April 2023

100 KNOTS

India's Aviation Ecosystem

Air Traffic Management
High Intensity Runway Operations

Flight Operations
Emergence & Chaos

Flight Safety
Role of Assertiveness

Training
Joys & Rewards of Teaching

History
Biju Patnaik

A Kerospace Solutions Company

Editor
Preet Palash
Sakshi Shreya

Contributors
Justin Jude Francis
Capt. Vijay Devadas
Capt. Akshay Renavikar
Commander Ashley Derrick (Retd)

Correspondents
Radhika Bansal
Jinen Gada

Photographer
Soumojit Sarkar
Dipalay Dey
Janam Parikh

Creative Head
Abdullah Haque

Queries and Suggestions
Mail: editor@100knots.com

EDITORIAL DESK

Radhika Bansal
Editor

Dear Colleagues,

Welcome to the April 2023 issue of the 100 Knots Magazine.

On the occasion of Biju Patnaik's 26th Death Anniversary in April, we will be scrolling through the pages of history to understand the life of aviator Biju Patnaik and his contributions to India's Freedom Struggle and Civil Aviation. Mumbai ATC controller, Mr. Justin Francis talks about High Intensity Runway Operations at CSMIA and explains how it is transformation aircraft separation standards and preventing wastage of airspace in case of excessive spacing or inefficient sequencing. Ex-Navy Flying Instructor, Commander Ashley Derrick (Retd) talks about the critical role of assertiveness in aviation safety as he conducts a comparative analysis of two Air India Express accidents. Capt. Akshay Renavikar talks about the Joys and Rewards of Teaching roles and how it has led him to follow the concepts in my own life. Capt. Vijay Devadas discusses why aviation industry needs to work together through various settings in the application of emergent systems and chaos to develop a much more robust process in having the airline function close to the emergent state and avoid chaos.

As always, Contributions, comments, and feedback are always welcome. All papers are received with a high degree of enthusiasm and will find a home in future issues.

Our sincere thanks to all the contributors for their support and interest.

We hope to hear from you soon!

Happy Reading!

100 KNOTS

Join India's aviation ecosystem

Follow us on

100knotsofficial 100Knots hundredknots

Scan the QR Code below or visit us at

www.100knots.com

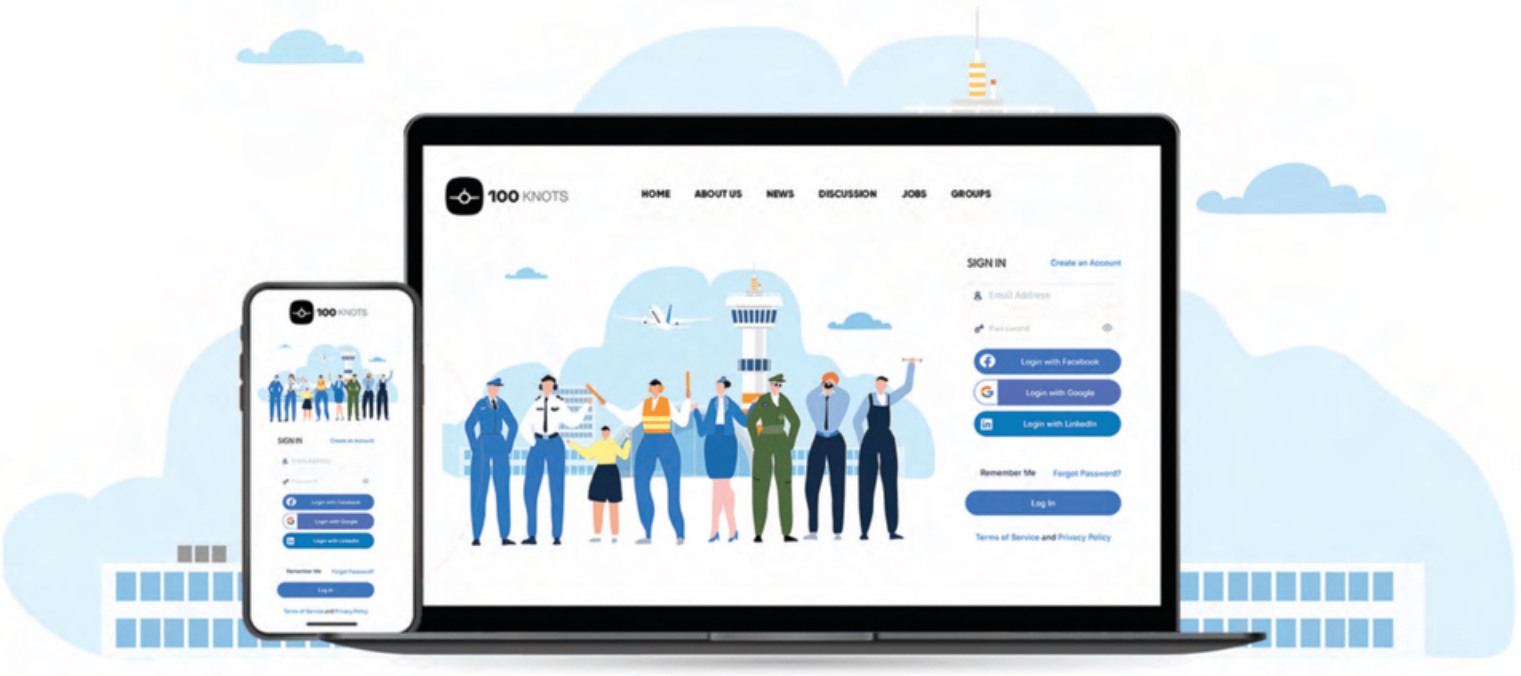


Table of Contents

Biju Babu

Life and Career of India's Tall Leader: Biju Patnaik

Radhika Bansal
Correspondent
100 Knots

Perhaps no other Aviator/Leader occupied the imagination of the people of India like Biju Patnaik, a freedom fighter, pilot, industrialist, politician, and philanthropist. The Encyclopedia Britannica described Biju as an "Indian Politician; who parlayed his fame as a World War-II aviator, anti-British freedom fighter and commercial airline entrepreneur into a political career, notably as Chief Minister of Orissa State, 1961-63 and 1990-95".

On the occasion of Biju Patnaik's 26th Death Anniversary in April, let's scroll through the pages of history to understand the life of aviator Biju Patnaik.

Early Life

The full name of Biju Patnaik was Bijoyananda Patnaik. He was born in Cuttack, Odisha, on March 5, 1916. His parents, Laxmi Narayana Patnaik and Ashalata Ray, belonged to Bhanjanagar in Ganjam. He completed his early education at the Mission Primary School and Mission Christ Collegiate of Cuttack. In 1932, he got admitted into the intermediate science class of the famous Ravenshaw College, where he was a talented sportsman and headed the football, hockey, athletics, and cricket team of the University.

"Flying is my first love, and though it has dimmed with age, it remains so," Biju Patnaik said during an interview.

From childhood, Patnaik was attracted to airplanes and dreamt of being a pilot one day. He dropped out of college and enrolled in a pilot training program at the Delhi Flying Club and the Aeronautic Training Institute of India.

"Flying is my first love, and though it has dimmed with age, it remains so."

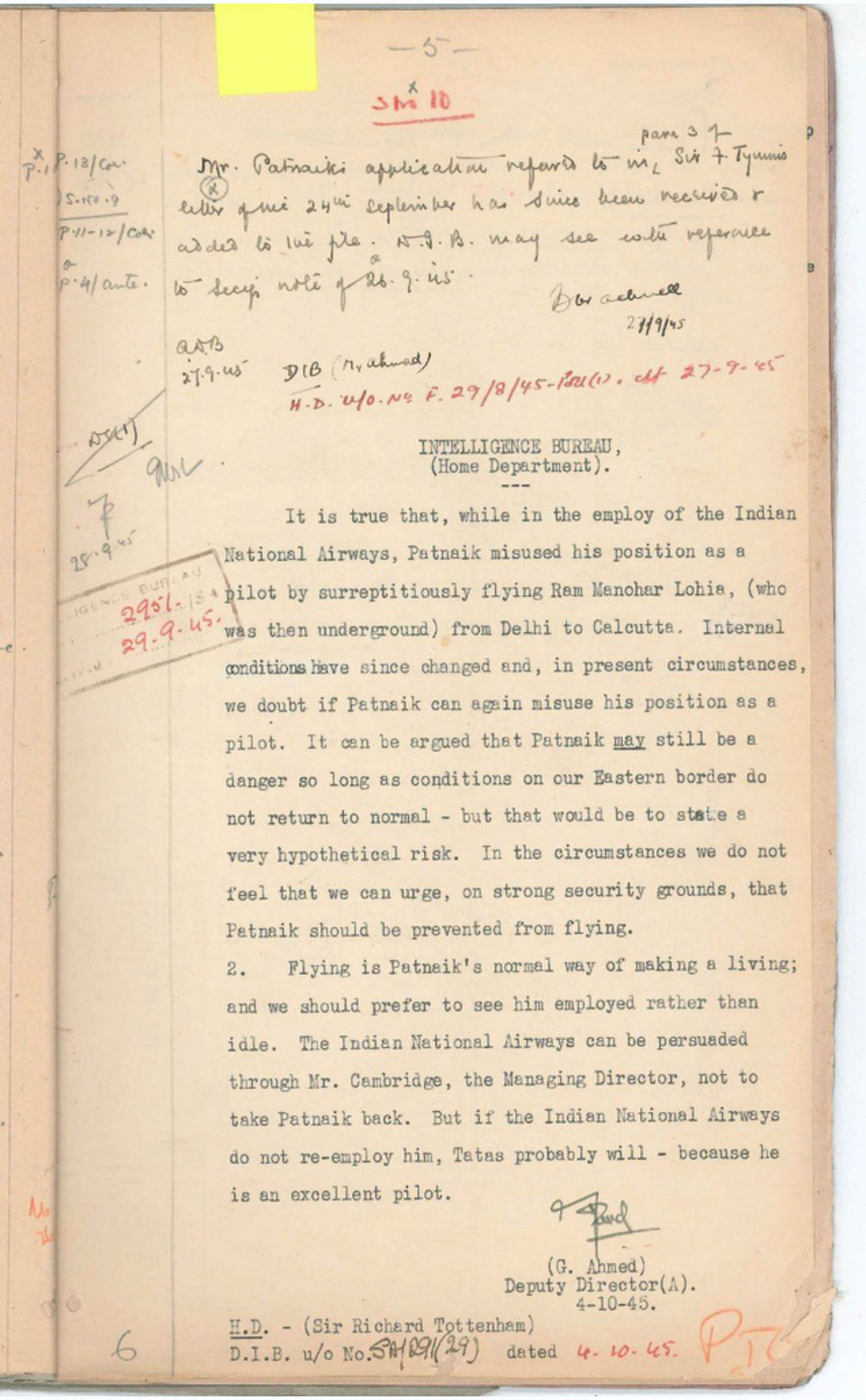
Royal Indian Air Force & National Freedom Struggle

