

LAUNCH EDITION

January 2022

# 100 KNOTS

India's Premier Crew Magazine

## Travel

A pilot couple's ode to the land of midnight sun



## Health

Managing Cosmic Radiation

## Statistics

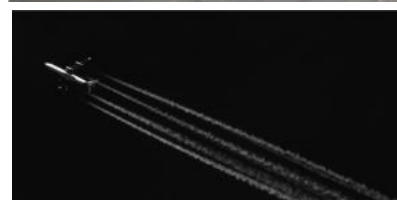
Indian Aviation Industry

## New Technology

Transponder Landing System

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## Message from the Editor

In last two years, we have seen some of the most unprecedented events, mankind has ever witnessed. The intensity and impact of COVID-19 pandemic has not only changed our life, lifestyle and thought processes but has also left a significant impact on the ways and working of our industry. But the silver lining is the way Indian Aviation sector has repeatedly bounced back and responded to these unexpected times.

India is on course to become the third largest aviation market in the world by 2024. A healthy mix of rising middle-class population, increasing competition amongst Low-Cost Carriers, infrastructure buildup at leading airports and progressive updation of policy framework will paint a bright future for Indian aviation sector.

The response to our request to authors for contribution has been overwhelming. Our sincere thanks to all the contributors for their support and interest.

I hope that reading this magazine will have an impact on and encourage you to become a more aware professional. We may never know how much our words or actions will influence the Indian Aviation tableau. But we will work with best interests in our heart and choose to be a positive influence on the industry professionals.

I close this message by inviting everyone to submit their exciting article ideas to 100 Knots. All papers receiving a high degree of enthusiasm in the peer-review process will find a home in the future issues. Therefore, we are committed to publishing all discoveries, methods, resources, and reviews that significantly covers Indian aviation sector at large.

Once again I welcome you to this journal – your journal! With your support as authors, reviewers, and editors, I see very bright prospects for 100 Knots to serve Aviation community even better in the future. We hope to hear from you soon, and we welcome your feedback!

# Indian Aviation Industry by numbers



**OPERATORS** 129

-  Scheduled Airlines 17
-  General Aviation 94
-  Flight Schools 34


(DGCA 1-Jan-2022)





**AIRPORTS** 201

-  Domestic 140
-  Custom 10
-  International 28
-  Defense 23


(Airports Authority OF India 2019-2020)







**AIRCRAFT FLEET** 1282

- Aircraft**
  -  Scheduled Operation 728
  -  General aviation 138
  -  Flight schools 219
- Helicopters**
  -  Scheduled 3
  -  General aviation 175
- Gliders** 8
- Balloons** 11


(DGCA 1-Jan-2022)







**PERSONNEL** 57246

-  Pilots 7230
-  Flight Attendants 12,619
-  Aircraft maintenance engineers 4219
-  Others 33,178

(Airports Authority OF India 2019-2020)



**BIGGEST OPERATOR (By Fleet)**

<b>Scheduled Airline</b>	 Indigo	281	<b>Corporate (Jet)</b>	 VSR aviation	9
<b>Corporate (Helicopter)</b>	 Pawan Hans	41	<b>Flight School</b>	 IGRUA	18

(DGCA 1-Jan-2022)



## MOST POPULAR



**Commercial Jet**

Airbus A320 Family

455



**Helicopter**

Bell 412

21



**Corporate Jet**

Dassault Falcon 2000

15



**Training Aircraft**

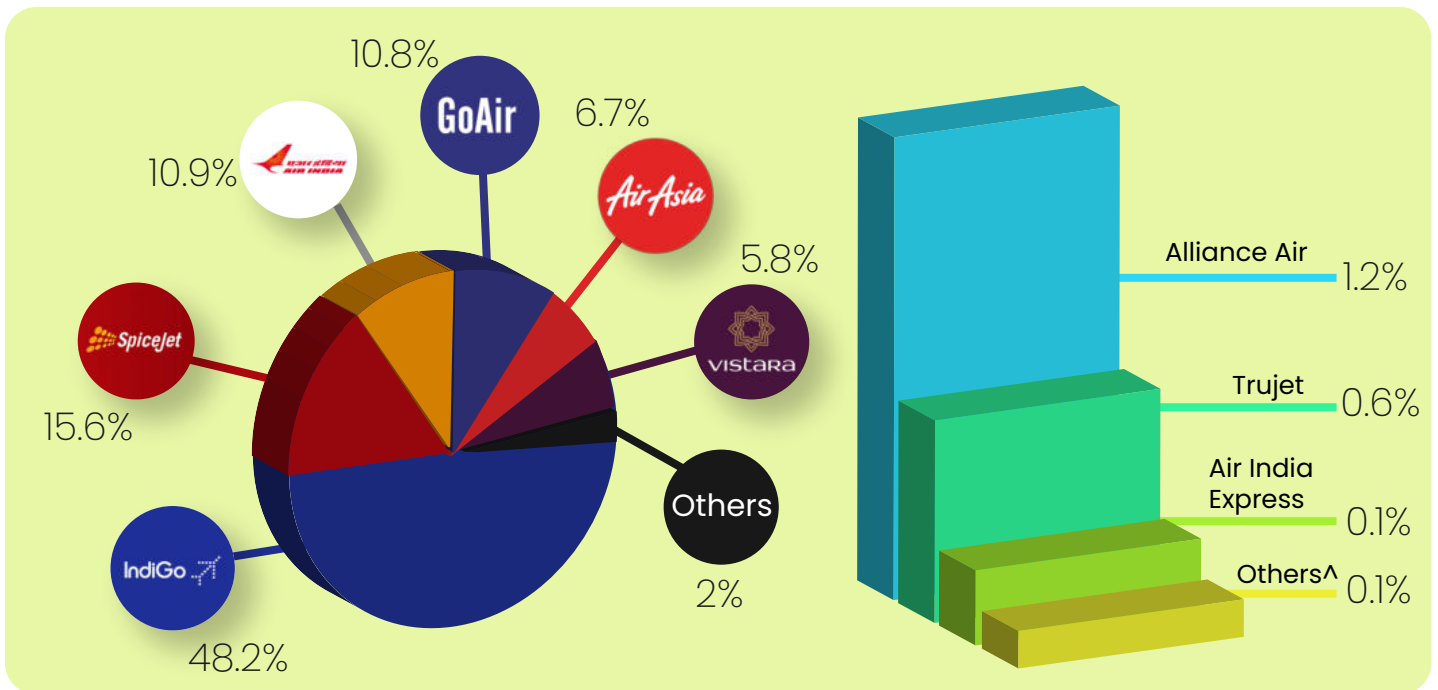
Cessna C172

90

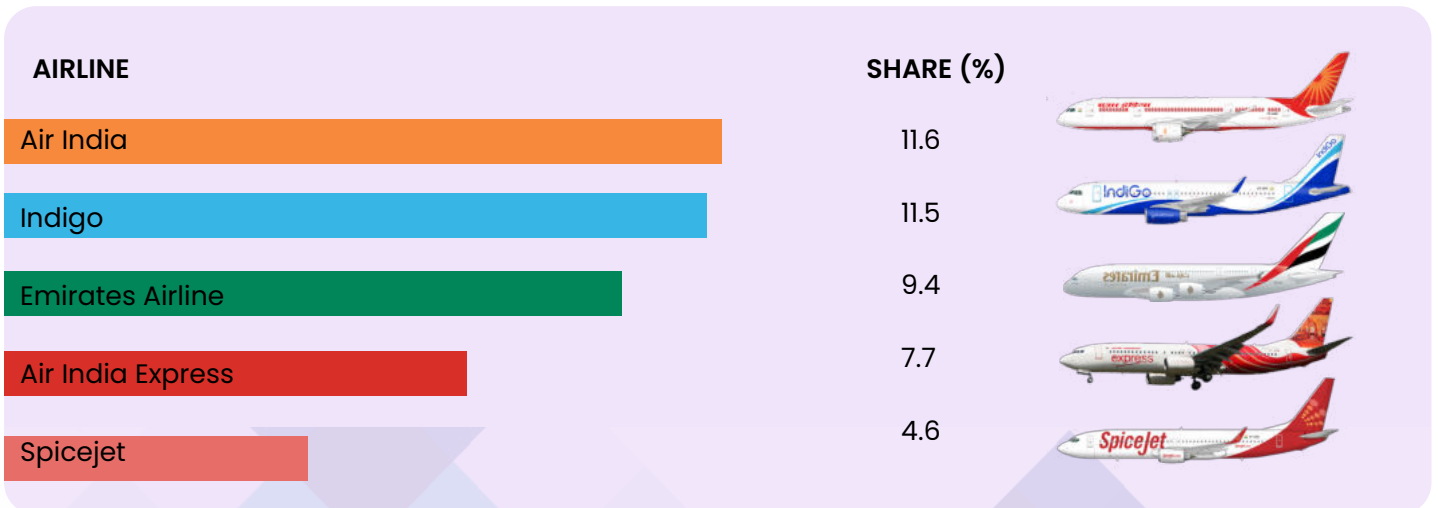


(DGCA 1-Jan-2022)

