In 2009, Sharma earned the tag of India's fastest woman racer in the Mercedes Young star driver program where she secured 6 race victories and 9 runner-up position. She finished in the 11th position at the Formula 4 event, and was one of the two women competing.

Funding & Sponsorships

Racing is a costly sport and sponsorships are not easy to come by in this highly competitive, male dominated sport. Not being able to afford a trainer in the early years, she would pay marshallers with her pocket money in exchange for some education on cars. As she progressed, her expenses were also rocketing and she had to look for alternative ways of funding her ambitions. She got inspired by the idea of flying after watching a film about the Formula 1 legend Niki Lauda. She convinced her parents and moved halfway across the world to California to train as a pilot. Sneha returned India to join Indigo, where she would command the Airbus 320. After seeing Sneha's dedication on track, Indigo airlines management came on-board, sponsoring her and allowing her more time to practice on tracks. Today, she is the only Indian driver to be sponsored by JK Tyres and by Indigo Airlines.

Fitness

In racing, weight translates to performance. Sneha lost over 30 kgs for racing, and follows a strict diet and workout plan. Neck muscles play a major role in racing and she had to work out with her helmet on to strengthen her neck. Apart from the gym where she focuses on free weights workouts, Sneha alternates between swimming, badminton, running and power yoga. "You need a lot of upper body strength and flexibility, which translates into a lot of stretching, free weight workouts like burpees and pushups," she says. Sneha hits the gym right after her round of flights – at times she wakes up as early as 3 am. She also avoids any forms of sugar or aerated drinks, but loves her greens and a bit of dark chocolate.

Racing in India

Motorsport has gained major popularity in India in over the last decade. The Federation of Motor Sports Clubs of India is the official governing body of motorsport in the country. Indian auto manufacturers are also investing in this sport and are already seeing returns with strong finishes in international events. Coimbatore, a pit-stop for every national level racing tournament, has become the Motorsports capital of the country.

After the cancellation of F1 in 2014 in the aftermath of a tax dispute between the circuit and the FIA, no international events were organized in India. This year brings a new hope after Hyderabad signed a letter of intent with the FIA, making them the newest E-Prix host for the 2022-2023 Formula E season. With renewed interest in the sport picking up attention in the country, Sneha hopes to see more women drivers on the tracks.

LEARNING

Her first set of teachers with respect to racing, were the mechanics who taught her the basic techniques like braking in and cornering. As she implemented these techniques, she slowly learned more through her experience in the local races. On one end, there was preparation for her journey as a pilot, which would support her dream. Even as she learns new tips and tricks, there is one important lesson that stays constant in her life and should apply to everyone, Sharma says: Success always happens outside the comfort zone.

The race track has prepared her well: "I have learnt to focus single mindedly, and make quick decisions – the latter has also helped with my flying," she says, also adding how her tolerance for high temperatures and challenging work environments stand her in good stead.

Off the Tracks

Off the field, Sharma drives a Hyundai Verna, and calls herself a big advocate of safe driving. Sharma says "Know the braking capacity of your car, because it's not about how fast you can go, but how fast you can stop if things go wrong. To avoid hydroplaning, light tap brakes in the water to make for a better grip, and always check tyre pressures for changing weather conditions – it'll help determine how much grip you get in the corners when you're taking turns on the road."

Ultimate Dream

Sneha hopes to advance in motorsport with the ultimate goal of reaching Formula 1. While she hopes that inspiring others will be a big part of her career, she is determined for another reason. Her mother, and biggest supporter, Renu, passed away few years ago and it is for her that she is now so driven.

"I see hurdles sometimes move away by themselves and I know it's her because she is close to God now. They're in it together." Sharma has recently secured funding from JK tyres.

Coming Home

A fictional account based on the 'Vande Bharat mission'
The largest repatriation mission in human history

Vikas Nautiyal
Deputy Chief Pilot
Air India Express

The aircraft was cruising at 36,000 feet over the Arabian Sea, flying along the designated preprogrammed route on the Flight Management Computer with the Autopilot doing a good job. Suddenly, Avi heard the no-nonsense voice of his Chief of Operations crackling on the aircraft radio, 'Why did you skip your pre-flight Covid test? Turn around and the flight has to return to Cochin IMMEDATELY'. Oh God! How was this possible? He was sure he had done the test...or maybe not...he broke into a cold sweat ...he could be grounded for this...he thought as the aircraft turned back. Uff...this would be big violation and a bigger embarrassment.