After graduation in 1936, Biju Patnaik worked briefly at Indian national airways before enlisting in the Royal Indian Air Force. He spent the majority of his time piloting Dakota-style transport aircraft and rose to the position of Chief of the Air Transport Command. Biju flew numerous missions to save British officials and families from the Japanese advance in the early 1940s. He was crucial in removing British officials from Rangoon, supply missions to aid China's Chiang Kai–Shek, and the battle of Stalingrad (1942-43). Imperial Japan began to march eastward and conquer Western possessions in Southeast Asia.

In addition to being a dedicated and skilled RIAF pilot (as noted in a 1945 Intelligence Bureau bulletin), Patnaik was also at heart a nationalist who was devoted to India's freedom and motivated by Mahatma Gandhi. He would covertly transport independence fighters like Ram Manohar Lohia to national meetings while serving as the head of the RIAF's Air Transport Command. He occasionally dropped "seditious" pamphlets in support of the Quit India Movement while flying British aircraft over Indian troops.

"While on leave, he ferried freedom fighters to secret meetings with their supporters. As head of the Air Transport Command, he sheltered prominent fighters like Jaya Prakash Narayan, Ram Manohar Lohia, and Aruna Asaf Ali. While flying the British to safety from Yangon, he also air-dropped leaflets supporting the cause of Netaji's Indian National Army," he added.

Biju recalled, "When the British authority found out, they nearly got me shot for subversive activities. That was when I was put behind bars during the Quit India Movement." He was arrested on January 13, 1943, and sentenced to two years for his actions.



—5—

SM 10

Mr. Patnaik's application referred to in para 3 of Sir F. Tymms letter of the 24th September has since been received & added to the file. H.B. may see with reference to Secy's note of 25.9.45.

27/9/45

AAB 27.9.45 DIB (N. Ahmed)

H.D. u/o No. F. 29/8/45-Ests(I). dtd 27-9-45

INTELLIGENCE BUREAU,
(Home Department).

It is true that, while in the employ of the Indian National Airways, Patnaik misused his position as a pilot by surreptitiously flying Ram Manohar Lohia, (who was then underground) from Delhi to Calcutta. Internal conditions have since changed and, in present circumstances, we doubt if Patnaik can again misuse his position as a pilot. It can be argued that Patnaik may still be a danger so long as conditions on our Eastern border do not return to normal - but that would be to state a very hypothetical risk. In the circumstances we do not feel that we can urge, on strong security grounds, that Patnaik should be prevented from flying.

2. Flying is Patnaik's normal way of making a living; and we should prefer to see him employed rather than idle. The Indian National Airways can be persuaded through Mr. Cambridge, the Managing Director, not to take Patnaik back. But if the Indian National Airways do not re-employ him, Tatas probably will - because he is an excellent pilot.

(G. Ahmed)
Deputy Director(A).
4-10-45.

H.D. - (Sir Richard Tottenham)
D.I.B. u/o No. SM/891(29) dated 4.10.45.

29.9.45

Indian National Airways

Following his release, Biju was employed as a pilot by Indian National Airways, a private venture established by Delhi-based industrialist Raymond Eustace Grant Govan. INA was one of the four major airlines in India at the time of Indian Independence in 1947. Govan Bros Ltd. and all its businesses, including Indian National Airways Ltd, were sold to the Ramkrishna Dalmia-led Dalmia Group in 1947. Its name was subsequently changed to Dalmia-Jain Airways. In 1953 Indian National Airways was nationalized and merged into Indian Airlines.

Biju Patnaik would later become the Chief Pilot of the Dalmia - Jain Airways, and during his stint as a pilot for the airline, he continued to lend his services to freedom fighters. In fact, there is an Intelligence Bureau note dated September 29, 1945, which claims that Biju "misused" his position as a pilot by "surreptitiously flying Ram Manohar Lohia (who was at the time underground) from Delhi to Calcutta."

Indonesian Freedom Struggle

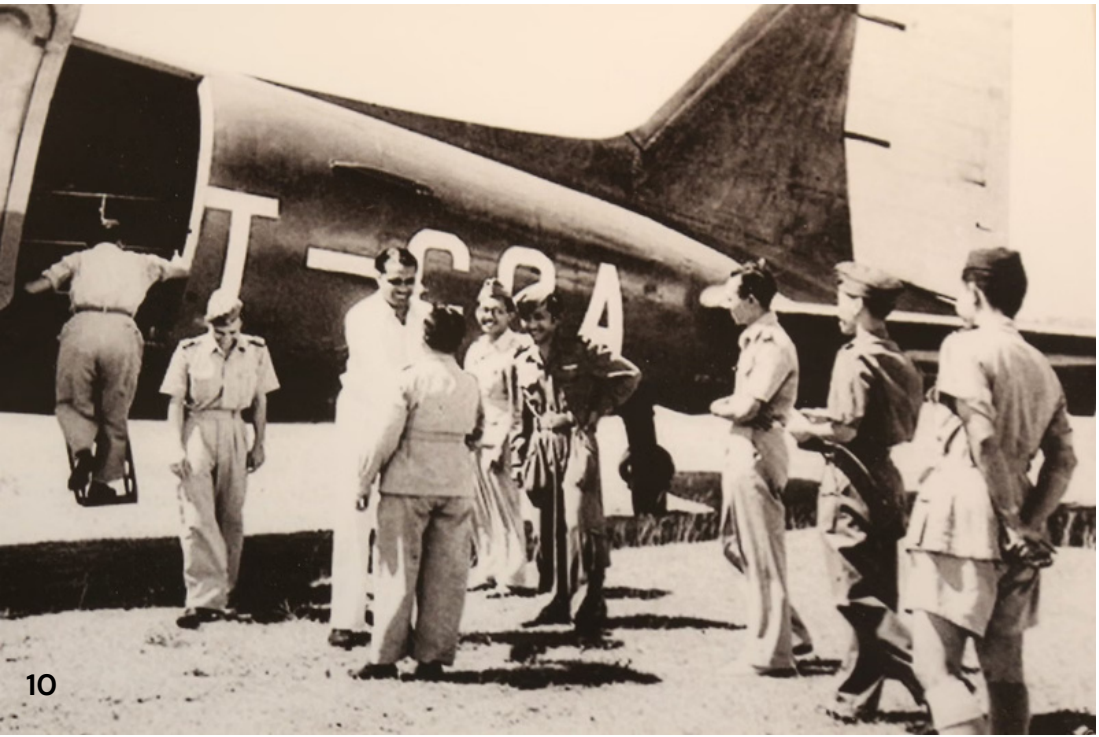
While participating in the Indian Independence Struggle, Biju Patnaik met Pandit Jawaharlal Nehru and later formed close ties. Nehru saw Indonesia as a possible Indian ally and compared their battle for Independence to India's own. When the Dutch forces launched 'Operation Product' on July 20, 1947, to capture the capital Jakarta, Nehru asked Biju to conduct risky air sorties to assist the Indonesian resistance, which involved flying in undetected to Yogjakarta where the 'resistance' Republican leadership led by Sukarno was based.

However, his most prominent mission was when he made a dramatic rescue to Indonesian Vice President Mohammad Hatta and Sjharir to attend the first Inter-Asia Conference, organized in Delhi by Nehru. This was done to incite public opinion against the Dutch in response to their attempt to stifle Indonesian Independence.