## Domestic market share (%) in terms of passengers carried 2019-20



## Market share (%) of top 5 scheduled operators- International Operations 2019-20



# TRANSPONDER Landing System



Capt. Anshul Sharma  
Flight Inspection Unit,  
Airports Authority of India

As a crew of the Flight Inspection Unit of the Airports Authority of India, our task involves undertaking commissioning, calibration and trials of the various Navigation Aids at airports across India and in the neighbouring countries. During one such exercise, we recently undertook trials of the Transponder Landing System (TLS) at Safdarjung Airport, New Delhi. TLS is quite an interesting system, not many of us have read about. In the succeeding paragraphs, I have briefly explained the system.

The Transponder Landing System is developed by Advanced Navigation and Positioning Corp. Though the system was conceptualised in the mid 90s, it has been under regular upgradation and development to further improve and enhance its functioning. TLS is an all-weather, precision landing system that uses existing airborne transponder and Instrument Landing System (ILS) equipment to create a precision approach at a location where an ILS would normally not be available.

A Conventional ILS system broadcasts using a number of "single purpose" antennas. One, located just off the end of the runway, provides a fan-shaped signal for azimuth direction (side to side) and another located beside the runway provides elevation to indicate a standard glideslope.

However, there are only a few components in the TLS system. The most visible are four units mounted in a 50 meter radius alongside the runway.

There is a base station unit, a Calibration/Built-in-Test (BIT) unit that monitors station accuracy and integrity, and two angles of arrival antennas.



*TLS electronics shelter, elevation sensor and uplink antennas*

# 100 KNOTS

The localizer and glideslope angle of arrival (AOA) sensors are used to define the flightpath from the transponder system as it nears the runway. A central processor in the base station computes the aircraft position in three dimensions, calculates where it should be in relation to the approach, and transmits corrections to the aircraft over the localizer and glideslope transmitter. The TLS complies with ICAO standards and recommended practices (SARPS) for ILS, secondary surveillance (SSR) and precision approach radar (PAR). TLS performance meets all FAA and ICAO Annex 10 requirements for a Category I approach in terms of Accuracy, Integrity and Reliability.

The TLS detects all aircraft within the service volume by interrogating Mode-A/C /S/IFF transponders. Once the ATC clears an aircraft for TLS approach, the pilot must tune and identify the TLS localizer frequency as they would with a traditional ILS. TLS broadcasts RF signals to the aircraft ILS equipment to provide Category I approach. The pilot training and airborne equipment required for TLS approaches are identical to that for traditional ILS or precision approach radar. Any aircraft equipped with an ILS localizer and glide slope receiver, Horizontal Situation Indicator (HSI) or Course Deviation Indicator (CDI), and a Mode 3/A or Mode S compatible transponder can fly a TLS approach. The guidance is presented to the pilot just as it would be for an ILS approach.

**Functioning:** The key to TLS technology is a compact footprint of an SSR interrogator and ground-based sensors that track an aircraft's location in range, azimuth (horizontal position), and elevation (vertical position) with very high accuracy. The range and azimuth for the surveillance tracks are computed using multilateration techniques on the arrival time of synchronous replies from the aircraft's radar beacon transponder. The elevation information for the surveillance targets uses the transponder Mode C reply. When an aircraft cleared for the TLS approach enters the approach volume, the system uses differential phase measurements on the transponder reply's carrier signal. These phase measurements are used to generate very precise azimuth and elevation positions of the target. The TLS then computes the aircraft's offset from the programmed approach path and generates the ILS correction for this offset. The TLS UHF/VHF guidance transmitters then broadcast this emulated ILS signal throughout the guidance volume. The guidance appears to the pilot as needle movements on the ILS course deviation

indicator in the cockpit that are identical to an ILS and can be flown by the cleared aircraft down to the minimum descent altitude. The aircraft position can also be displayed on ground console with a format matching a Precision Approach Radar display for use in Ground Controlled Approach operations. For Ground Controlled Approach (GCA) operations, the TLS provides controllers with secondary radar display of area aircraft traffic. For landing multiple aircraft using precision approach radar consoles, up to four individual PAR consoles can be used for controllers to work independently guiding up to four aircraft simultaneously.

## Key differences as Compared to an ILS.

First, the approach profile for TLS is not a function of alignment between the approach path and antennas like a traditional ILS that radiates the signal without tracking the aircraft position. The approach path is configured using virtual point technology, meaning the localiser and glideslope aiming points are mathematical points programmed into the site's TLS configuration. The TLS can inherently support offset and non-linear approach procedures where a straight-in approach is not feasible due to noise abatement or obstacle clearance issues. Virtual point technology also allows the TLS to provide localiser signal that complies with ICAO tolerances regardless of the runway length or obstacles at the end of the runway. Second, while a traditional ILS signal to an aircraft is impacted by multipath due to buildings and the surrounding terrain, for the TLS, it is the aircraft's transponder replies that are affected by multipath. ANPC has developed multipath mitigation with antenna selection and signal processing. Additionally, the TLS tracking algorithms smooths the received measurements. Included in these mitigation techniques, is a site-specific calibration process that models the multipath received at each sensor array. Third, though the TLS provides a signal that is identical to an ILS, it does so with equipment siting that is more compact than an ILS. This may enable many airports to have a precision ILS approaches which would otherwise not be feasible with the traditional ILS equipment.

# TLS over ILS

## ADVANTAGES

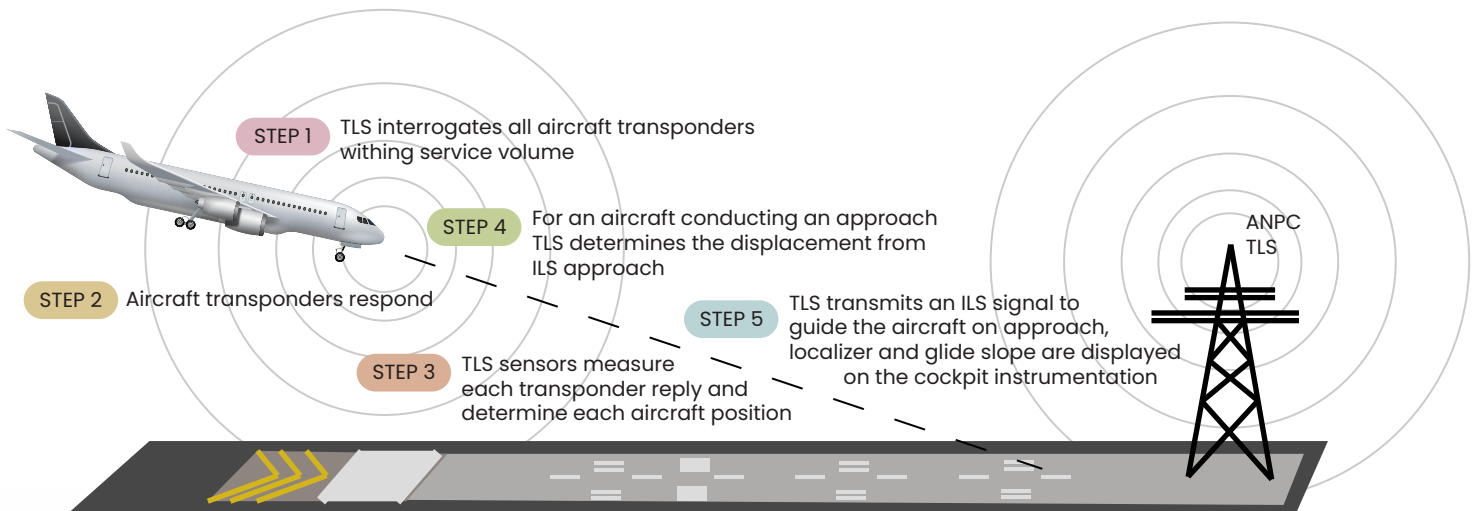
- Works over any terrain using directional antennas.
- The Localiser can be aligned even on short runways ending at water / obstruction.
- It has multiple approach options including offset and selectable glide slope.
- No false glide slope above 3. degrees that is possible with ILS
- No false localizer capture off angle that is possible with ILS.
- Works with any runway length and terrain around runway.
- Provides terminal area surveillance
- Has PAR as a backup to recover aircraft with malfunctioning ILS receiver or no ILS receiver.

