August 2022

100 KNOTS

India's Premier Crew Magazine

Operations
RECAT-EU

Flight Safety
CFIT Prevention

Health
Musculoskeletal Injuries

Sustainability
Flying Clean and Quiet

Disasters
Air India 101

A Kerospace Solutions Company

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EDITORIAL DESK

Dear Colleagues,

Welcome to the August issue of the 100 KNOTS Magazine.

In this issue, we have brought together Industry experts from all domains who have written on critical subjects, both technical and non-technical that affect our daily operations.

As we can see, the air travel industry is getting back on its feet and this is quite evident from the numerous flight delays/ cancellations and the current unprecedented traffic at airports worldwide. Most of the problems of delays, increased flight times, heavy controller workload can be attributed to a lack of capacity in air traffic. In this issue, our subject matter expert Prashant Prabhakar explores how Europe is trying to cope up with capacity restrictions by introducing RECAT-EU, a much more precise categorization of wake turbulence separation minima for departure and arrivals.

DGCA Aerospace Medicine Specialist, Dr. Sanjay Bhargava talks about the growing cases of Musculoskeletal injuries among Flight and Cabin crew, how to recognize and treat/avoid them. Experimental test pilot and TRE, Capt. Peeush Kumar talks about Preventing Controlled Flight into Terrain (CFIT) with the help of Point in Space Procedures (PinS). Flight Instructor Capt. Siddharth Ganesh discusses his experience of flying and training on the Pipistrel Velis Electro, world's very first fully electric. He discusses the various aspects of electric flying and how it is going to revolutionize the pilot training industry.

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

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

We hope to hear from you soon!

Happy Reading!

100 KNOTS

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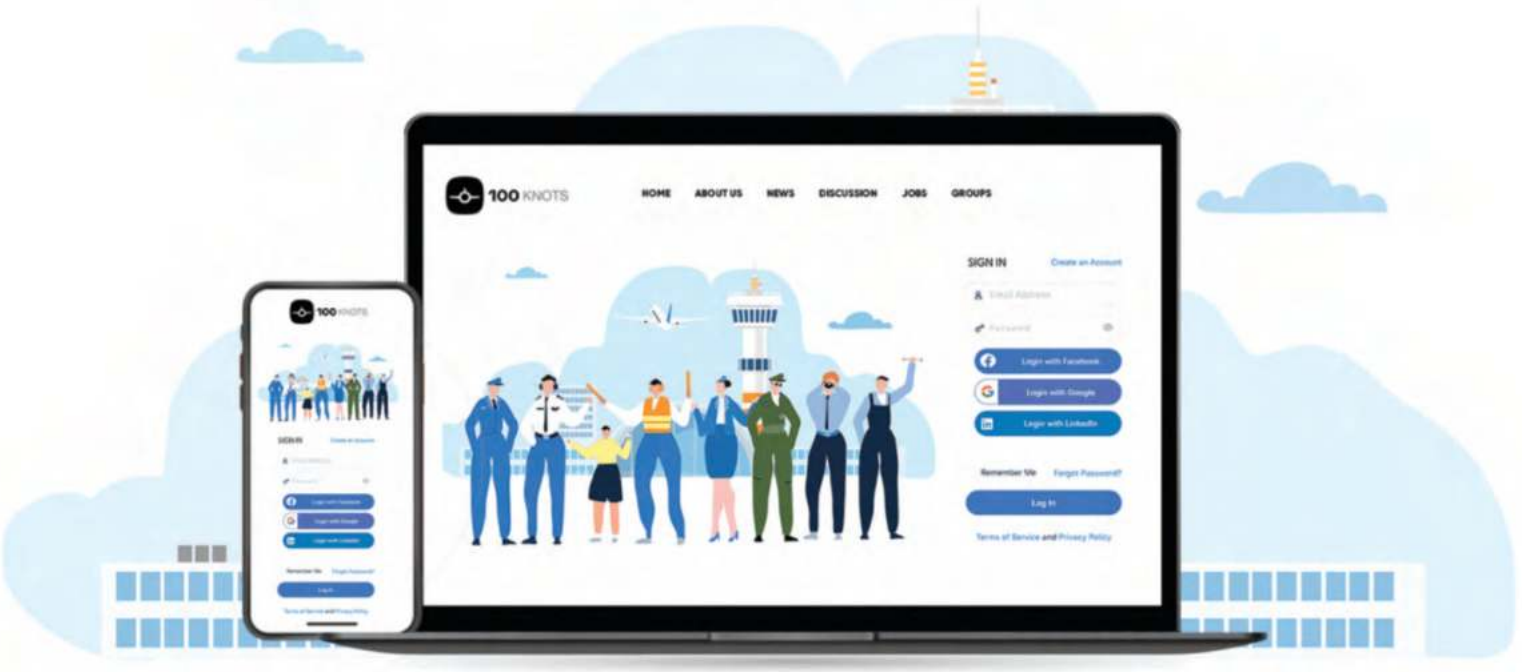