Because the Dutch controlled Indonesia's air and sea routes, Sjahrir could not flee. Nehru turned to pilot Biju Patnaik to rescue Sjahrir. On July 24, 1947, Biju Patnaik took off in his old-fashioned Dakota DC3 with his wife, Gyan Patnaik as his co-pilot, leaving behind their 14-day-old son. In Singapore, he received a message from the Dutch threatening to shoot down his aircraft if it entered Indonesian airspace."

In response, Biju allegedly said, with backing from Nehru, "Resurgent India does not recognize Dutch colonial sovereignty over the Indonesian people. If my aircraft is shot down, every Dutch plane flying across the Indian skies will be shot down in retaliation."

Dodging the Dutch air surveillance, his airplane landed on an improvised airstrip near Jakarta. As there was no fuel to return, he used up whatever petrol was left behind from abandoned Japanese military dumps and flew them back to New Delhi via Singapore.



Patnaik received honorary citizenship in Indonesia and the "Bhoomi Putra," the highest Indonesian award for this bravery. The highest national honor, the "Bintang Jasa Utama," was given to Biju Patnaik in 1996, Indonesia's 50th anniversary of Independence.

Kalinga Airlines

Following India's Independence, he started his own airline, Kalinga Airways, in 1947, based in Calcutta, and would become the chief pilot. Later that year conducted, several sorties transported soldiers to Jammu & Kashmir and evacuated civilians following the invasion by guerilla fighters from Pakistan's North West Frontier Province (NWFP).

In 1953, the airline and seven other independent domestic airlines including Deccan Airways, Airways India, Bharat Airways, Himalayan Aviation, Indian National Airways, Air India, and Air Services of India, were nationalized and merged into the Indian Airlines Corporation.

Kalinga Airways restarted operations in December 1957 by merging five airlines, Assam Airways, Indamer Airways, Jamair, Kalinga, and Darbhanga Aviation, with a fleet of 15 DC-3s. Since May 1960, Kalinga has specialized in supply-dropping operations in the country's northeast regions. Non-scheduled functions from Bombay to Dubai were also operated but were suspended in October 1962 to focus on supply dropping. The air-drop operations were taken over by the Indian Air Force in June 1967, and the airline reverted to passenger and cargo charters until February 1972, when its ceased operations.

Personal Life

Gyan Patnaik, the wife of Biju Patnaik, was also a pilot. She was the first Indian woman to be licensed as a commercial pilot. When the Japanese besieged Rangoon in the 1940s, Gyan Patnaik accompanied Biju in the movement for liberation and the evacuation of British families from the city.
Biju Patnaik's younger son, Naveen Patnaik, is the current Chief Minister of Odisha. His elder son Prem Patnaik is a Delhi- based industrialist. His daughter, Gita Mehta, is an English writer.

Dakota at Odisha Airport for Public Display

Odisha Chief Minister Naveen Patnaik recently unveiled Dakota DC3 (AT-AUI) aircraft for public display at Biju Patnaik International Airport Bhubaneswar.

As per the Chief Minister's office, "The iconic Dakota Aircraft belonged to erstwhile Kalinga Airlines and was founded by Ex-Chief Minister of Odisha Biju Patnaik." The said airlines operated nearly a dozen Dakotas, and the former CM and Naveen Patnaik's father, Biju Patnaik, was its Chief Pilot.

With the efforts of the Odisha government, the Dakota Aircraft was shifted from Netaji Subhas Chandra Bose International Airport (NSCBI) in Kolkata to Bhubaneswar on January 18 this year by road. Before bringing the Dakota to Odisha, the Airports Authority of India (AAI) had allotted 1.1 acres of land for the aircraft to be placed in front of the airport named after the legendary leader. A memorial will be built for this purpose.

Since this aircraft is closely associated with Biju Patnaik, it will resemble Odisha's rich aviation history, which would be a befitting tribute to one of the most iconic personalities of Odisha. People will see this Dakota Aircraft as a memento of late Biju Patnaik's bravery and heroics.

HIRO

High Intensity Runway Operations

Justin Jude Francis
Air Traffic Controller
Mumbai Oceanic and Tower Control

Implementing HIRO

As part of the "One Sky - Global ATM Implementation Strategy" of ICAO, signatory states are working towards reducing separation minima in order to make optimum use of existing airspace, providing optimum levels to aircraft as far as practicable, and as a consequence reduce fuel consumption, pollution and move towards a greener future in aviation.

HIRO (High Intensity Runway Operations) is one such application in terminal Air Traffic Control where separation of aircraft is so quantified and defined that optimum inter arrival spacing is provided to push departures. This prevents wasted airspace in case of excessive spacing, inefficient sequencing, and other operational factors. Before we dig further, lets familiarize ourselves with some key terms that are the determining factors in the implementation of HIRO.

Runway Occupancy Time (ROT) The time an arrival or departure is deemed to be present on the runway, as a result the runway is considered occupied.

Time To Threshold (TTT) The time an arrival will take to cross the runway threshold, if the current attitude of the aircraft is maintained as is at that instant

Inter Arrival Spacing The spacing between two consecutive arrivals. It may be in terms of distance (nautical miles) or time (seconds/minutes)

Time taken for Departures to line up, which is determined by the angle of incidence and distance of the holding point to the active runway.

Traditionally, inter arrival spacing was defined in terms of distance. For instance, an airport may have a procedure where the distance between two arrivals of the same type may be defined as 6 NM. The lacuna with this implementation was that even in times of headwind or aircraft performance at finals, where the arrivals could have been brought closer, strict adherence to 6 NM results in wastage of available airspace.

Recent paradigm changes have shifted this separation to a time-based mode. Contemporarily, following proof of concepts and rigorous safety assessments, the runway occupancy time of arrivals and departures is calculated from historical data and is adjusted for aircraft performance and other infrastructural factors such as availability of rapid exit taxiways and associated ground lights and angle of incidence of holding points to the active runway.

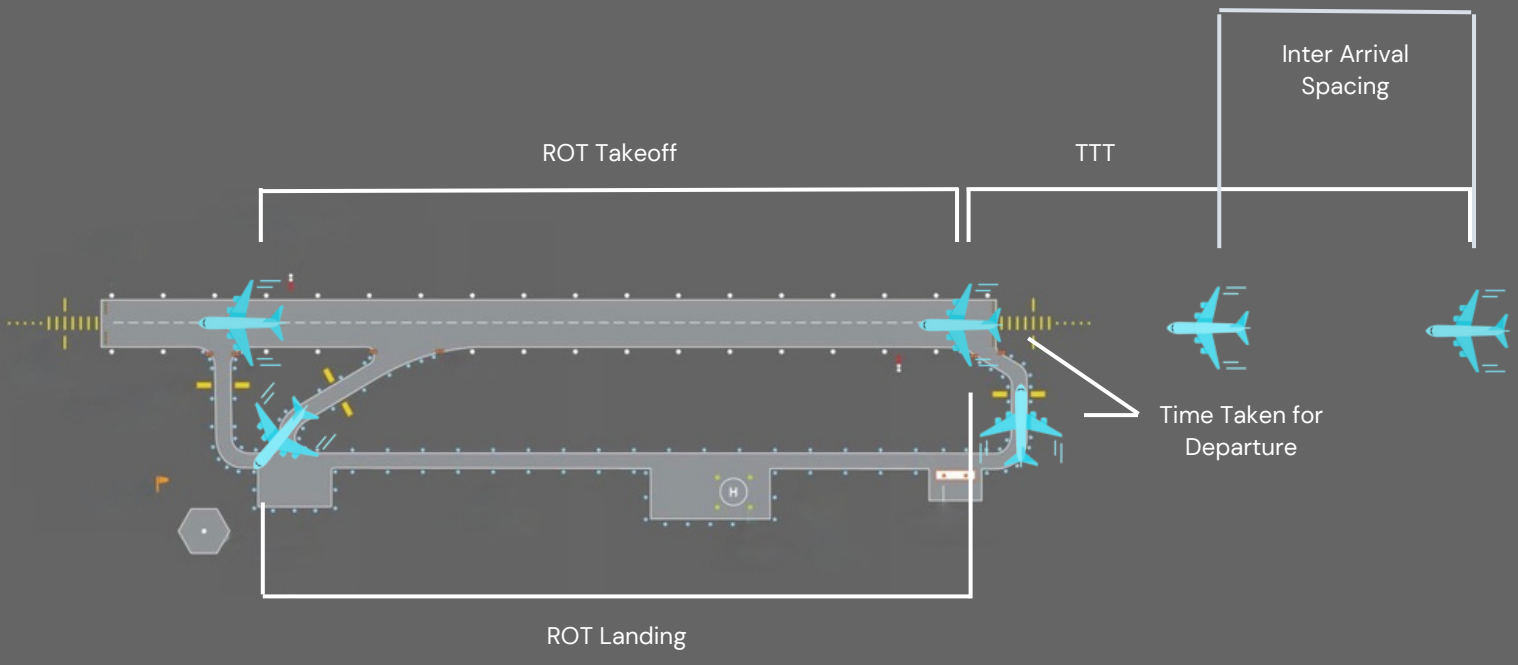
Next, a time to threshold is calculated at which time an aircraft should ideally be issued a landing clearance. Adding the ROT and the TTT at which a landing clearance should ideally be issued, we obtain the inter arrival spacing between two arrivals to push a departure. This is how time-based separation is replacing the distance-based separation so as to boost efficiency and accommodate increased capacity.