## DRAWBACKS

- Simulates an ILS signal that is specific to one aircraft's location on a given ILS frequency.
- Provides guidance to only four aircraft simultaneously on discrete frequencies.
- Only those aircraft cleared for a TLS approach will receive proper guidance.
- Other aircraft that erroneously tune to a TLS frequency without proper clearance will not receive correct guidance.
- TLS requires a human operator to acquire the aircraft at the system display console and instruct the system to provide guidance based on its transponder code.

## Latest Development

Trials were recently conducted for an Unmanned Aerial System (UAS) or Unmanned Aerial Vehicle (UAV) to operate and navigate in an environment devoid of a Global Navigation Satellite System (GNSS) such as the Global Positioning System (GPS). Trials were undertaken by interrogating an aviation transponder (either mode C or S) that is carried by the UAS and measuring the time elapsed for the response to multiple, ground-based antennas and using triangulation (multilateration) to locate the transponder and by association, the UAS. The ground-based system then routed this position information back to the UAS via the UAS's data telemetry link. The autopilot utilised this position information for navigation in the same way it would utilise a GPS-based position report. These trials successfully demonstrated that the TLS system is capable of guiding a UAS through a series of waypoints in the absence of GPS signals. The serviced area for a TLS system may extend up to 100 Nautical miles.







The Transponder Landing System offers many advantages and can provide landing guidance at places which cannot be served by the traditional Instrument Landing System. The TLS has been successfully used by helicopters to make approaches to an Oil rig/ Heliports where visual approaches in below VMC conditions have often resulted in accidents. The TLS may also be effectively used to provide an offset and non-linear precision approach in hilly terrain where CFIT has resulted in numerous accidents.

## About the Author

Capt Anshul Sharma is an Ex-Indian Naval pilot with experience of flying different type of aircraft across the world. A well experienced Flying Instructor involved in training a large number of trainee pilots of Indian Navy and Indian Air Force on varied types of aircraft. He has been a DGCA approved Designated Examiner (DE) on DO 228 since 2014. Capt Anshul has had the distinction of commanding two frontline Naval Squadron in India and Mauritius. For promoting safe flying practices in Mauritius and contributing significantly to the aviation fraternity, he was honoured with the Fellowship of the Aeronautical society of Mauritius. Capt Anshul is presently employed with the Flight Inspection Unit of the Airports Authority of India.

*Romancing Iceland*  
An Ode to the Land of Midnight Sun





**Barkha Chellani**  
**Kaustubh Gautam**  
Airline Pilots

Captain Kaustubh is a senior A320 captain while Captain Barkha is an experienced senior first officer A320 both with Indigo. Kaustubh and Barkha first met at their flying school when they were just starting out to pursue what they intended to do forever, to fly. That was 11 years ago and fortunately enough they fell in love. Their profound and unequivocal love for travelling only grew as they visited all these new places!



## 100 KNOTS

Kaustubh and I did not say much as we loaded our luggage into a rental car at Keflavik airport. We had just landed in Iceland and were silenced by the stunning landscape.

A little about ourselves: Kaustubh and I had met as cadet pilots in the year 2011. Our story evolved as friends to lovers fueled by a common passion towards flying airplanes, travel and food. Today we serve as commercial pilots in a leading airline, also are happily married to each other :)

We were to be married in the winters of 2019 and before we tied the knot of holy matrimony, we planned ourselves for 9 days of journey across the Nordic Island in the Icelandic summer in May,2019. Iceland aka the "Land of the Midnight Sun" aka "the

land of Fire and Ice" had been on our bucket list for almost a decade. The land of many colors, a dynamic canvas, dramatic landscapes, volcanoes, grand glaciers, crystal beaches, waterfalls and the unbelievable Geysers, you name it and Iceland has the works!

We landed at the Keflavik airport and rented ourselves a 4x4 Kia Sportage. When renting a car in Iceland its highly recommended to get a 4x4 sturdy vehicle and invest in a good insurance that includes snow, ash and gravel damages. Iceland is known for its notorious winds, unpredictable extreme weather and national highways covered in gravel. Camper vans are a good option too, since Iceland offers safe and extremely picturesque camping spots.



# PLACES TO VISIT



## Golden Circle

This 300 km route when covered in the clockwise direction covers 3 major attractions and takes about 4 hours by car



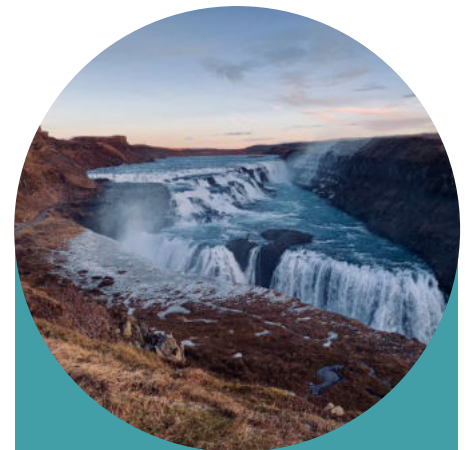
**Thingvellir national park**

It is the site of the ancient Icelandic parliament. The tectonic plates of North America and Europe meet at this national park and the rift is clearly visible. How cool is that! You can also spot this nature's wonder in the TV series Game of Thrones.



**The Great Geysir**

The eruption of the geysir can hurl boiling water of 80 to 100 degree Celsius up to a height of 70 meter in the air. Oh! they are truly a marvel to watch and will make you skip a heartbeat just like the sight of



**The Gullfoss waterfall**

Its grandeur is unmatched and I fall short of adjectives to describe its beauty. On many days the waterfall skirts the skies above with multiple rainbows which is a sight to behold.

## Reynisfjara Beach "The Black Sand Beach"

Among the several volcanic lavas spread beaches, this one stands out with the presence of stunning basalt columns, towering cliffs, caves and lava formation. These unique formations artfully created by nature have battled the powerful tides of the ocean since ages and continue to stand tall in all their glory.

Legend has it that these intriguing basalt columns were actually two Icelandic trolls who tried to drag a ship from the ocean to the beach before dawn. However, before they could do so daylight broke and these trolls were cursed to turn into stones.



## Solheimasandur Plane Wreck

It had been something which we had waited for long to visit and it was indeed worth the wait.

The story behind it is: "In 1973 a United States Navy DC plane ran out of fuel and crashed on the black beach at solheimasandur, in the south coast of Iceland. Fortunately, everyone in the plane survived. The remains are still on the sand very close to the sea and to date stands as a symbol of survival and optimism in general aviation. The scenery of this abandoned plane on a totally black sand is surreal and the landscape is astounding too. Being pilots ourselves we were supremely enthusiastic to visit the site.



## Sejalandsfoss Waterfall

This waterfall is along the Iceland's southern coast and is fed by melting water from the famed glacier capped Eyjafjallajökull volcano, yes! the same one that shut down half the world's airspace in 2010. This powerful waterfall cascades into a pretty meadow. However, the path that runs behind the curtain of water is the main attraction. One can truly enjoy a unique viewpoint of the waterfall.

Like everything else in Iceland, there is a folktale about this waterfall. "About one thousand years ago, there was a Viking adventurer, Prasi Porolfsson. He was one of the first few people to settle in the area. Throughout his life time, he had amassed a great store of gold, which he never did anything with. when he knew, he was going to die, he hid the gold in a chest behind the waterfall. No one was able to ever find the gold".