THIS ISSUE

RECAT-EU

Wake Turbulence Recategorization

Prashant Prabhakar
Subject Expert
100 Knots

After more than 2 years of slump in passenger travel, air traffic is slowly and steadily getting back on its feet and this is quite evident from the numerous flight delays/ cancellations and the current unprecedented traffic at airports worldwide. Most of the problems of delays, increased flight times, heavy controller workload can be attributed to a lack of capacity in air traffic.

Capacity at airports is a function of the available terminal airspace, runways and taxiways, technical issues etc. Runway capacity and efficiency use is directly linked with the minimum separation between aircraft. These minima are constrained by ATS surveillance capabilities and wake turbulence. It is for these reasons that it was felt mandatory to revise wake turbulence categorisation and corresponding separation minima to enable optimisation of airport capacity and efficiency whilst maintaining acceptable levels of safety.

Problems with the Current Structure

The existing ICAO wake vortex separation rules were implemented over 40 years ago and in some respect become outdated, as the A380 overtook the largest passenger aircraft generating greater vortices than those from the 'HEAVY' category.

ICAO separations are based on certificated Maximum Take Off Mass (MTOM) and it includes three categories (i.e HEAVY, MEDIUM or LIGHT) allocating all aircraft into one of them. Because the separations are defined based on the worst case in each category, this means that each category may cover a wide range of different sized aircraft, leading to over-conservative separations in many cases, and so a loss of runway throughput.

Leader/Follower	A380-800	Heavy	Medium	Light
A380-800		6 NM	7 NM	8 NM
Heavy MTOM >= 136 tons		4 NM	5 NM	6 NM
Medium 7 tons <= MTOM < 136 tons				5 NM
Light MTOM < 7 tons				

For example, Both A320 and E145 are in the MEDIUM category, whilst their wing spans have a difference of more than 12 metres. Therefore, they suffer from over-conservative separation.

RECAT-EU: Revised separations of A320 and E145 when following a A340

Difference in size between A320 and E145

What is RECAT-EU?