© Avel Chuklanov

It has been established that a 2 minute or 120 second separation between arrival A1 and A2 is sufficient to push a departure D1. Earlier, a 6 NM spacing was required, which might have resulted in more than 2 minutes to push the same departure. What has been accomplished here is that there has been a saving of some inter arrival distance, which when aggregated over a few arrival sequences, has resulted in an overall gain of slots, thus increasing the capacity of the airport. Earlier, while, say, 30 miles was needed to push 5 departures (6 NM X 5 departures), now, if we are able to obtain 2 minutes inter arrival spacing at 5 miles, the same 30 miles could be used to push 6 departures (5 NM X 6 departures). TTT is an invaluable tool utilized for reliable implementation of HIRO. Let's understand this with an example.

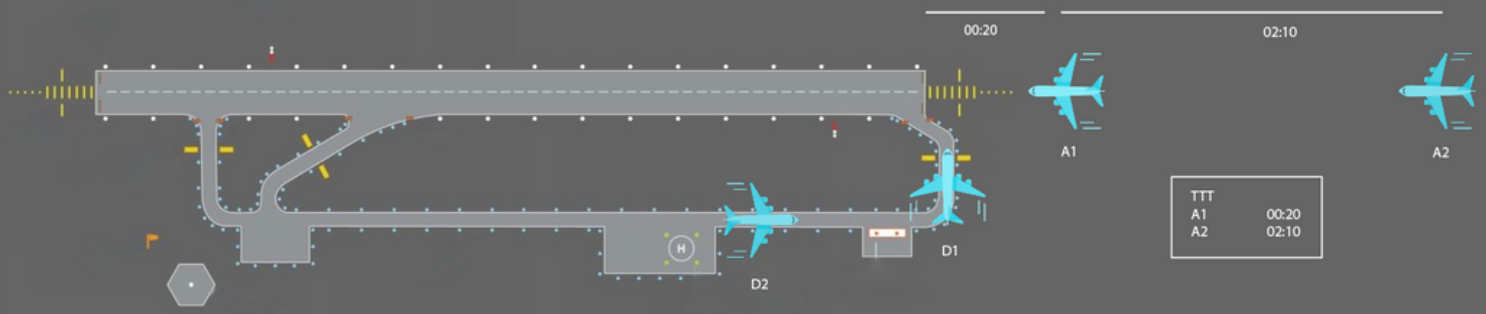
Consider the case where A1 is at 2 miles and A2 is at 7 miles. The S band radar would obtain the time to threshold of both arrivals considering their instantaneous attitude. These two would then be displayed on the surface movement radar display of the controller as TTT for A1 00:20 and TTT for A2 as 2:10. Even though at this instant the TTT difference between the two arrivals is less than two minutes, we know that there will be further speed control on A2 as it descends further in its profile. This will increase its TTT as it comes in closer to land. This dilation allows approach controllers to dynamically sequence arrivals, based on the aircraft performance, so that a differential TTT will ultimately exist when A1 is just crossing the runway threshold and its TTT is approaching 0 seconds.

Now, when A1 is just over the threshold, the tower controller will finally decide whether reasonable inter arrival spacing exists to push a departure. At this time, the TTT for A1 would read 00:00 and TTT for A2 may read 02:01, thus giving a spacing of 2 min 1 sec, which is sufficient to push a departure.



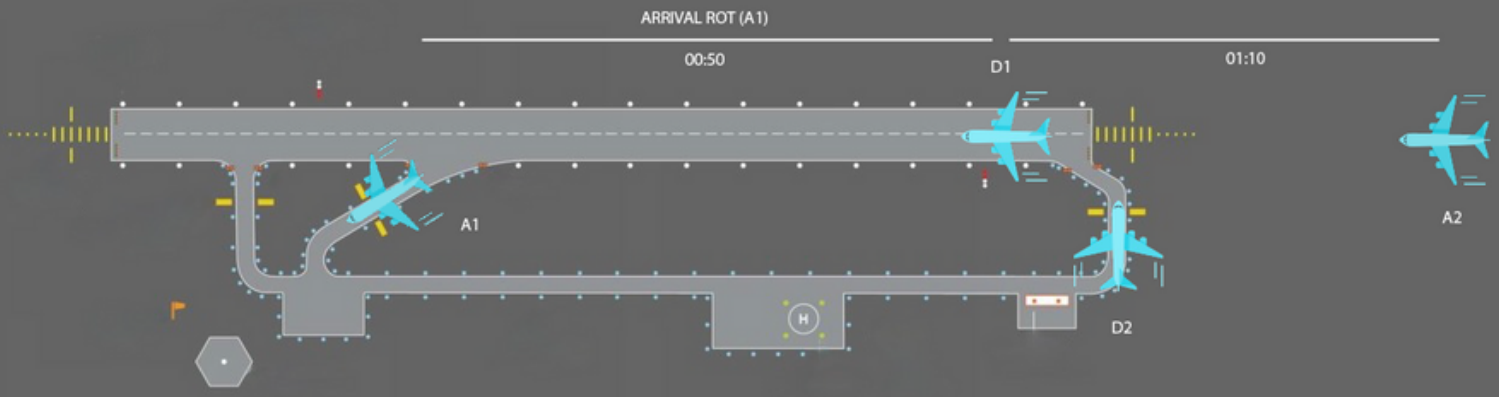
STEP 1

Arrival 1 (A1) is issued landing clearance. Departure 1 (D1) is at holding point ready for immediate departure and issued conditional lineup clearance behind A1.



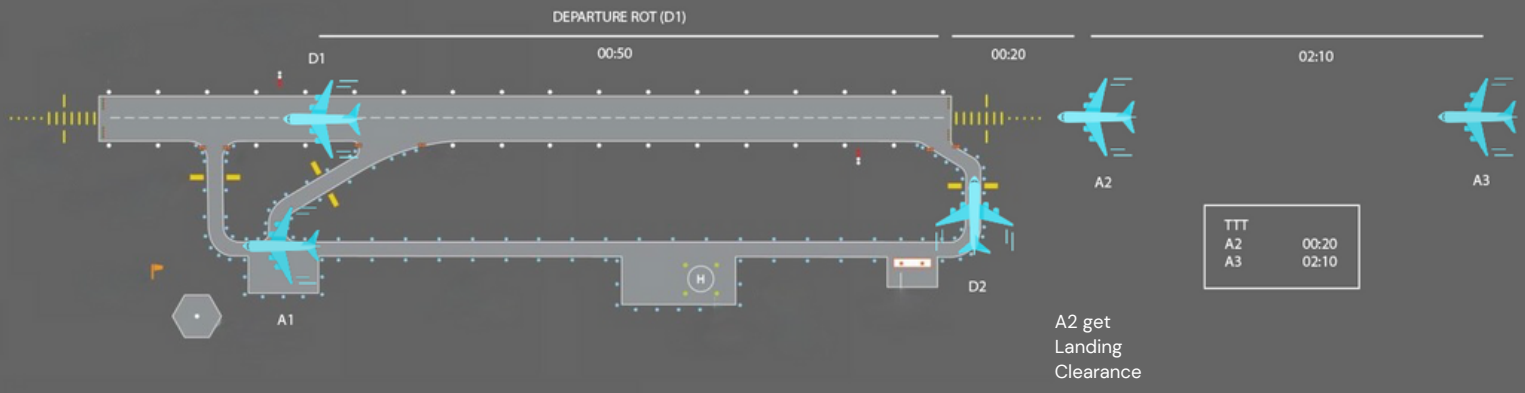
STEP 2

Arrival 1 (A1) lands and vacates the runway with ROT of 00:50. Meanwhile Departure 1(D1) lineup and Arrival 2 (A2) continues to descend on profile with TTT of 01:10.



STEP 3

Departure 1 (D1) takes off with ROT of 00:50. Arrival 2 (A2) is issued landing clearance. In the meanwhile, Departure 2 (D2) reached holding point.