## Floating icebergs of Jokulsarlon

It is one of Iceland's most visited landmarks and highlight of an Icelandic Road trip. One can easily get transfixed while watching the floating icebergs as they break away from the massive glacier and move on their own. Apart from sightseeing there are many activities to do depending on which season one visits and weather conditions.

We chose to indulge in a few activities like Ice cave hiking and exploring inside of the lava tubes.



## Blue Lagoon

This is a favorite amongst both luxury and economic travelers. It is a geothermal spa which gets its water from the nearby Svartsengi geothermal power plant. It is rich in natural salts and minerals which bathers can rub on.

# 100 KNOTS

## FOOD

There are many eateries in the capital city but I will list some of the best ones here.

1. Tommi's burger joint, which is a must try when in Iceland. Restaurateur Tommi Thomasson is the man who brought burger to Iceland and started the burger joint chain, rest is history.

2. Another gem goes by the name of "Kaafi cruz". It serves the most delicious raspberry cheesecake, woodfired pizzas and piping hot coffee to enlist a few.

3. A paradise for coffee lovers in this Nordic Island is Reykjavik Roaster. They serve some specialty in house brewed coffee which will kick in caffeine in your veins for the road trip



## COST

One should be well prepared with the money that Iceland makes you spend. 8 to 10 days are good enough to explore and relax at the island. An average trip cost for 10 days exclusive of flight tickets could be 150000/- INR to 200000/- per person. Although summers are a good time to visit Iceland, costs could be lower if one is visiting Iceland in the winter months. In winters Iceland flaunts clear blue skies, major chance to casually spot the Northern lights, a canvas covered in frozen waterfalls; one can also indulge in activities like ice fishing, skiing and snowmobiling. It is truly a winter wonderland, also lesser tourists to crowd!

## ACCOMODATION

In Iceland, the weather is the biggest character you deal with every day. It could rain or shine or pull up a storm in the blink of an eye. The avenger to this situation is always a jacket, one that is waterproof, snow proof, wind proof...everything proof so could let your spirits and enjoy Iceland. Layering with jeans, warmers, knitwear, cotton t-shirts could be easily done if one has good pair of shoes and a bomb of jacket.

Accommodations and food in Iceland can be quite expensive. Iceland is mainly mountainous, means little land is available for human habitation and farming. On top of that there is harsh winters leading to unfavorable farming conditions. Iceland also has one of the highest taxes in the world. We stayed in a variety of places but most memorable would be at the local Icelandic Horse Farm, watching the panoramic views of the glaciers around, spell bound!





*"Because to travel is to live,  
you will reach your destination  
even if you travel slowly!"*

**ALL YOU NEED TO KNOW**

- Schengen
- Icelandic
- Icelandic Krona
- 322,000 (Oct 2013)
- Lutheran (80.7%)
- 103,000 km<sup>2</sup>
- UTC
- 354

**WEATHER**

- Cold -3°C to 2°C
- Hot 8°C to 14°C

**WHEN TO TRAVEL**

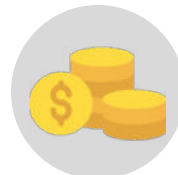
- Warmest June-August
- Northern Lights September-January
- Midnight Sun June

**INTERESTING FACTS**

- There are 130 volcanoes in Iceland, 18 have erupted since the settlement of Iceland 1100 years ago
- Iceland is the cleanest country in the world and has purest water
- Iceland is one of the safest places in the world, so there is least chance of getting robbed or harassed



Some Icelanders believe in the hidden people called huldafólk and a few claim to have seen them.



Tipping is not expected in Iceland



Iceland is one of only a few countries that still allows whale hunting

# Managing Exposure to Cosmic Radiation



**Sakshi Shreya**  
Legal Associate  
(Aviation)

Radiation is the transfer of energy from a source. It may be in the form of electromagnetic radiation such as x-rays and gamma rays or in the form of particles such as neutrons and protons.

Cosmic radiation is the collective term given to the radiation that comes from the Sun (solar radiation) and from the galaxies (galactic radiation).

Galactic radiation accounts for 90% of total radiation received by earth. It originates from exploding supernovas (exploding stars) and hence always present irrespective of day or night.

Solar radiation is a result of disturbance in the sun's atmosphere. "Solar particle events" or "solar flares" leads to exceptionally high numbers of charged

particles ejected from the sun and, depending on direction of travel, may collide with the Earth. These solar particle events occur on average about once a year and result in a sudden increase in radiation levels for a brief period of time (hours or days). Avoiding exposure to solar particle events is difficult because they often happen with little warning.

## Measuring Cosmic radiation

The unit for measuring radiation is the sievert, which is a measure of potential harm from ionizing radiation.

1 sievert = 1000 milli sieverts  
1 milli sievert = 1000 micro sieverts

\* The rem is another unit used to express potential harm from ionizing radiation. 100 rem = 1 sievert

## Cosmic radiation and Aviation

Earth's atmosphere is very well shielded by its magnetic field and cosmic radiation particles being electrically charged are mostly deflected back to space with very little radiation reaches earth's surface. This shielding however, is weaker at higher Latitudes and Altitudes. It is for this reason that doses of cosmic radiation increase significantly when we fly higher and towards the magnetic poles.

# 100 KNOTS

As airlines are flying longer distances and connecting far-flung cities, the practice of using polar routes to save time and fuel has gained prominence. This means airplanes are flying longer, higher and closer to the poles, resulting in greater exposure to cosmic radiation by aircrew and passengers.

## The worrying recent trend

The five-year study by the IRSN found that while the number of crew receiving annual exposure above a specific safety limit remains relatively tiny, the proportion doubled between 2016 and 2019.

The institute studied exposure of an average of 22,000 crew members working for unnamed carriers. Their total annual dose rose 38% between 2015 and 2019, and the average individual doses increased steadily.

Before 2015, most of the 100 employees receiving the highest annual doses were cabin crew, but by 2019 there was an equal split with pilots, who tend to specialize in one type of plane and route.

## Airline crew vulnerability

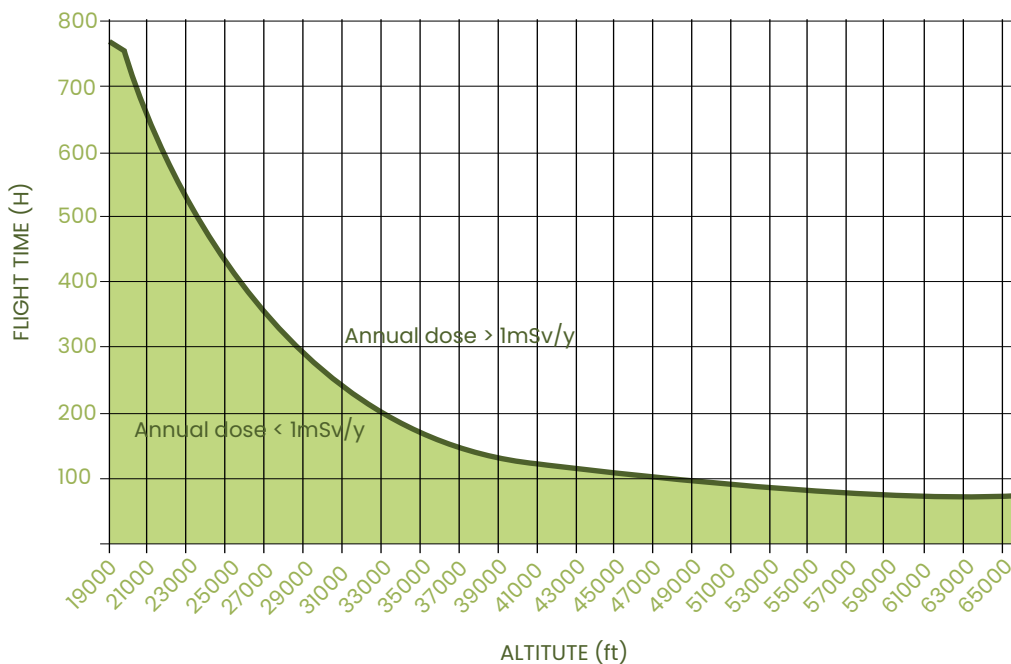
Commercial airline crew are placed second most vulnerable worker category to radiation exposure after people making nuclear fuel.