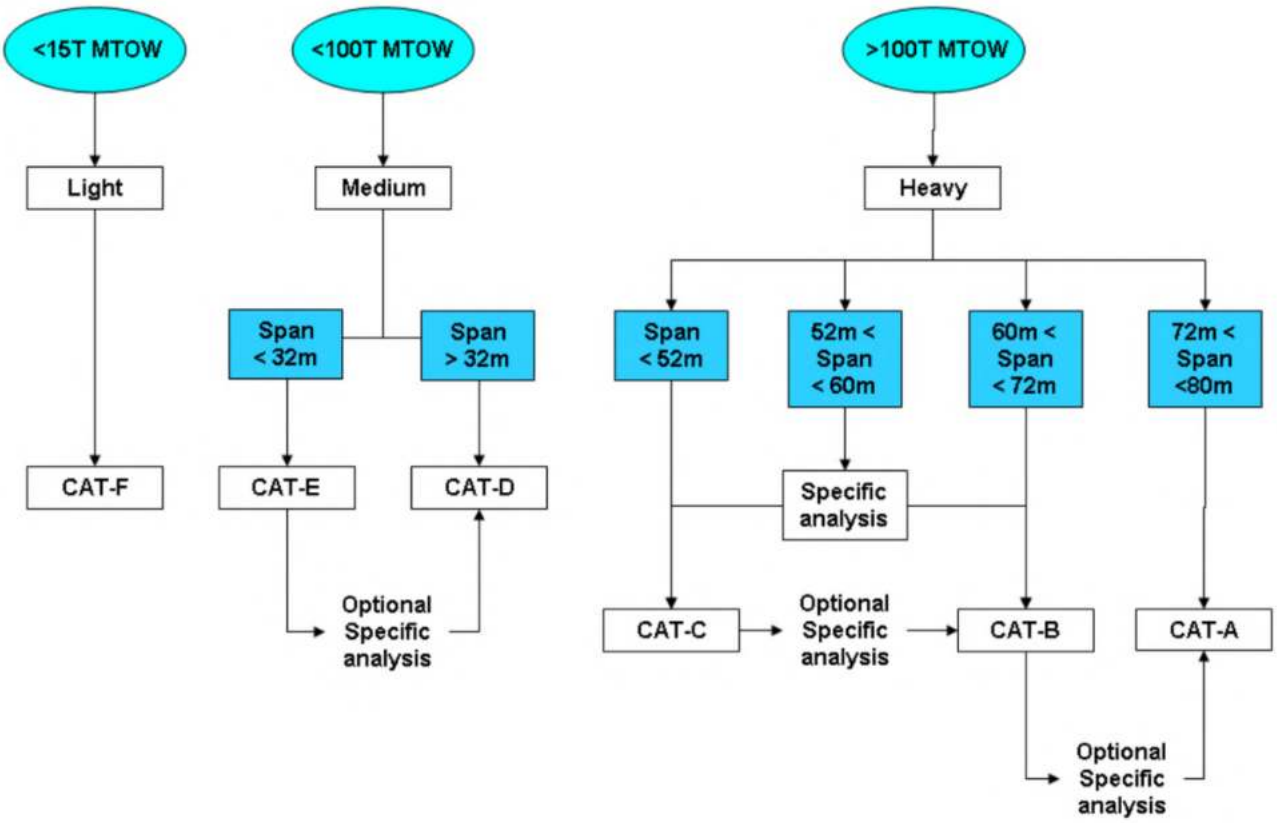
In the recent years, knowledge about wake vortex behaviour in the operational environment has increased, thanks to recorded data and improved understanding of physical processes. This knowledge was utilized to tackle the problem of over conservative separations, and a much more precise categorisation, RECAT-EU was established.

The RECAT-EU scheme is based on a set of principles, comparing the wake generation and wake resistance between aircraft types, and splitting ICAO HEAVY and MEDIUM categories into 'Upper' ('Larger') and 'Lower' ('Smaller'). This allows reduction of separation minima for some traffic pairs, enabling runway throughput increase, whilst maintaining acceptable levels of safety.

The categorization of RECAT-EU is based not only on the MTOM, but also on comparing the ability of generating turbulence and resistance to turbulence between aircraft pairs. When reducing the minimum safe distance between aircraft, not only the preceding aircraft's vortex strength is taken into consideration, but also the following aircraft's ability to withstand the effects of flying into wake turbulence.

How does RECAT work?

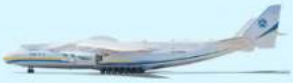
The criteria used for categorisation of existing and new aircraft types has been modified as listed below.



Aircraft New Categories Examples

Super Heavy CAT A

A124



A225

A380

Upper Heavy CAT B

B747

B777

A350

Lower Heavy CAT C

B757

B767

IL76

Upper Medium CAT D

A320-Family

B737

C130

Lower Medium CAT E

CL600

Q400

E135

Light CAT F

C525

C172

C152

RECAT-EU scheme		"Super Heavy"	"Upper Heavy"	"Lower Heavy"	"Upper Medium"	"Lower Medium"	"Light"
Leader/Follower		A	B	C	D	E	F
"Super Heavy"	A	3 NM	4 NM	5 NM	5 NM	6 NM	8 NM
"Upper Heavy"	B		3 NM	4 NM	4 NM	5 NM	7 NM
"Lower Heavy"	C		(*)	3 NM	3 NM	4 NM	6 NM
"Upper Medium"	D						5 NM
"Lower Medium"	E						4 NM
"Light"	F						3 NM

RECAT-EU WT distance-based separation minima on approach and departure

RECAT-EU scheme		"Super Heavy"	"Upper Heavy"	"Lower Heavy"	"Upper Medium"	"Lower Medium"	"Light"
Leader/Follower		A	B	C	D	E	F
"Super Heavy"	A		100s	120s	140s	160s	180s
"Upper Heavy"	B				100s	120s	140s
"Lower Heavy"	C				80s	100s	120s
"Upper Medium"	D						120s
"Lower Medium"	E						100s
"Light"	F						80s

RECAT-EU WT time-based separation minima on departure

Benefits

RECAT-EU deployment will bring immediate capacity benefits, with additional movements in peak traffic periods, and / or reduce time to land or depart a traffic sequence. These benefits are expected to further increase over time as the overall fleet mix is forecasted to evolve towards larger aircraft.