HIRO Implementation at CSMIA, Mumbai

Following a POC and safety assessment with various stakeholders such as the airport operator and airlines, the shift to time-based separation was adopted at CSMIA, Mumbai. While implementing this time-based separation, the below conditions have been considered:

Primary runway in use, along with incident taxiways, RETILs and associated AGL

Accurate and consistent availability of S-Band radar

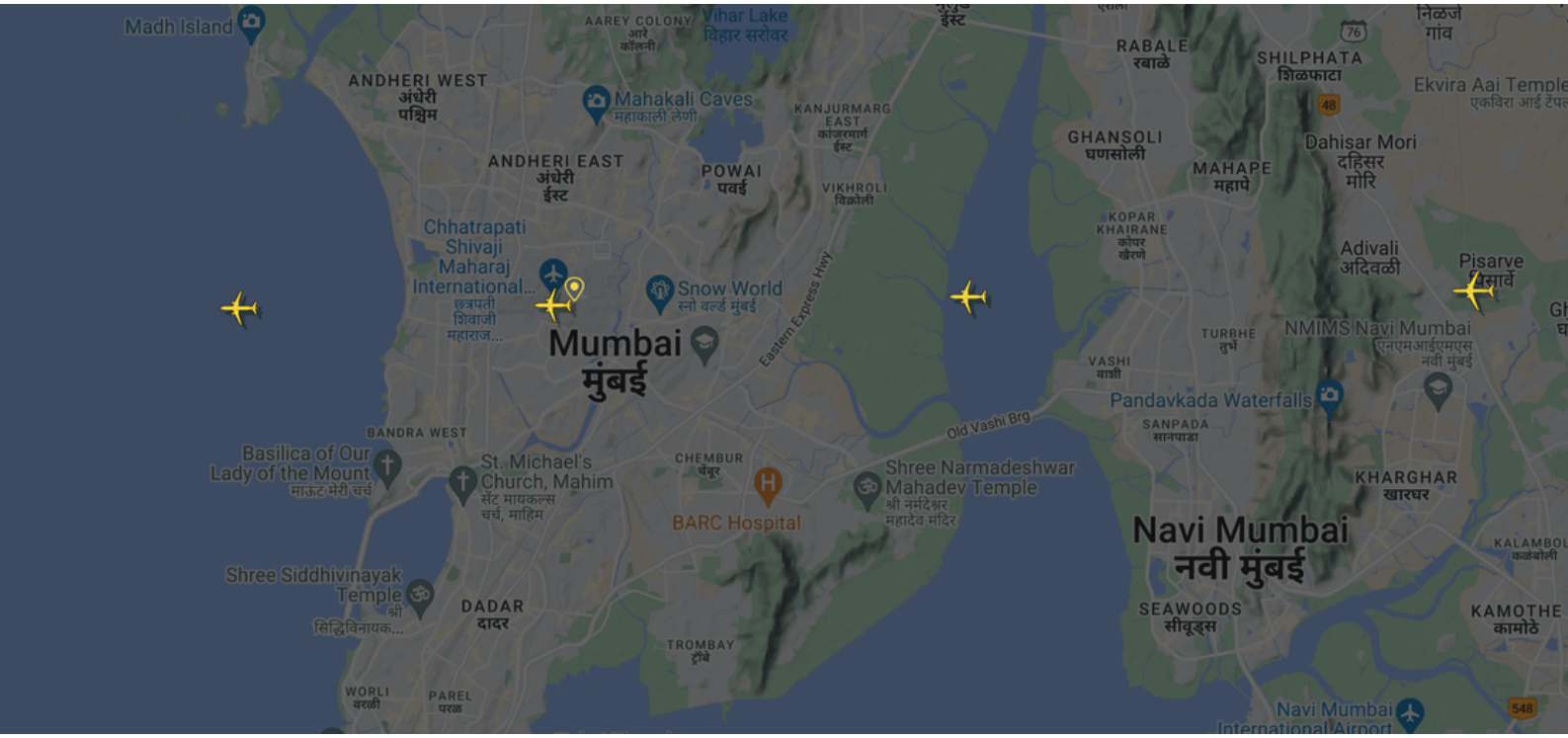
Serviceable traffic display picking up a reliable feed from Surface Movement Radar

Calm wind conditions without any reported gusts

A1, A2 and D1 often will be combination of different types of aircraft. Specific TTT values are defined for all such combinations

Dry runway surface condition

Note 1: This value of TTT is quantified for various combinations of arrival - departure sequences and the runway in use.
Note 2: This is not applicable to super heavy (Wake Category J aircraft), and a distance-based separation is still used when a super departure is to take place. Wake separation still supersedes TTT and may be suspended to satisfy wake separation criteria



How Can Pilots Help?

Pilots are an instrumental stakeholder in HIRO achieving its objectives. A few tasks which would go a long way in boosting capacity using HIRO are

Familiarize yourself with the aerodrome layout prior to flying the sector

Be concise, accurate and timely in requests to controllers.

In case of anticipated delays in line up, take off roll, or vacating the runway, or any deviations from normal operations, a timely heads up to the controller can help mitigate the roll over effects of such occurrences

On the Runway

- Always Execute a Normal Landing
- Be Flexible - Adapt to The Actual Conditions
- Adjust Braking to Exit at Appropriate Speed

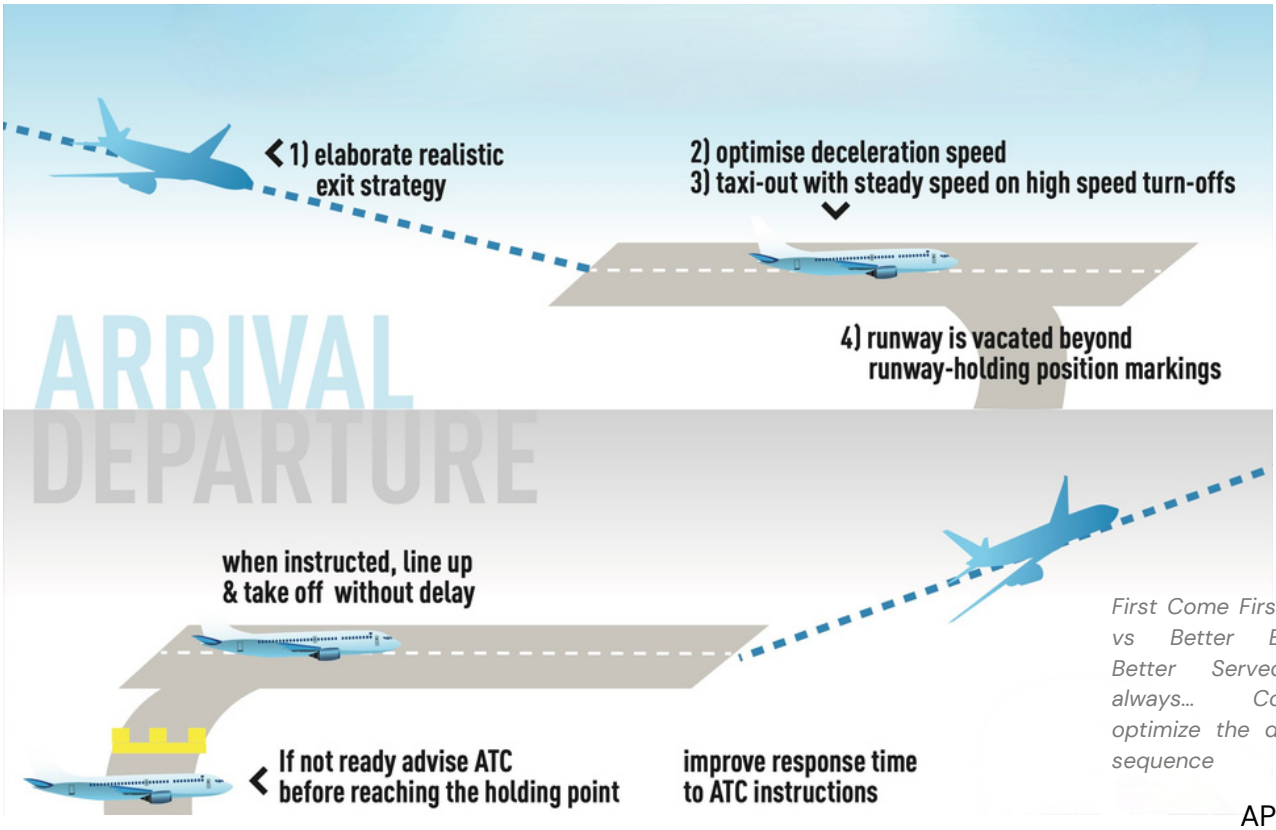
Plan Ahead

- Rapid Exit Taxiway
- Distance
- Autobrake Setting

Plan the Most Appropriate Exit

- Least Time Spent on Runway
- Not Always the Shortest Landing Distance
- Consider Best Braking Strategy - Don't Be Overambitious
- Taxi Routing Should Not Affect Decision

Avionics have evolved in leaps and bounds. Modern aircraft like the A350 and A380 series have an on-board real-time ROT calculator. In case of any significant deviations in ROT, a timely prompt by the pilot can allow the controller to either sequence his departures, coordinate for extra spacing or tactically revert to distance-based separations to mitigate such occurrences.



First Come First Served vs Better Equipped Better Served? Not always... Controllers optimize the departure sequence

Final Thoughts

It gives me immense pride that following successful implementation of HIRO, CSMIA Mumbai emerged as the busiest single runway airport in the world in June 2018 by handling 1003 movements in 24 hours, supplanting London's Gatwick airport.