According to the Institut de Radioprotection et de Surete Nucleaire (IRSN), exposure to these cosmic rays is about 150 times more potent at FL 330 and above, compared to sea level, and is two or three times higher at the poles than the equator.

The IRSN study found that 96 crew members had exposure of between 5 to 10 mSv in 2019. \* A CT scan of someone's head equates to about 2 mSv.

The National Council on Radiation Protection and Measurements reported that aircrew have the largest average annual effective dose (3.07 mSv) of all US radiation exposed workers. One other estimate of annual aircrew cosmic radiation exposure ranges from 0.2 to 5 mSv per year.

## ESTIMATION OF AIRCREW COSMIC RADIATION EXPOSURE



Curve representing the 1 mSv threshold for identifying aircrew who may require further dose assessment based on number of flight hours and cruising altitude

National Institute of Occupational Safety and Health (NIOSH) has also estimated that pilots will fly through about 6 solar particle events in an average 28-year career.

## Are all crew members affected?

Not really! It depends a lot on your area and type of operation. More than three-quarters of the pilots and flight attendants who received an annual dose of more than 5 mSv were flying wide-body planes on long-haul routes to North America and Asia.

## Regulations

The International Commission on Radiological Protection (ICRP) recommend effective dose limits of maximum 20 mSv/year averaged over 5 years (that is, a total of 100 mSv in 5 years. For pregnant radiation workers, the ICRP recommends a dose limit of 1 mSv throughout pregnancy and a 0.5 mSv monthly radiation limit. Most regulators require assessment of aircrew exposure when it is likely to be more than 1 mSv /year, and adjustment of work schedules so that no individual exceeds 6 mSv/year.

## Effects on human body and life

Cosmic radiation is ionizing in nature, that means, it can displace charged particles from atoms. According to the World Health Organization (WHO) International Agency for Research on Cancer (IARC), this can lead to the disruption of molecules in all living cells causing cancer and reproductive problems in humans. For flight attendants, a NIOSH study found that exposure to 0.36 mSv or more of cosmic radiation in the first trimester may be linked to increased risk of miscarriage. This exposure can get much higher if she flies through a solar particle event. Crewmembers receiving 68 mSv will, on average, incur an increased lifetime risk of fatal cancer of about 1 in 360. Genetic defects can also be passed on to future generations.

## Effective management of exposure to cosmic radiation

· Reduce: Try to reduce your time working on very long flights, flights at high latitudes, or flights that route over the poles.

· Pregnancy: If you are pregnant or planning a pregnancy, it is important to consider your cosmic radiation exposure. If you are pregnant and aware of an ongoing solar particle event when you are scheduled to fly you must inform your airline. Be advised DGCA prohibits pregnant crew members from taking flying duties.

· Keep a track: Ask your airline to provide you with annual exposure log. DGCA mandates affected airlines to maintain a radiation exposure record and inform the aircrew about their radiation exposure and associated health risks and assist them in making informed decisions with regard to their work environment.

· Do it yourself: You can also calculate your usual cosmic radiation exposures through FAA's CARI 6M program. This website allows you to

enter information to estimate your effective dose from galactic cosmic radiation (not solar particle events) for a flight.

## Data on active events

· A Solar Radiation Alert system has been developed that considerably reduces the risk to air travelers of being exposed to excessive amounts of ionizing radiation following a severe solar disturbance. <http://www.cami.jccbi.gov/radiation.html>

· The National Aeronautics and Space Administration (NASA) Nowcast of Atmospheric Ionizing Radiation System (NAIRAS) is being developed to report potentially harmful flight radiation levels to flight crews and passengers. This tool provides the current radiation dose rate forecast

· The National Oceanic and Atmospheric Administration (NOAA) Space Weather Prediction Center's Aviation Community Dashboard provides a forecast for solar particle events.

## Myths about cosmic radiation

The Aurora Borealis and Aurora Australis (northern and southern lights) are colorful displays resulting from interaction of charged particles with air in the upper atmosphere. Such displays are not an indication of increased ionizing radiation levels at flight altitudes and do not present a hazard to air travelers.

## About the Author

Sakshi Shreya is a legal associate with expertise in aviation litigation. Her clientele includes major Indian operators. She has authored books on Aviation Leasing and Finance. Her works are published under various National and International journals. Her profound interest in law and passion for travel led her to develop an anomalous interest in Aviation law. She is also the Co-Founder of 100 Knots.

# Planespotting At Mumbai

No matter how normal aviation gets, it still amazes people how a giant metal tube can just cut through the air so smoothly. Thanks to planespotter's lens, this huge community of admirers can truly appreciate the beauty of these engineering marvels. Worldwide planespotting is a popular hobby and a very successful career for some. Infact, most airlines and aircraft manufacturers have a full time photographer at their disposal to document events and development.

Majority of photographers aim for careers in commercial or cinema, but once in a while, you come across people whose cameras have a liking for something different. One such personality is Mumbai based, Utkarsh Thakkar popularly known as "vimanspotter". Utkarsh is a featured photographer who has mastered the complex art of aviation photography and produced some stunning results. What got him here? Let's hear it in his own words.

## My Motivation

Ever since I was a little boy, I would love staring out of the window to marvel at the planes. Be it the class room window at school or my residence, I would spend hours watching airplanes take-off and land thus, fuelling my passion for aircraft. Back in 2002 I took my first international flight to Muscat in Gulf air and from that day my liking for aircraft started growing. After that trip I always used to tell my father to take me to the airport to see airplanes, for me time just flew by gazing at those beauties flying in the sky. As I got older, my passion for airplanes and the aviation industry only grew, and with that I started Plane-spotting. To pursue my passion further in 2015, I made an Instagram account dedicated to the airplane and travel under the name of Vimanspotter. It's been 6 years since I began, and my years of experience in handling my social media page coupled with my passion and love for aviation gave me a lot of opportunities to work in the aviation industry.



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## My tools

I use Nikon D5600, GoPro Hero 5, iPhone X.

Many people believe that plane spotting demands a large camera setup. But there's nothing stopping you from starting plane spotting with your smartphone camera. I, too, began my plane spotting with a phone camera. Taking images and videos with a phone has gotten more easier than with a DSLR in the age of Instagram reels and stories where content need to go fast. When I travel, I use my iPhone X or my GoPro 5 to take the majority of my images and videos. I use a my Nikon D5600 DSLR with a 70-300mm lens for planespotting from outside airport, and a DSLR with an 18-55mm lens for in-flight shooting.



## Favourite Airline

Singapore Airlines is my favourite airline. I've flown with them a few times, and believe me when I say that flying with them is never disappointing. Many airlines are capable of providing excellent service, but to get the correct level of consistency, discipline, which is where Singapore Airlines excels and what distinguishes Singapore Airlines. Even if you fly economy class, Singapore Airlines offers a fantastic dining experience. Their food is really quite tasty. In their IFE, they provide a good selection of Bollywood movies. The seat is really comfy, with plenty of legroom.

My favourite airline in India is Vistara, which has the Singapore Airlines DNA in terms of crew discipline and service. I personally like their interior product selection, particularly the mood lighting, which is a simple feature that makes a significant impact in your journey. Even their menu choices used to be amazing, but after COVID, I've heard a lot of complaints about it, so I'm hoping they'll improve it soon. If you enjoy coffee, do you prefer Starbucks in particular? Then you should surely fly with them in premium economy or business class to enjoy a cup of Starbucks at an altitude of over 30000 feet, which will revitalise you once you get at your destination.



## Dream

To fly in cockpit jump seat and travel once in all commercial aircraft.

100 KNOTS



See my work

Instagram @vimanspotter  
(<https://www.instagram.com/vimanspotter/>)







## Fighting Climate change

# Contrail Prevention



Preet Palash  
Editor

Climate change if unmitigated, presents a significant challenge to international aviation due to the anticipated growth in the aviation sector, the potential energy demand and carbon emission associated with that growth. In 2010, international aviation consumed approximately 142 million metric tonnes of fuel. Until 2040, fuel consumption is only expected to increase by 2.8 to 3.9 times, despite an expected increase in international air traffic by a factor of 4.2 over the same period.