...He woke up with a start. It was a bad dream. He thought about it lying very still. The preflight Covid test was an additional medical test which the crew had to undergo before special passenger repatriation flights. They also had to undergo another test just after the flight, get quarantined in a hotel for 5 days and repeat the test, before leaving for home. It was a tedious but necessary process to keep the crew and their families safe from infection.

It was dark. Avi was still in bed. The clock struck a familiar hour when he would normally (in the long days of lockdown), be fast asleep, waiting patiently for flying to resume. But tonight was different. He was scheduled to fly the first passenger repatriation mission in the morning at 1000hrs. He had gone through the exhaustive Standard Operating Procedure tailored for the mission, done the preflight Covid test at a hospital along with the Capt and the cabin crew and had spent some time in the evening talking to his very anxious mother who lived far away and alone in Delhi. She wasn't taking the news too kindly that he was going on a flight when there was a National Lockdown and the whole world was staying indoors to save themselves from the infection. 'Wasn't there anyone else who could do that flight?' she had asked. 'Do you have enough vegetables at home?', he counter questioned, just to distract her. It had been almost 20 days since the National Lockdown and the stock of provisions and patience were wearing thin with everyone, especially the elderly who were so used to their daily routines, morning walk, sabji-wala, milkman, newspaper, Satsang, the normal trappings of everyday life. Everything had been disrupted. Would speak to mom after landing, he thought to himself...reconfirmed with his mobile that it was 0200hrs, still 6 hrs to go for his pickup, as he melted back to sleep.

'Avi' (First Officer Avishek) had always wanted to fly and had persuaded his mother that if he couldn't join military flying, (his first choice, but she would have none of it), he would definitely fly as a commercial pilot. After years of dedication, hard work and spending a princely sum taken as a loan from the bank, he had landed himself this job of flying a Boeing 737 aircraft and was an extremely grounded and happy young man. Coming from a humble background, he was paying back his monthly EMI for the loan taken for his CPL. He had heard that other airlines were not paying their pilots and his company had also reduced salaries. Some other airlines had gone bankrupt and he shuddered to think ahead. There was a sincerity of purpose a middle-class upbringing brought in you which the rich lacked. He had noticed this when he mingled with the richie-rich-toy-boys who were his batchmates at flying school.

The alarm went off at 0600hrs, a full hour earlier than it would normally for a 1000hrs departure. Afterall, this wasn't an ordinary day or an ordinary flight. Avi hadn't flown since the lockdown and he didn't want to make any mistakes, he thought as he checked the weather update for the day, reread the Standard Operating Procedure for Evacuation Flights, wondering how much work would have gone in to make such a detailed and exhaustive document. It was an exhaustive SOP. The clock struck 0700hrs, it was time to don the uniform and be on his way to the airport when many a challenge lay. He didn't want to be late. The Commander, Capt 'PA' was an ex-military man known to be a strict disciplinarian, fastidious, with a no-nonsense attitude and legendary punctuality.

Meanwhile....in another place and time...
It was 0200hrs....5 nights prior to the first Evacuation flight. Ministry of Home Affairs guidelines had just been received that evening on commencement of passenger repatriation flights to bring back all stranded Indian citizens back to India. The GOI had named it 'Vande Bharat Mission'. There was precious little time to plan the entire operation and the proverbial 'midnight oil' would have to be sacrificed in the bargain. What was most important was for the management to give the 'boys' aka operating crew, detailed and unambiguous instructions on how to carry out the missions. There was no margin for error, as it is never was in any aviation operation, but the health and safety risks made these missions even more challenging. In aviation, every practice had a policy and every policy had a procedure, including the SOP on how to take a nap while flying (which was termed 'controlled rest') and the SOP on how to answer nature's call when flying (maybe someone would label it as 'controlled release' one day).

Aviation loves SOPs. All Normal Operations have SOPs and (obviously) all Non-Normal procedures have more stringent SOPs. SOPs are tedious boring things, but they guide one to exactly what to do and say and when and what not to do and not to say and when. The purists knew that good SOPs made for safer skies and made the crew ready for all situations in the air whether it was a Failed Engine, a Technical Malfunction, Unpredictable Weather or a Sick Passenger. And, in times like these when the crew could be endangered or infected with a viral infection, while flying missions in these special circumstances, these SOPs would have to be modified...to become more exhaustive (read 'more boring')...and modified fast! There was no chance to leave a stone unturned.