About the Author

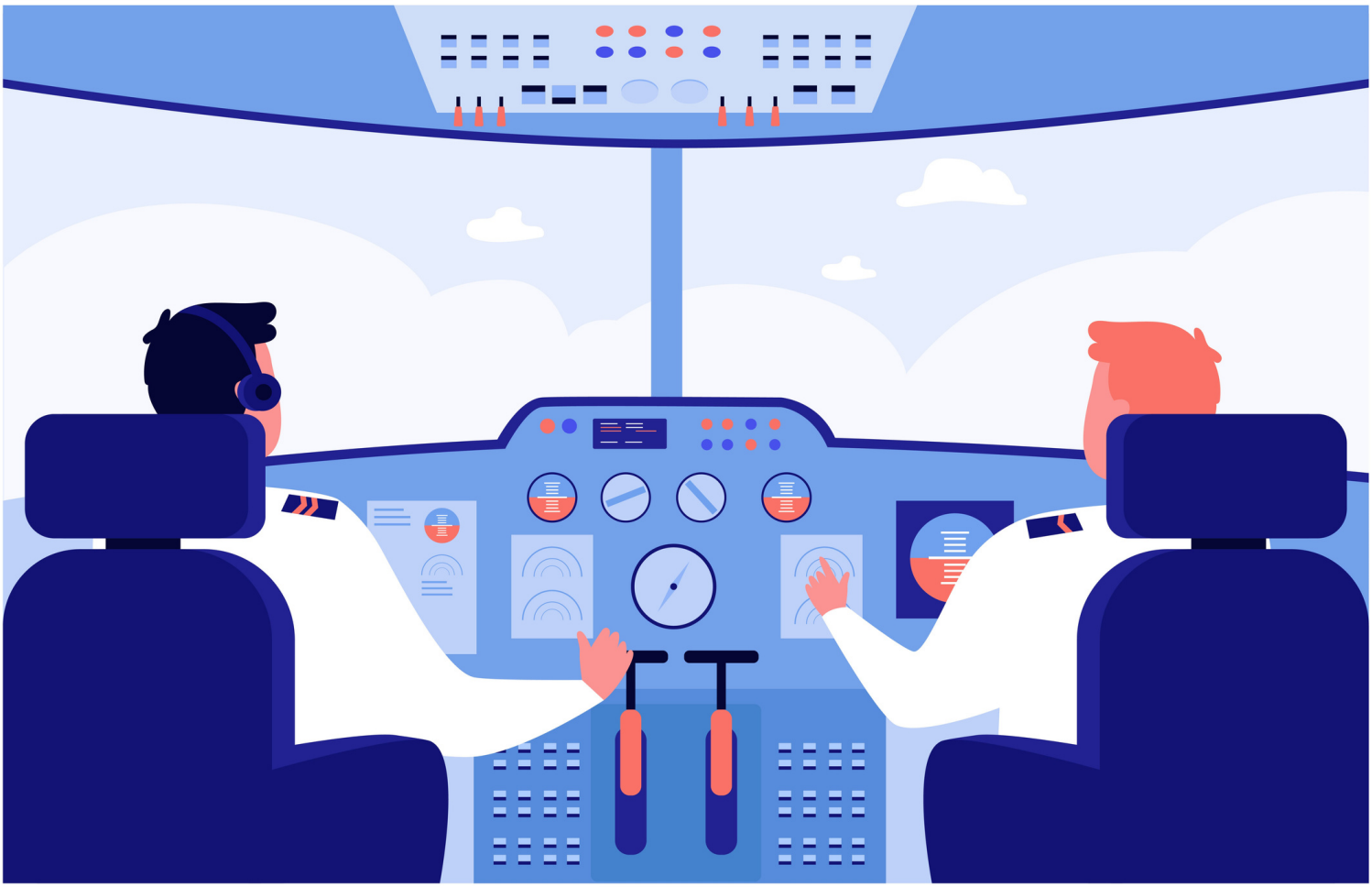
Justin has more than 10 years of ATC experience and hold current Aerodrome and Oceanic control ratings at Mumbai. In addition to regular ATC procedures, he is also trained in CPDLC and HIRO operations at CSMIA, Mumbai.

Justin is graduate with Bachelor of Technology in Electronics and Communication Engineering. When off duty, he enjoys backpacking and exploring unconventional destinations. He also likes reading fiction and classic rock music.

The Critical Role of Assertiveness in Aviation Safety

A Comparative Analysis of Two Air India Express Accidents

Commander Ashley Derrick (Retd)
Ex-Navy Flying Instructor



The importance of assertiveness and effective communication cannot be overstated in aviation. This is especially true for copilots, who must possess the confidence to challenge their captains when necessary to ensure the safety of passengers and crew. Two tragic accidents involving Air India Express – Flight 812 in 2010 and Flight 1344 in 2020 – provide clear examples of how a lack of assertiveness can contribute to devastating outcomes. This article will delve deeper into these accidents, highlighting the absence of assertiveness in both cases and the possible influence of organizational culture. I believe that the lessons are valid for all high-risk industries.

Air India Express Flight 812 – 2010

On May 22, 2010, Air India Express Flight 812 overshot the runway while attempting to land at Mangalore International Airport in India. The aircraft crashed over the cliff at the 'tabletop' runway, killing 158 of the 166 passengers and crew members on board. The subsequent investigation revealed the captain's history of unsafe practices, including disregarding standard operating procedures and making critical errors during the approach.

The first officer's role in this accident in the form of Professional Assertiveness was the final line of defense that could have prevented this accident from happening. Although he was aware of the captain's unsafe practices, he could not assert his duty in the cockpit that day. He called out, "Go around" many times when it was still safe to abort the landing attempt. However, he did not assertively challenge the captain's decisions, which could have averted the accident. All he had to do was call out "Going around" again on the radio and execute simple actions to abort the approach and climb straight ahead.

That would mean he has to take over the aircraft controls from the unresponsive captain and challenge his unsafe actions. The SOP says that he is mandatorily required to do that under those circumstances. However, he merely chose to keep warning the captain in desperate pleads.

Air India Express Flight 1344 – 2020

Ten years later, on August 7, 2020, Air India Express Flight 1344 met a similar fate when it overshot the runway at Kozhikode International Airport, also in India. The aircraft broke into pieces, resulting in 21 fatalities, including both pilots. The investigation concluded that under high stress induced by duty period issues, the captain disregarded weather warnings and opted to land despite unfavorable conditions.

Once again, the first officer's role in this accident is crucial. As in the Flight 812 incident, the first officer did not assertively challenge the captain's decision to proceed with the landing, even though the weather conditions were less than ideal. The co-pilot had urged the captain to 'Go around' but took no action per the SOP.

The Role of Organizational Culture

A deeper analysis of the organizational culture within Air India Express is essential, as it appears to have significantly influenced the circumstances that led to both accidents. This fact was stated clearly in both accident reports. Some pointers gathered from the accident reports that may help the airline (now under different management) with introspection are discussed below.

Systemic Authority Gradient

The airline's culture seems to emphasize hierarchy and deference to authority, creating an environment where first officers might feel discouraged from speaking up and challenging their captains' decisions. There are indications of that in the form of unreasonable privileges extended to seniors at the cost of operational efficiency and safety. This culture of deference could have contributed to the lack of assertiveness exhibited by the first officers in both accidents.

Culture Seeping into Cockpit

Seniority and rank often precede open communication and collaboration in hierarchical organizational cultures. In the context of aviation, such a culture can result in junior pilots and crew members feeling intimidated or hesitant to question their superiors, even when they have legitimate concerns about safety. This can lead to a dangerous imbalance of power and accountability in the cockpit, where the captain's decisions may go unchallenged, despite the risks they pose. Similar effects can occur in any high-risk industry.

Career Concerns

If pilots and crew members believe that crossing the unspoken lines of authority gradient by speaking up or challenging authority could negatively affect their career advancement, they may choose to remain silent, even when they have safety concerns.

Leaders Walking the Talk

The organization's management and leadership are crucial in shaping its culture. Imagine when leaders do not consistently demonstrate a commitment to safety and create an environment where all employees feel empowered to voice their concerns without fear of retribution. Breaking free from a culture prioritizing hierarchy over safety can be challenging in that case. Therefore, Leaders must lead by example, openly demonstrating their commitment to safety and creating an environment where every employee's input is valued and respected, with absolute trust that it will not be used against them.

By examining the organizational culture's role in the accidents of Air India Express Flight 812 and Flight 1344, all involved in high-risk industries can learn valuable lessons about the importance of assertiveness and open communication in safety behavior.

Lesson for Leaders

The accidents involving Air India Express Flight 812 and Flight 1344 serve as sobering reminders of the potential consequences of an unhealthy authority gradient in high-risk industries. Leaders need to plan their strategy to avoid it from festering in their organization.

Here's a 10-point checklist for Leaders to prevent unhealthy authority gradient:

Implement comprehensive training programs emphasizing crew resource management, decision-making, assertiveness, and collaborative problem-solving.

Encourage open communication and collaboration among all employees, regardless of rank or seniority.

Foster an environment of psychological safety where employees feel comfortable raising concerns without fear of retribution from senior staff.

Ensure performance evaluations and promotions are based on both technical skills and the ability to work effectively in a team, reducing the impact of seniority alone.

Establish clear policies and procedures that prioritize safety and emphasize the importance of shared decision-making and mutual respect.

Encourage leaders to lead by example, demonstrating their commitment to safety, open communication, and approachability.

Regularly review and update training programs to ensure they remain effective and relevant, addressing authority gradient issues.

Create a feedback loop where employees can share their experiences and contribute to ongoing improvements in authority gradient reduction.

Recognize and reward employees who demonstrate a commitment to safety, effective communication, and challenging unhealthy authority gradients.

Continuously monitor and assess the organizational culture and authority gradient to identify areas of improvement and ensure progress toward a safer and more inclusive work environment.