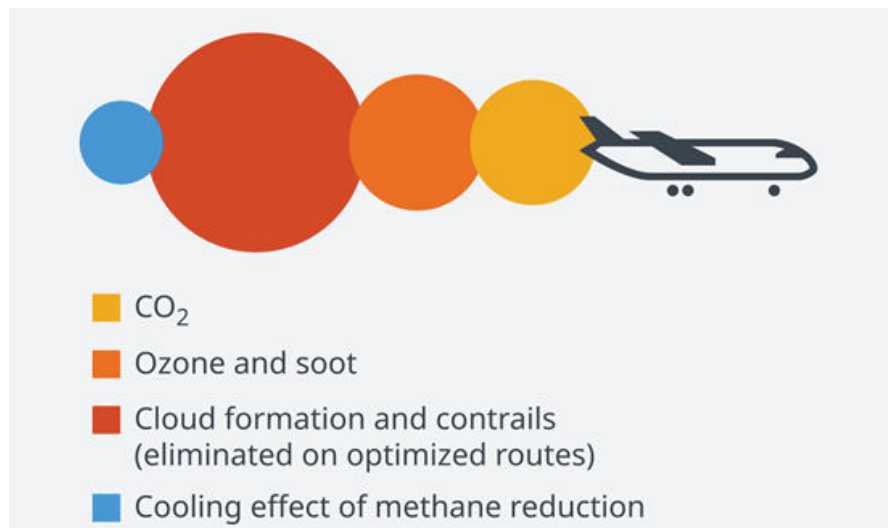
Contrary to the popular belief, aviation fuel burn is a big contributor towards global warming. Recent research shows that contrails formed by aircraft at cruise levels, generate 59% of aviation's climate impact, versus 32% arising from direct CO2 engine

emissions. Moreover, data suggests that future net-zero emission engines and fuels may exacerbate contrail formation as a result of higher water emissions.

Mitigation strategies have been suggested that potentially have technological or operational tradeoffs, whereby non-CO2 impacts might be reduced, but at the expense of additional CO2 emissions. Weighing the costs and benefits of these trade-offs is complex, involving both uncertainties in the non-CO2 impacts and the choice and usage of metrics to compare the impacts.

### What are contrails ?

A contrail is an aircraft condensation trail that appears as line-shaped clouds in the sky. They are composed of ice particles that form in the exhaust of an aircraft when flying in a narrow range of altitudes in the upper atmosphere, several miles above the ground. Contrails can form within a few wingspans of the aircraft behind the exhaust and can dissipate within a few aircraft lengths from the engine exhaust because of the lack of available water vapor in the atmosphere.



'Data suggests that future net-zero emission engines and fuels may exacerbate contrail formation as a result of higher water emissions.'

The formation of contrail ice particles starts at microscopic scales when extremely small soot or other particles form in the aircraft combustion exhaust through a process in which a few tens to hundreds of molecules come together and grow to larger sizes by sticking together. Further growth may occur by condensation of water vapor present in exhaust gases on the particle surfaces made up of compounds such as sulfates and nitrates. Subsequent growth of particles happens due to ambient relative humidity that exceeds 100%.

Frequently, because of mixing due to turbulence in the upper atmosphere, the jets broaden vertically and horizontally. The horizontal broadening can at times cover a large portion of the sky depending on the amount of water vapor available in the atmosphere at cruise altitudes, resulting in contrail-induced cirrus clouds. These can persist for much longer times - typically several hours, similar to ordinary cirrus clouds that are also composed of ice particles.

"Effects of the trapped energy far exceeds benefits of the reflected incoming solar radiation". Scientists have been looking for links between contrails and climate since the 1970s.

These high clouds reflect sunlight back into space, which has a cooling effect. But they also act like a thermal blanket. That holds heat in the atmosphere. At night, this has a warming effect on the atmosphere. The effect of the trapped energy far exceeds benefits of the reflected incoming solar radiation. By avoiding ice-supersaturated regions (ISSRs) in the atmosphere, aircraft can reduce the likelihood of forming these persistent contrails.

"Altering cruise altitude, Fleet replacement, Sustainable Aviation Fuel"

Leading scientists and meteorologists believe that ideal conditions for contrail formation can be thermodynamically predicted from temperature, water vapour emission, pressure and the overall efficiency of the aircraft. Almost all the research studies as of now has been concentrated on simple parametric operational changes, e.g. changing the overall global fleet cruise altitudes.

## Solar geoengineering

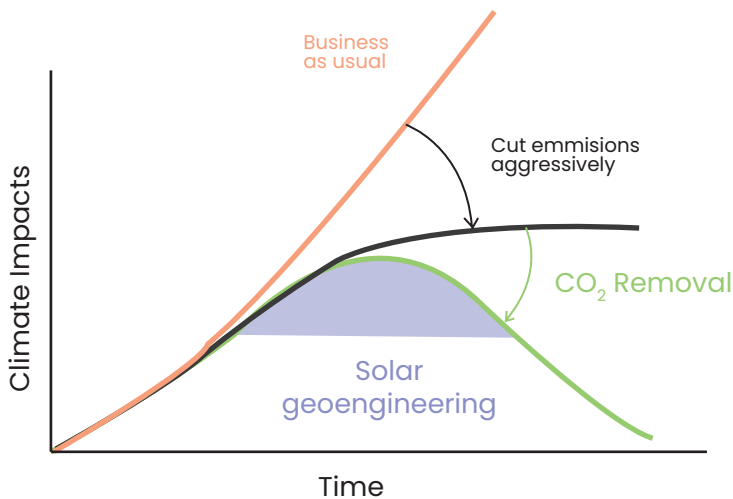
Strategy of altering flight altitudes could potentially go one step further; contrails have far greater regional effects than those expected from global mean values, which could potentially aid mitigation efforts by avoiding flights in regions where contrails warm the Earth and increasing them in regions where contrails cool it.

There have also been numerous design-based strategies to mitigate contrails, but they tend to share one characteristic: the need to overhaul current aircraft in lieu of the more climate-friendly designs. However a complete replacement of current fleet in near future sounds too ambitious considering large lifespan of jet aircraft. Nevertheless it could be a good long term solution, interim solutions which can use the current infrastructure would still be needed.

The adoption of Sustainable aviation fuel (SAF) in geographical areas associated with the formation of persistent contrails and contrail cirrus could significantly mitigate the climatic impact of contrails, seeing as the simulations using SAF instead of conventional aviation fuel in these areas lead to the formation of much thinner contrail cirrus with lifetimes of several hours less. Soot particle emissions necessary for cloud formation could be up to over 50% lower for the HEFA-C blend when compared to a Jet A fuel with medium sulphur content.

	Approach	% Flights Diverted	% Change In Contrail EF	% Change In Fuel Burn	% Change In Total EF
1	Small Scale Diversion	1.7%	-59%	+0.014%	-36%
2	Cleaner Engines	0	-69%	0*	-42%
1+2	Diversion+ Cleaner Engines	2%	-92%	+0.027%	-57%

\*Assuming no change to fuel efficiency for cleaner engines.



A live trial - One promising mitigation option is alternative aircraft routing by optimizing aircraft trajectories by operationally adapting flight altitudes. EUROCONTROL's Maastricht Upper Area Control (MUAC) has recently concluded ground-breaking live contrail prevention trials with DLR, the German Aerospace Centre (DLR). This contrail prevention trial was the first of its kind in the world, and investigated the operational feasibility of contrail prevention by ATC and measure its impact.

The trial is assessed how to avoid warming persistent contrails with eco-efficient flight trajectories in live operations. MUAC examined relatively minor operational measures such as small flight level changes, for example diverting aircraft 2,000 feet up or down from their normal flight path, to reduce persistent contrail formation and contrail cirrus. The findings of these trials is expected to help fight aviation's climate change impact in a very practical way.

Still far from home - With promising new research push on operational and technological possibilities to reduce contrail-cirrus, and new work on emission metrics that focus on comparing short-lived climate forcers with longlived greenhouse gases, better assessments of potential mitigation strategies might be expected in the coming years.

However, the clear message is that mitigation of non-CO2 impacts through contrail prevention tends to raise complex questions regarding both scientific uncertainty and trade-off (with CO2) consequences, whereas reducing CO2 emissions has clear and long-term benefits, and does not suffer from the same levels of scientific uncertainty. Clearly, the answers to 'contrails-induced clouds' questions are not clearly established yet, and require more assessment of the pros and cons.