'DB' was the man designated to piece together the SOP from the minutes of the meeting between the Operations Team as they put forward their inputs on the challenges that lay ahead. The entire plan was being made over the phone while dispersed in different locations and in lockdown. None at that point knew that 'Vande Bharat Mission' would surpass the largest Indian evacuation from foreign shores, larger than the airlift of Indian Nationals from Kuwait in the wake of the invasion by Iraq in 1990. But these comparisons didn't scare DB. He had served in the Indian Air Force prior to joining the company as a management pilot and a briefing at 0200hrs did not ruffle him. Neither did the fact that they had only sketchy details of the impending task. How many flights? How many days? What destinations they would have to plan for? Were all the crew familiar with those destinations? How many crew members were stuck at places other than their bases due to the unexpected Lockdown in the country? Could they make it back to fly these missions? Were they equipped in terms of availability of the Personal Protective Equipment? Many such questions drew a blank! But he knew from gut feeling that they would be able to manage....as ordained... as they were on the right side of truth. DB and his team worked furiously for the next 6 days and nights. They would have to fly the planes empty on the way out. They started calling the crew asking for their well-being and availability, getting the protective clothing, provisioning for the transport, getting hotels which were shut, tying up with the hospitals for the medical tests, stitching together all the orders and instructions, slowly mitigating one risk after another and sending for approvals from the big bosses at the regulator. Some kids weren't well. Some crew were stuck in other cities.

Some hotels were shut. Many cobwebs had to be dusted. But...largely... they would be ready. It was a satisfying thought. There was no time to relax yet, as meticulous planning was only one side of the operation, clinical execution was the other.

As the first aircraft shot through the sky heralding the commencement of ''Vande Bharat Mission', DB was a proud man. What made it even more significant was that his own brother 'AB', an officer in the Navy was on board INS 'Jalshwa', the Indian Navy ship bringing in passengers from Maldives to Cochin and would be sailing from Maldives in the next few days. 'Operation Vande Bharat' would be executed both by air and by sea simultaneously and in that effort, the Indian Navy had launched 'Operation Samudra Setu'. This was truly a National Mission and aimed at getting Indian citizens back from 47 countries around the world. A truly unprecedented event. The enormity of the task only hits you in the face you when you are done with it, he mused.

Meanwhile.... in yet another place and time...

Efraim Mampilly spent a tense night waiting for the list to be released. It was crucial that his name be there, otherwise he didn't know how he would survive the next week. His savings had already been sent home and he had to vacate the tiny room he stayed in above the bakery he worked in. The owner was a kind man but had come to bad times due to the closing down of the business and for Efraim, it meant it was time to pack his bags and return home to his native Kerala. He had been working in this bakery in the by lanes of the old part of Sharjah for the last 5 years. He lived alone and had modest habits. The job paid him a decent sum and he sent most of it back home to his family. This time he was sure, he wouldn't return. His phone rang. It was some lady from the Indian High Commission. She said that since he was a senior citizen, his name was on the list of passengers on the evacuation flight and he was to reach the office that afternoon to complete all the paperwork and medical. He thanked God. At least, he would be home for Eid this time.

Later that evening, walking back with his air ticket and medical report in hand, he wandered around the closed market area, to see if he could buy a few essentials. What a relief, he thought entering his room. The last time had been chaotic, he remembered those days vividly. In 1990, he was in Kuwait when the war had unexpectedly started and the Indians were caught in the cross fire. In a strange land, with no sides to take, he along with thousands of Indians like him, were left stranded. Help reached them after a few weeks when the evacuation was organized by the Indian Government and they were extricated to safety. It subsequently was hailed as the world's largest civilian evacuation in history with the safe airlift evacuation of about 170,000 Indian citizens. He had read about it in the papers once he was back home and how it was all planned. Seeing the crowds at the High Commission that evening and the number of Indians he knew who has applied for the return, he knew that this time too, it was going to a staggering number who would be heading back to the country. Why do they always leave? He asked himself what was the most compelling reason for people like him to repeatedly try and find work abroad. There was no answer.