About the Author

An ex-Navy Flying Instructor with about two and a half decades of experience in flying and aviation operations at sea. He is a seasoned Accident Investigator with over 35 accident analyses under his belt. He specializes in Safety Risk Studies and Intervention Design for accident prevention, with a focus on Organizational Culture. An Auditor of 12 airports, covering over 10000 personnel of the Indian Navy and the Coast Guard. As an experienced public speaker, he has made 300+ appearances at official and social functions, captivating audiences ranging from 20 to 3,000, including TEDx IIM Trichy. He regularly undertakes research and writes on Safety, Culture, and Leadership.

Airlines at the Edge of

Emergence and Chaos

Capt. Vijay Devadas
A320 Captain

Suppose you dismantle a mechanical watch and see the harmonized working of its parts. It's such as mesmerizing sight to observe how these parts interact in moving the hands of the watch. The watch is a complicated mechanism; However, try taking one piece off balance; this orchestrated play would come to a grinding halt, and the watch stops". On the other hand, a team of humans working together at a construction site can adapt and re-organize even if we remove one or few humans from the working area, and did you ever wonder why? Because a group of humans forms a complex system (Page, 2009).

Complex Systems

In other words, complex systems interconnect and interact through a network of functional, emotional, physical, psychological, financial, etc., at various levels. The functional sum is more significant than its arithmetic sum of parts. However, unlike a watch, complex systems do not stop functioning if one component fails or goes missing; they survive just like the cellular genome of our human body, which strives and adapts to various hostile conditions. So, for example, the group of workers at the construction work site too would survive the task by extra work shifts to balance the reduced number of workers.

An airline is synonymously a complex system with numerous departments constantly interacting with each other in scope and context. Most airlines would still survive if few employees left, or a few airplanes were grounded, even if there is financial loss. As history has demonstrated during a pandemic, some airlines have stayed resilient and survived, and some have not. How is it that if an airline is a complex system, some survive and some do not? For that, let us try and understand the following concepts: non-linear theory, emergent systems, and chaos.

Linear and Non-Linear Systems

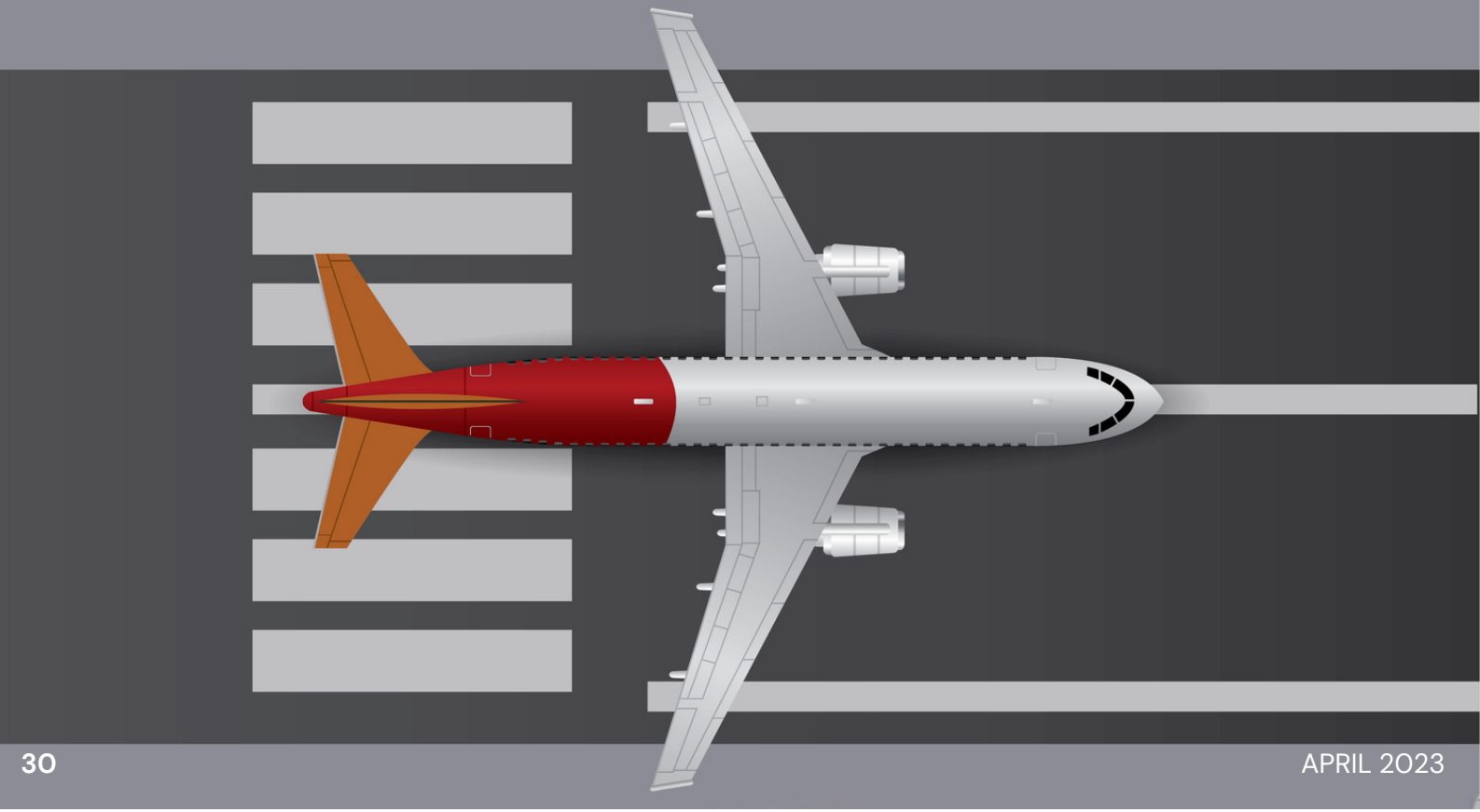
What is a linear system?
In our classic watch example, if one gear moves a certain amount, it would move its interlinked equipment in the proportional geared value. This ratio will never change today or after 200 years; that's a linear system.

What is a non-linear system?
A change in a unit value on one component would have a power function of change in the other (Guastello, 2010). So, for example, if I try to insert a dollar for a soda can in a wending machine, each time I try doing that, the machine dispenses a different number of soda cans, which is a non-linear system. Honestly, I wouldn't say I like that gambling vending machine.

Let's return to our example of an airline, assuming the frequency of route A-B is just one and the subsequent load factor is 40%. However, the frequency between A-B increases gradually; in response, the passenger load increases or decreases not on a linear factor but on a random pattern with various interlinked contributing factors. Let's interpret the increased connectivity, maybe the load is balanced on all flights due to flexibility, or there could be a high load on the morning and evening flights due to office hours and travel convenience. The interesting point is that the load is not linearly proportional to the number of flights. This is what a non-linear system in this context means: Each time an independent variable change, it translates its effect to various other nodes on predictable or unpredictable scales.

What's In It for The Airline Industry?

In the airline environment, most verticals work with departmental goals, not realizing how this nonlinearity affects everyone in a different pattern. For example, a reduced budget by the finance vertical, which subsequently translates into a flight crew training budget. Naturally, the training department will tweak its program to meet the budget. But in all honesty, maybe the pilots couldn't adapt to this change in the training modules at a cognitive level; however, which appeared to survive on the surface due to redefined training markers and standards, thus synonymous with reduced standards. Additionally, we cannot predict the expected outcome to close precision in a non-linear system. Hence, without evidence, we wouldn't know how the financial budget would influence training outcomes.



Emergent Systems

While traveling from Delhi to Agra by road with my family, it was quite a traffic-free day. However, at one intersection, there was a sudden flux of cars, bicycles, and pedestrians due to a dysfunctional signal. Well, some cars slowed down and gave way for others. Some changed lanes and paced up; in one case, a motorcyclist emergency braked to avoid a collision. The intersecting traffic system comprises various components, such as the physical layout of the intersection itself, the dysfunctional traffic lights, the cars, the bikes, cyclists, the pedestrian, and the space itself, all constituting its environment. The environment at any point is not constant, and it evolves with changes in actions by each car, motorcycle, and pedestrian for any reason. At every change, each element in the system reacts to this change, just like the vehicle slowing down and adapting to a car speeding up across. If we look at a system's survivability context, it readjusts various component states and emerges to a new equilibrium, thus an emergent system (Green, 2000).

Synonymously, an airline with multiple department employees (pilots, crew, maintenance, commercial, aircraft, and buildings comprise a complex system). A change by one of the department's employees or components affects the system's environment and its interacting link. An interrelated department employee/ component would react by adapting to the difference. For example, if the maintenance personnel cannot fix some snag, the pilots adapt by tweaking their procedures. Likewise, if the IT dept has an internal mail server downtime, everyone in the organization would switch to a different communication channel, such as phone calls, personal networks, paper notes, and meetings in person; so, the entire system emerges into a new state of equilibrium (Buckley, 1998).

In other words, the disrupted system does not Collapse immediately, nor does it return to its older equilibrium. Instead, it finds a new balance until a further change in the internal and external system state. This emergent property of the system creates innovation, new ideas, and efficiency. A word of caution, the emergent form is close to the next of nature's most unforgiving places, which is called chaos, especially with its fragile boundary layer condition between emergence and chaos.