# Akasa Air

## All We Know



Radhika Bansal  
Journalist

### KEY NOTES

The first aircraft of the Airline will come sometime after the 15th of April. Akasa will need that first aircraft for the completion of the air operators' certification (AOC) process. According to CEO, Vinay Dube, Airline will have a fleet of 20 aircraft by next summer. It will immediately apply for rights to fly abroad on meeting the 0/20 rule (no age bar but having a minimum fleet of 20 planes) and start flying overseas to places like Gulf, SAARC and Southeast Asia as soon as it gets the permission to do so. A final call on onboard WiFi is yet to be taken and the in-sea charge will be "disclosed over time".

Ahead of its summer launch, Akasa Air has started the hiring process for cabin crew, maintenance staff, airport managers and other staff. The new private airliner has also started the hiring process for senior security, security executive positions, Cabin Crews,

Senior Cabin Crews in-flight managers, duty managers and customer service executives while Akasa's head office will be in Mumbai, the airline is in talks with various airport operators to decide its primary hub depending on the availability of check-in counters, parking slots and office space being offered. "Where we see our niche is flying between metros and tier 2/3 cities. That's what we will target initially," Vinay Dube said in a recent interview.

### B737 AIRCRAFT DEAL

During the Dubai Airshow 2021, Akasa Air has placed an order for 72 Boeing 737 MAX on November 16. Valued at nearly \$9 billion at list prices, the order includes two variants from the 737 MAX family, the 737-8 and the high-capacity 737-8-200. The 737 MAX family promises a reduction in fuel use and carbon emissions by at least 14% compared to airplanes it replaces.

Boeing dominates India's wide-body market of 51 planes but fare wars and high costs have led to casualties among full-service carriers (famously Kingfisher Airlines in 2012 and Jet Airways in 2019) making low-cost carriers and Airbus even more dominant.

Boeing's share of India's 570 narrow-body planes fell to 18% from 35% after Jet Airways collapse in 2018, data from consultancy CAPA India shows. Currently, SpiceJet is the only customer for the MAX planes in the country.

## Timeline

January 2021

First media reports of former Jet Airways and Go Air CEO Vinay Dube looking to start a new airline in India. Nikhil Ved, Jet Airways former head of strategy and planning, was onboard by then. Vinay Dube files for a no-objection certificate (NOC) with the aviation ministry. As the government requires project's paid-up capital and board composition, the next step for Vinay Dube was to look for an investor who could provide the necessary capital and hold enough credibility for the government to give the go-ahead.

May 2021

Dube began talking with several investors

June 2021

Rakesh Jhunjhunwala and some NRI investors are on board. Jhunjhunwala's backing brings a huge PR boost for the start-up. In an interview with Bloomberg, Rakesh Jhunjhunwala says considering investing \$35 million for a 40% stake in the airline. "I've got some of the best airline people in the world as my partners," he said.

October 2021

Holding company of Akasa Airline, SNV aviation obtains initial NOC (No-objection certificate) from the Directorate General of Civil Aviation (DGCA). Rakesh Jhunjhunwala along with his wife meets India's Prime Minister, Mr Narendra Modi.

December 2021

Akasa air unveils its brand identity with 'The Rising A' symbol representing the spirit of flying, the aim of height and the pursuit of dreams. The Tagline is 'It's Your Sky' and the airline chooses 'Sunrise Orange' and 'Passionate Purple' colours that reflect warmth and energy

November 2021

Boeing and Akasa Air announces orders for 72 737 MAX airplanes at Dubai Air Show. Akasa Air also announces purchase of CFM LEAP-1B engines to power the Boeing 737 MAX airplanes. The agreement that also includes spare engines and long-term services agreement is valued at nearly \$4.5bn at list price.



### Signing the deal with CFM International

On November 17, Akasa signed an agreement with CFM International for its LEAP-1B engines in a deal valued at nearly \$4.5 billion at list price. The agreement includes spare engines and long-term services, the companies said in a joint statement.

The deal gives Akasa Air a comprehensive maintenance program delivered by CFM. CFM's advanced LEAP engine has logged over 12 million engine flight hours in commercial operation. The LEAP-1B engine entered into service on the Boeing 737 MAX in 2017. Over 600 aircraft have been delivered to some 66 operators worldwide and the fleet has logged more than 2.5 million engine flight hours.

### Destinations

Akasa Air is expected to be based out of Bengaluru International Airport and it plans to have a route network close to the city such as Bengaluru-Mumbai, Bengaluru-Chennai, Bengaluru-Hyderabad among others.

### Business Model

When the news emerged in the beginning, it was mentioned that Akasa is a ULCC or Ultra Low-Cost Carrier. But in a recent Interview, Akasa's CEO Vinay Dube clarified that they have no intention at all of being a ULCC. There's been a bit of misunderstanding in the way it came out initially. He said he wants to crush the rumours of the ULCC model right now so that it's never associated with Akasa.



Akasa wants to be a dependable and affordable airline. And that is their business model. They will have a single type of aircraft, a single category of seats, they are not going to have a business class or a premium economy class, they will have a buy onboard, like others in their category.

## KEY PEOPLE AND INVESTORS



• **Rakesh Jhunjhunwala** – Co-Founder and Investor – Rakesh is an Indian billionaire business magnate, stock trader and investor who is backing the airline with an investment of USD 35 million (INR 260.7 crore) to acquire a 40% stake. He manages his portfolio as a partner in the management of his assets firm, Rare Enterprises.



• **Vinay Dube** – Managing Director, Chief Executive Officer and Co-Founder – Vinay is the former CEO of Jet Airways and owns a 15% stake in the airline. An Indian-American with over three decades of experience, Vinay joined Jet Airways in June 2017 after a decade-long career at Delta Air Lines as their Vice President for the Asia Pacific, American Airlines and Sabre Inc. Vinay resigned from Jet Airways in May 2019, one month after the airline suspended operations. He then joined Wadia Group-controlled Go Air in February 2020 as their chief executive officer but resigned soon after in August, the same year.



• **Aditya Ghosh** – Co-Founder – Aditya is a former president and whole-time director of IndiGo. He will hold less than a 10% stake in the Airline and will be a board member. Ghosh, previously the general counsel for IndiGo, became president from 2008 to 2018 when it grew from a fledgeling airline to the country's biggest carrier by market share. He is also a board member at ethnic fabric and lifestyle retailer Fab India as well as hotel aggregator Oyo Rooms.



• **Siddharth Bhardwaj** – Chief Pilot Fleet – A graduate of Indian School of Business and Embry Riddle Aeronautical university, Siddharth has served multiple management positions in Jet Airways, Rizon Jet, Scoot Air before joining Akasa in October 2021.

• **Floyd Gracious** – Vice president Flight Operations – Floyd is an industry veteran with a 28 year career at Jet Airway. He served multiple management positions in jet airways before joining Akasa Air as Vice president Flight Operations in August 2021. before quitting as its senior vice-president, revenue management and network planning. Post that, he was the chief operating officer at Visa enabler VFS and then the chief commercial officer at GoAir for six months till September 2020.

• **Belson Coutinho** – Chief Marketing & Experience Officer – Belson served as the senior vice president of Jet Airways until 2019 and then joined VFS Global as Chief Marketing Officer till August 2021.

• **Ankur Goel** – Chief Financial Officer – Ankur was IndiGo's former head of treasury and investor relations. He has over 16 years of experience in various fields of finance. He was a core member of the team that led IndiGo's public listing in 2015 raising INR 3,000 crore followed by a Qualified Institutional Placement (QIP) in 2017 for raising around INR 4,000 crore.

• **Neelu Khatri** – Head of Corporate Affairs – Neelu is an industry veteran who held several senior positions at Honeywell Aerospace. As part of the pioneering

group of women officers commissioned into the Indian Air Force, Khatri served for 15 years and obtained the rank of wing commander. During her air force career and after, she worked extensively on various capital and revenue programs with India's Ministry of Defence.

• **Bhavin Joshi** – Senior Vice President (Leasing and Procurement) – Bhavin previously served as the DGM – Strategy and Projects (Office of the CEO) at Jet Airways from 2013 to 2016.