On the flight, he saw the crew who had walked into harm's way to get their country-men back to safer

shores. What was their motivation to risk their lives? He wondered. Didn't they have families back home? The cabin crew were wearing their HAZMAT (Hazardous Material Contamination) suits but under them, it was astonishing that they continued to wear their warmest smiles. They continued to treat the passengers with empathy, while still being professional. They continued to 'Listen with their Eyes and See with their Hearts', as they had been instructed and advised. Like Ephraim, all the passengers had their own stories. Extremely Fragile stories. There were the passengers who needed to reach back to the safety of their homes. There were pregnant women, who would be safer in India and their babies would be born here. There were senior citizens who needed to be kept safe from infection. There were people who had overstayed their Visas due to the pandemic and lockdown. There were people like Ephraim who had lost their jobs and couldn't afford or continue to stay in a foreign country. There were some who had lost a near or dear one in India while they were stuck abroad and could not even attend their last rites. They were all battling an invisible microscopic virus which had irretrievably changed their lives. They were all in it together. The atmosphere was tense. Who carried the infection, no one knew? Maybe the passenger on the next seat. Protocols had to be followed by everyone. Passengers were given fresh masks and face shields and hand sanitizers. But despite the fear, the overwhelming emotion was of hope. Hope for life to recommence. Hope for a new dawn.

In the cockpit, all was normal. The jet was cruising at 35,000 ft over the Arabian Sea in the quiet of the night. The autopilot was doing a good job. Avi was extremely proud to be part of the mission and equally excited to be flying after a long break. Down on the surface of the sea, while DB tracked the flight on Flight Radar App, AB was on board INS Jalashwa, as they set sail from Maldives for Cochin with 700 civilian passengers. The Captain's clipped voice came up over the radio for the Passenger Announcement. 'Ladies and Gentlemen. I welcome you on this historic first flight heralding the 'Vande Bharat Mission ...' He spoke of the flight details, the changed protocol, the weather enroute, the hopes and challenges that lay ahead and trailed off with **'Please sit back and relax. You are in good hands. We are going home. Jai Hind'**

Note from the Author

This is an account of fiction, inspired by real life events. None of the characters bear any resemblance to any real-life professionals involved in the actual repatriation of Indian citizens in the wake of the global pandemic. Air India Express heralded the repatriation missions in May 2020 under 'Operation Vande Bharat', and was later joined by Air India and other Indian Carriers to bring back stranded Indians from across the globe in 10 phases. The entire Mission, including the follow up Air Bubble arrangement lasted almost 2 years and a total of 3.09 crore passengers were repatriated in flights operated under them making it possibly, the Largest Repatriation in Human History

About the Author

Capt. Vikas Nautiyal grew up in Dehradun and was commissioned in the Indian Air Force in 1991 in the fighter stream. He flew MiG-21 and MiG-29 before graduating as a Cat 'A' Qualified Flying Instructor and Directing Staff / Flight Commander at the prestigious Flying Instructors' School. He is a graduate of the National Defense Academy and has a Master's Degree in Aviation Management. He served as Chief Operations Officer at a frontline forward base and at Flight Safety and Inspection Directorate. On graduating in civil aviation, he is qualified on the Boeing-737, empanelled as a Subject Matter Expert with the Aircraft Accident Investigation Board of the Ministry of Civil Aviation, an IOSA certified Quality Auditor, and currently serving as a management pilot, appointed as Dy Chief Pilot in his airline.

Quality Control vs Quality Assurance Flight Crew Training

Capt. Amit Singh FRAeS
A320 Captain

A competent flight crew is not only a regulatory requirement but also a critical factor that enhances safety and efficiency. Training of flight crew is a mitigating factor for accident prevention and safety assurance. However, we **continue to witness occurrences** year after year with some of the occurrences having the same cause. It is, therefore, necessary that a **GAP analysis is carried out in order to determine the reasons why the training imparted does not translate to safer flight operations.** In order to do so there is a need to review the training process, understand the terms quality control and quality assurance and the key differences between the two.

CIVIL AVIATION REQUIREMENTS SECTION 7 - FLIGHT CREW STANDARDS TRAINING & LICENSING SERIES 'D', PART V ISSUE I, 27th JULY 2016 mandates that the operator shall establish a **quality assurance system, acceptable to the DGCA which ensures that training and instructional practices comply with all relevant requirements.** The same is required to have complied for all FTOs and ATOs. The details relating to the approval of the quality assurance program and the regulator's oversight are given in ICAO Doc 9841.