Chaos System

What is chaos? Maybe it's chaos during extreme weather disrupting air traffic management with flight cancellations and stranded passengers, or an inflight medical emergency where the crew must handle a passenger's deteriorating health while flying over the middle of the Atlantic, where immediate medical intervention is required. At some point in our lives, most of us have experienced chaos; however different it would have been, it's a nerve-racking, unpleasant, and unpleasant experience. So do we like chaos? Definitely no. Can we avoid chaos? Well, that depends on our system state before the chaos happens.

We discussed that a system's emergence state is efficient and adaptive and provides novel solutions to problems. For example, emergent systems are like pressure cookers; they cure and cook the meat well at the right temperature and pressure, but a slight temperature burst can cause the Cooker to explode. Another emergent system is like a nuclear reactor where a fission reaction within a controlled environment would give high energy and could be efficiently harnessed. Still, a slight Mismatch of the control rods can make the response go out of control and turn into a bomb. So hence it's with caution that one must stay in the emergent system state for a long time as it's very vulnerable and in the most miniature resistance zone. So, in our case of the airline chaos scenario, it would have been in an emergent state before getting chaotic (White, 2007).

Let's understand what emergent states could have been in the inflight medical emergency scenario; the chaotic state here is the passenger's health deteriorated, requiring immediate surgical intervention while flying over the Atlantic with no diversion available for many hours. However, earlier, at some point, the aircraft would have been flying over land with significant airports close by, and the passenger would have been stable, a system in perfect equilibrium. Of the multiple elements here, "passenger Health, the Atlantic Ocean or land," if there is a deviation from one of the elements, keeping the others constant, the system can evolve, adapt and emerge to a much safer survivable state. Which is if the passenger's health deteriorates while flying inland and not requiring surgical intervention. In that case, the pilots might have performed a medical diversion (innovation, emergence) and returned the system to an equilibrium in a newer state.

Hence, we could look into the dynamic scenario and break the system into such schema (equilibrium– disruption – non-equilibrium – emergence – new system state – equilibrium). If that's the case, then why would the system get chaotic? Shouldn't it reach a new equilibrium and remain there? I agree the system should have worked this way. It would only happen when the disruption width and depth are within a specific minimum threshold range for the system to emerge until it can readjust itself in various positive emergent states. (Waldrop, 2019); any further disruption than this, the system would be in chaos (into the Atlantic and no place to divert).

Non-Linear, Emergence, and Chaos Flux

Let's combine the concepts such as complex systems, nonlinearity, emergence, and chaos in the preview of an airline. An airline, by its function, structure, and purpose, is a complex system, the sum of parts that could be a simple additive structure. Still, its functional sum could be much more significant or lesser than the arithmetic sum of a non-linear system. Further, we moved into emergent systems and chaos where an airline can never be in equilibrium and has disrupting factors pushing it away from the balance. As a survival strategy, the system emerges into a new state of equilibrium. And finally, we spoke about chaos, where if many changes occur in a system in terms of quantity and intensity, the system might not emerge and move into chaotic conditions. What can we do about this? Well, the bad news is chaos can't be eliminated as long as we choose to enjoy the benefits of an emergent system that is efficient, innovative, and even economical. Still, the good news is we can identify emergent states close to chaos.

First, we have to develop systems to adapt to non-linear environmental changes. Next, we must create a reliable working model to operate the system (airline) in emergent states, which means the system must have means to avoid the chaotic state and self-recover in case it slips into chaos. For this, we must assess every system, predict its outcomes in various non-linear ways, and perceive the different emergent states it could create. To have realistic data, each system component must be studied for its property and relation with various parts through mathematical and computational models. The key here is to avoid interacting with elements without well- defined or ambiguous emergent conditions. Finally, the systems design flexibility should be less rigid as an individual element; in other words, the rigidity should not be structural to each component; instead, they have to be stiff as a functional, interconnected element.

Conclusion

This study is a precursor for what lies within the hidden chaos mountain, which needs further study and research. Notably, Chaos is prominently seen in a graphical or numerical pattern due to its presentation salience, where the iterations are limitless. Hence, the elements and their system interaction must be translated into quantifiable mathematical sequences, models, and graphs with automated computational modeling (Gregoriades & Sutcliffe, 2006). And in moving forward, the aviation industry needs to work together through various settings in the application of emergent systems and chaos to develop a much more robust process in having the airline function close to the emergent state and avoid chaos.

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 bachelors 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. The author is also an Affiliate member of the Royal Aeronautical Society, a Student member of the American Psychological Association, and a full member of the Society of Experimental Test Pilots – Indian Section.

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 coffees as a beverage, which helps him think with insight and penning down his thoughts.

References

Page, S. E. (2009). Understanding complexity. Teaching Company.
Green, D. G. (2000). Complex Systems. Cambridge University Press.
White, R. (2007). Complexity and Chaos. Knowledge products.
Waldrop, M. M. (2019). Complexity: The emerging science at the edge of Order and
Chaos. Open Road Integrated Media.
Gregoriades, A., & Sutcliffe, A. G. (2006). Automated Assistance for Human Factors
Analysis in complex systems. Ergonomics, 49(12-13), 1265–1287. https://doi.org/10.1080/00140130600612721
Guastello, S. J. (2010). Non-linear Dynamics of Team Performance and adaptability in
emergency response. Human Factors: The Journal of the Human Factors and
Ergonomics Society, 52(2), 162–172. https://doi.org/10.1177/0018720809359003
Buckley, W. F. (1998). Society-- a complex adaptive system: Essays in social theory.
Gordon and Breach.

The Joys and Rewards of TEACHING

The Protege Effect

Akshay Renavikar
TRE A320/330/350

The more I teach, the more insights I gain and the more my knowledge is expanded. The role-reversal is really subtle, and ironically, I frequently find myself learning while imparting knowledge. I've learned as much as I've imparted over the years. Here are some pearls of wisdom I have gleaned from my experience teaching.

You have a deeper understanding of something when you learn it with the goal to teach it later. I consider what is so fascinating and worthwhile that it would be worthwhile to teach before assuming the job of the trainer. I then consider how to express that idea.

Teaching made me aware of my knowledge shortcomings. I became more inquisitive and humble. Every student asks me at least one question for which I have no answer. I make it a point to respond with the solution. My students evolved into my mentors in many ways. Now that I fully comprehend the phrase, "You won't learn anything if you believe you already know everything. You will learn everything if you believe you know nothing."

There are syllabi to follow and templates to provide, but not all of them are universal. Also, tailoring and simplifying ideas made me entirely reevaluate how I teach. To avoid repeating what is already available, I now plan and focus on my preparations. I discovered how to develop scenarios with a plot to convey a message that could result in self-discovery. Blaise Pascal, a French mathematician and philosopher, famously said, "I have made this longer than usual because I have not had time to make it shorter," which encapsulated this reality.

If we don't evaluate and apply knowledge, we lose it at predictable rates. This is a natural cycle for a teacher. In order to optimise and emphasise key memory facts, I also learned how to take brief notes and educate the subconscious mind through repetition. Regular quizzes that tested this knowledge helped to strengthen long-term memory. I now teach my pupils these methods because they compelled me to learn them inadvertently.

I believed that integrity motivated me and that it translated into accountability. Looking back on my more than ten years as a trainer, I can see that accountability was what brought about integrity. To uphold this accountability, I have had to make difficult judgements. It's simple to remain silent or to criticise. To brief, debrief, and prepare reports, however, requires time and dedication. It is important to keep track of both the skills and competencies that need to be improved and those that can be strengthened and promoted. It's a dedication to your ideas, your way of thinking, and your function as a coach and mentor.

I started implementing the ideas I was teaching in my own life. I now instruct students on pilot skills that they may apply to other areas of their lives. Not actually at the top of an organization's priority list is feedback. That is the final pointless task a trainee must complete. I've learned to read the trainee pilots' body language, word choice, and facial expressions rather than requesting feedback at the conclusion of the course. I utilise it to make the necessary course modifications because it offers real-time feedback. I understand that in addition to being a channel for knowledge, I also serve as an example.

I'm hoping that many people who read this article—especially current pilot instructors—will be convinced of the effectiveness of teaching for learning. When you learn anything, immediately impart it to others! Knowledge sharing is a form of giving, and giving is joyful. My trick to learning is writing this post.

Teaching has a significant ability to improve learning, and this ability is profoundly underrated. "Every time we attempt to teach somebody anything, we are likely to learn more than those we are trying to educate. We benefit most from giving."

I hope that this paper motivates pilots and pilot instructors to approach the teacher position from a whole fresh angle.

About the Author

Captain Akshay Renavikar comes with a wide range of aviation experience, from commercial wide-body planes to flying MiG combat fighters for the Indian Air Force. He is currently a demo, ferry, and EASA A320/330/350 Examiner/Instructor pilot. Additionally, he collaborates with ATOs from all around the world on CBTA and simulator training. Capt. Akshay has eight ATPLs from his work with international airlines after training and flying with several of them. He has worked in a variety of executive positions and has both an MBA and a Bachelor of Science.

100 KNOTS

For advertising, queries and suggestions
mail: editor@100knots.com

© Turkish Technik