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- **Shammi Tapse** – Chief Pilot Training – Shammi was ex deputy chief pilot fleet at jet airways and worked as a Line Captain at SpiceJet before joining Akasa in Aug 2021. He holds a Post Graduate degree from Embry Riddle Aeronautical university.
- **Pritesh Patil** – Deputy Chief Pilot Fleet – Pritesh started his airline career as a first officer at jet Airways in 2014.
- **Praveen Iyer** – Chief Commercial Officer – He is part of the founding team as Akasa's chief commercial officer. Praveen held several positions at Jet Airways
- **Anand Srinivasan** – Chief Information Officer – Anand is the former Vice President of the revenue management department at GoAir for two years till June 2020.
- **Adam Voss** – Head of Engineering – Adam is an Industry veteran and worked as Executive General Manager Engineering for Fiji Airways from 2012 to 2016,
- **Ajit Bhagchandani** – Vice President Inflight Services – Ajit has previously worked for Kingfisher Airlines, Jet Airways and GoAir in the same position.
- **Airbnb** – Investor – It is an American company that operates an online marketplace for lodging, primarily homestays for vacation rentals, and tourism activities. Based in San Francisco, California, the platform is accessible via the website and mobile app.

Senior Vice President Base Maintenance, Workshops and GSE for Qatar Airways from 2017 to 2018 and Senior Vice President Engineering & Maintenance for Jet Airways from 2018 to 2019.

- **Par Capital Management** – Investor – It has interests in US ULCC Sun Country Airlines. It manages a private investment fund. The firm was founded in 1990 and is located in Boston, Massachusetts.

- **Manav Bhatkuly** – Investor – Manav is the founder of investment fund New Horizon, where he has invested around Rs 6 crore in the upcoming airline. Bhatkuly is known for identifying big companies in their early years. He was among the first institutional investors in many leading companies in India including Sun Pharma, Godrej Consumer, Axis Bank and Apollo Hospitals.

- **Capt NIKHIL VED** – Chief Operating officer and Accountable Manager

Started off in 1995 as a B737 first officer at jet airways, he ascended quickly to the post of Chief Pilot in 2005. He was promoted to Vice President, Flight Operations in 2013 that he maintained until 2019 when jet airways was declared bankrupt. He joined GoAir as Vice President Flight Operations and In-flight Services in 2019 and moved to Akasa Air in Jan 2021. His present status in the airline is unknown.

## About the Author

Radhika Bansal is a journalist with deep interest in Aviation and Tourism. Aircrafts and airport operations have always fascinated her. She has a Master's degree in Journalism and Mass Communication. She keeps track of airline route development, aircraft orders and deliveries.



# RECENT UPDATES

## **Akasa-CFM deal to cut LEAP-1B engine maintenance costs**

Akasa Air announced bulk purchase of CFM LEAP-1B engines to power its Boeing 737 MAX airplanes. The agreement that also includes spare engines and long-term services agreement is valued at nearly \$4.5bn at list price. With this purchase and services agreement, Akasa Air will have from day-1 of its operations an innovative and comprehensive maintenance program delivered by CFM



## **Construction Work of Agartala's new Airport terminal completed**

The new terminal of the airport in Agartala is designed to handle 1,000 domestic and 200 international passengers during peak hours and features 20 check-in counters, six parking bays (all power in & push back), four-passenger boarding bridges, conveyor belts and passenger-friendly modern facilities and amenities like In line baggage system(ILBS), Escalators, Lifts etc



## **Hyderabad Airport Wins National Energy Conservation Award 2021**

Hyderabad Airport has been awarded with Certificate of Merit for the excellent efforts in the areas of energy conservation by Bureau of Energy Efficiency. It was the only airport in the Airport Sector that received this distinct recognition. GHIAL has been at the forefront of adopting energy efficiency practices and has been recognized for the efficient energy management initiatives. Recently it commissioned its second phase 5 MW solar power plant. With this addition of solar power generation, 50 % of the energy requirements of Hyderabad Airport terminal will be met

## **India formalizes acquisition of 56 Airbus C295 aircraft**

Acquisition of these aircraft will replace the Indian Air Force (IAF) legacy AVRO fleet. Under the contractual agreement, Airbus will deliver the first 16 aircraft in 'fly-away' condition from its final assembly line in Seville, Spain. The subsequent 40 aircraft will be manufactured and assembled by the Tata Advanced Systems (TASL) in India as part of an industrial partnership between the two companies.





## SpiceJet starts 737MAX operations after DGCA lifts ban

The sole Indian operator of the type celebrated the return to service of the 737 MAX with a special flight from New Delhi to Gwalior on November 23. SpiceJet had in 2017 ordered 205 Boeing 737Max planes, which includes 155 firm orders and 50 options. The 737 Max planes were grounded in 2019 following two fatal crashes involving the aircraft.

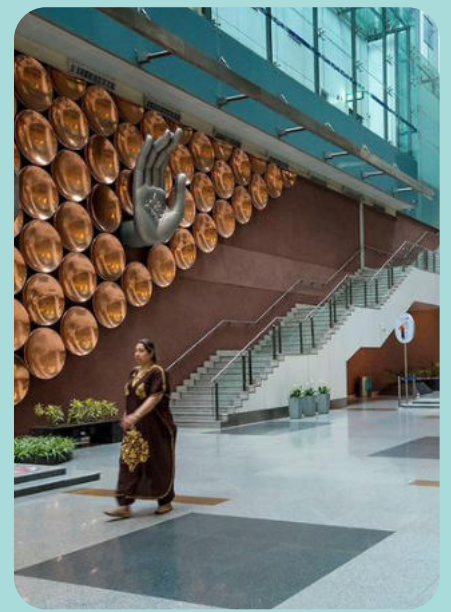


## SpiceJet accepts 2 Boeing 777-200ERs as 737MAX grounding compensation

SpiceJet will be taking delivery of two used Boeing 777-200ERs soon. Apparently these planes are coming from Boeing, and are part of SpiceJet's compensation for its Boeing 737 MAX fleet being grounded for 19 months. The airline management has refrained on commenting on the delivery schedule but has started hiring B777 type-rated flight crews. However, Boeing has not disclosed exact details of the settlement deal.

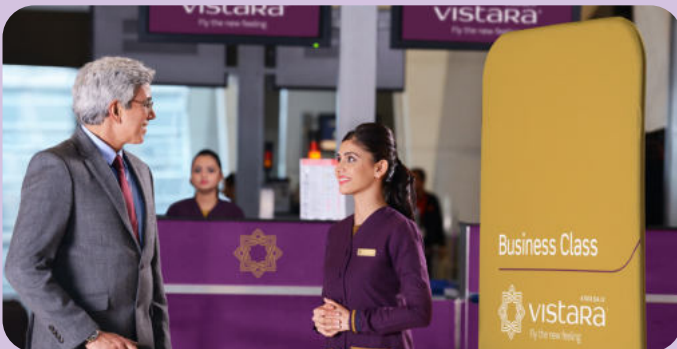
## Akasa's huge 737MAX order to challenge Airbus monopoly

Akasa has followed the low-cost carrier model of ordering aircraft in bulk, which gets the customers a significant discount on list prices from OEMs like Boeing. Moreover, Boeing is reeling out from the 737 Max controversy, the order means regaining a part of its lost ground. While the American plane maker dominated the market with Jet Airways, SpiceJet, Air India's wide-bodied planes several years ago, it has lost to its European rival, which is set to deliver hundreds of single-aisle aircraft to Indian carriers.



## IGI to become 'Net Zero Carbon Emission Airport' by 2030

Delhi International Airport Limited (DIAL) – a GMR-led consortium, is set to become Net Zero Carbon Emission Airport by 2030, much ahead of the IPCC's 2050 target adopted by all major industries all over the world. Mr. Videh Kumar Jaipuria, CEO-DIAL announced this in a video message displayed by Airport Council International (ACI) in an event during COP26, titled, "Delivering the Net Zero Airport of the Future".



## Vistara's fleet crosses 50 aircraft mark amid raging pandemic

As TATA-SIA venture navigated the aviation industry's worst-ever crisis, COVID-19, it continued to grow in a measured way towards its vision and long-term plans. The airline registered a growth of 3.3 percentage points in market share since July 2020. Vistara expanded its fleet by over 25% since April 2020, to have 51 aircraft by 2021 end, and has significantly grown its global network to include seven new destinations across Asia, Europe, and the Middle East.



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