In a recent reply to an RTI filed with the DGCA, the regulator stated that all ATRP's/ATOs and FTOs comply with the requirements of Indian Civil Aviation requirements by appointing a Quality Manager and having an approved Quality Assurance Manual for flight operations training. **However, on scrutiny of the RTI manuals of a state-run ARTP/ATO , the quality manuals were not listed in the list of DGCA approved documents nor was there a quality manager appointed for the same.** Even though Flight Standards Directorate (FSD), DGCA replied that specific approval is given to the Quality Assurance Program, the same was not found in the operator's Operations Manual Part D approval.

The DGCA replied to the question **'Who is the responsible manager for Quality Assurance in the operator's management.'? The reply was that the head of training was responsible for quality assurance in an organization. The OMD of the ATRPdid not list the Quality policy, duties, and responsibilities of QM.**

Therefore, it is evident that the **Flight Training Directorate is not fully conversant with the tenants of the Quality Assurance System and thus is not able to evaluate the quality assurance program of the ATRP/FTO/ATO**. The requirement of a Quality Manager and a Flight Operations Quality Assurance Program is **often confused with the Engineering Quality Manager and Flight Safety Operations Quality Assurance which are entirely different and have nothing to do with the pilot's training program and quality assurance**. There is an imperative need to train theoperator and regulatory staff in order to implement the quality assurance program to ensure that the GAP identified between training and flight operations is filled thereby enhancing safety.

What is Quality Assurance?

The term 'Quality Assurance" is frequently misunderstood to mean the testing and checking of products and services and in this case the flight crew/pilots. Training Organizations that do checking and testing activities are merely applying quality control measures, which are designed to catch product and service defects but not necessarily prevent them. For example, an ATO that administers exams at the end of the training syllabus, only to discover that a large proportion of the students failed to meet the required standard, has only identified a deficiency in expected results. **The implication may be that there is a problem with the training program, the instructor, or even the student selection criteria. In this instance, the ATO has no idea what the real problem is or what to do about it.** Quality control by itself provides limited value without the suite of complementary activities that comprise quality assurance.

Quality Assurance, on the other hand, attempts to improve and stabilize the training process and to identify and avoid, or at least minimize, issues that lead to problems in the first place. It continuously verifies that standards are adhered to throughout the training process by introducing various checkpoints and controls. It further introduces **a system of audits to ensure that documented policies, processes, and procedures are consistently followed.** It is the "assurance" part of quality management.

A quality assurance plan for an ATO shall encompass well-designed and documented policies, processes, and procedures for at least the following activities:

(a) Monitoring training services and process controls;
(b) Monitoring assessment and testing methods;
(c) Monitoring personnel qualifications and training;
(d) Monitoring training devices and equipment qualification, calibration, and functionality, as applicable;
(e) Conducting internal and external audits;
(g) Developing, implementing, and monitoring corrective and preventive actions and associated reporting systems; and
(h) Utilising appropriate statistical analysis to identify and respond appropriately to trends.

The Quality Assurance Program should include a formal, written quality policy statement that establishes a commitment by the accountable manager of the training organization to achieving and maintaining the highest possible standards in quality. It should describe how it performs the organization and management of its training operations in order to ensure conformity with the training organization's procedure manual as approved by DGCA.

The Quality Manager is appointed in order to verify, by monitoring activities in the field of training, that the standards as established by the training organization are carried out properly. The Quality Manager reports directly to the Head of Training and when the Head of Training is not the accountable manager, reporting mechanisms shall be instituted to ensure that the accountable manager is aware of all issues impacting the quality of training services being provided by the affected training organization.

An effective quality assurance plan will aid significantly in the ATO's compliance with requirements, its conformity with the standards, and the adequacy of its training activities. Taking the ATO's performance to a higher level requires a structure that ensures that the combined quality assurance effort of the employees reaches its full potential and a fully functional safety management system reaches a mature stage of implementation and effectiveness.

About the Author

Amit is an aviation Safety & Training expert with over 35 years of airline experience. Amit is the founder of an NGO, Safety Matters Foundation which is dedicated towards establishing a generative safety culture in aviation. Amit has been associated with IndiGo and AirAsia India where he headed Training and Operations/Safety respectively. Amit is a Fellow of the Royal Aeronautical Society, UK which is the highest grade awarded to those who have made outstanding contributions in the profession of aeronautics. Amit writes the human factors blog mindFly and has published papers on the subject which have been used as a part of airline pilot training curriculum.

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