- The runway throughput benefits can reach 5% or more during peak periods depending on individual airport traffic mix
- For an equivalent throughput, RECAT-EU also allows a reduction of the overall flight time for an arrival or departure sequence of traffic, and this is beneficial to the whole traffic sequence. This may offer more flexibility for the Controllers to manage the traffic
- RECAT-EU will also enable more rapid recovery from adverse conditions, helping to reduce the overall delay and will also enable improvements in ATFM slot compliance through the flexibility afforded by reduced departure separations
- The benefits are expected to further increase over time as the overall fleet mix is forecasted to evolve towards larger aircraft

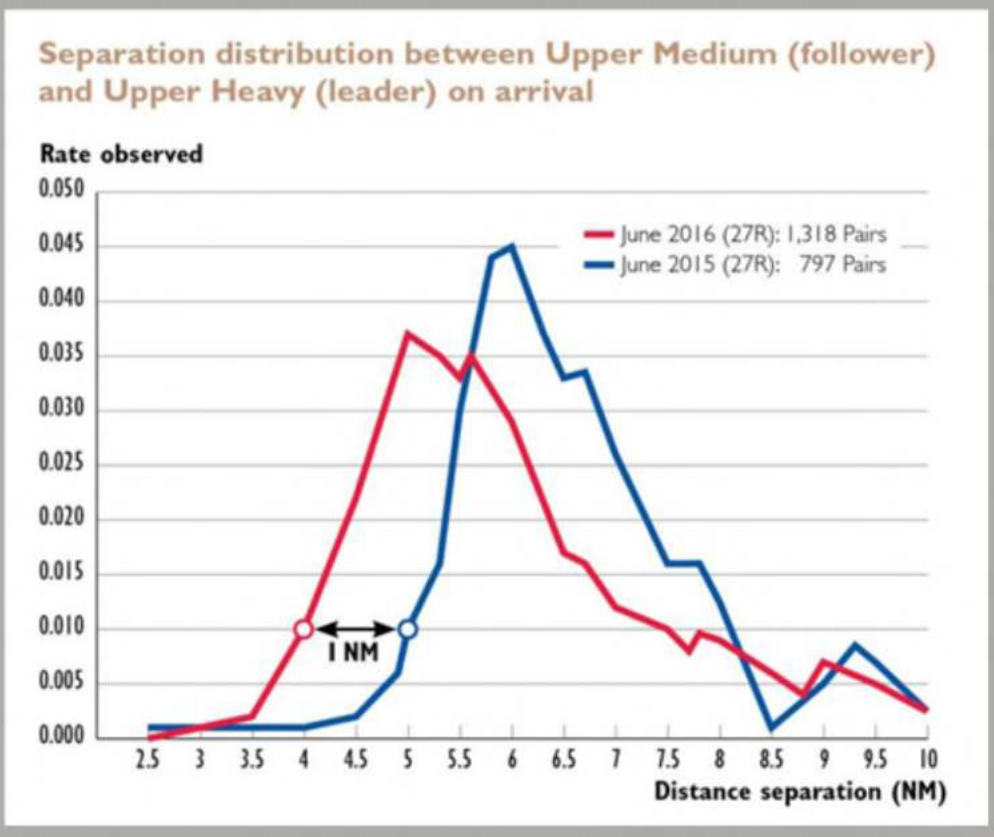
How to deploy RECAT-EU?

The RECAT-EU scheme may be applied in full or in part, to update or replace the current wake separation scheme applied locally. The operational use of RECAT-EU scheme will require limited changes to the ATM functional system. In other words, it will only require updating local flight plan in the strip, adaptations to the Approach and Tower traffic surveillance display with new wake turbulence category designations, and publications of new applicable minima.

ATC controllers will need to be trained to work with the six categories, and this can be conducted by use of ATC simulations.

Flight Crew must be made aware and briefed on the local change.

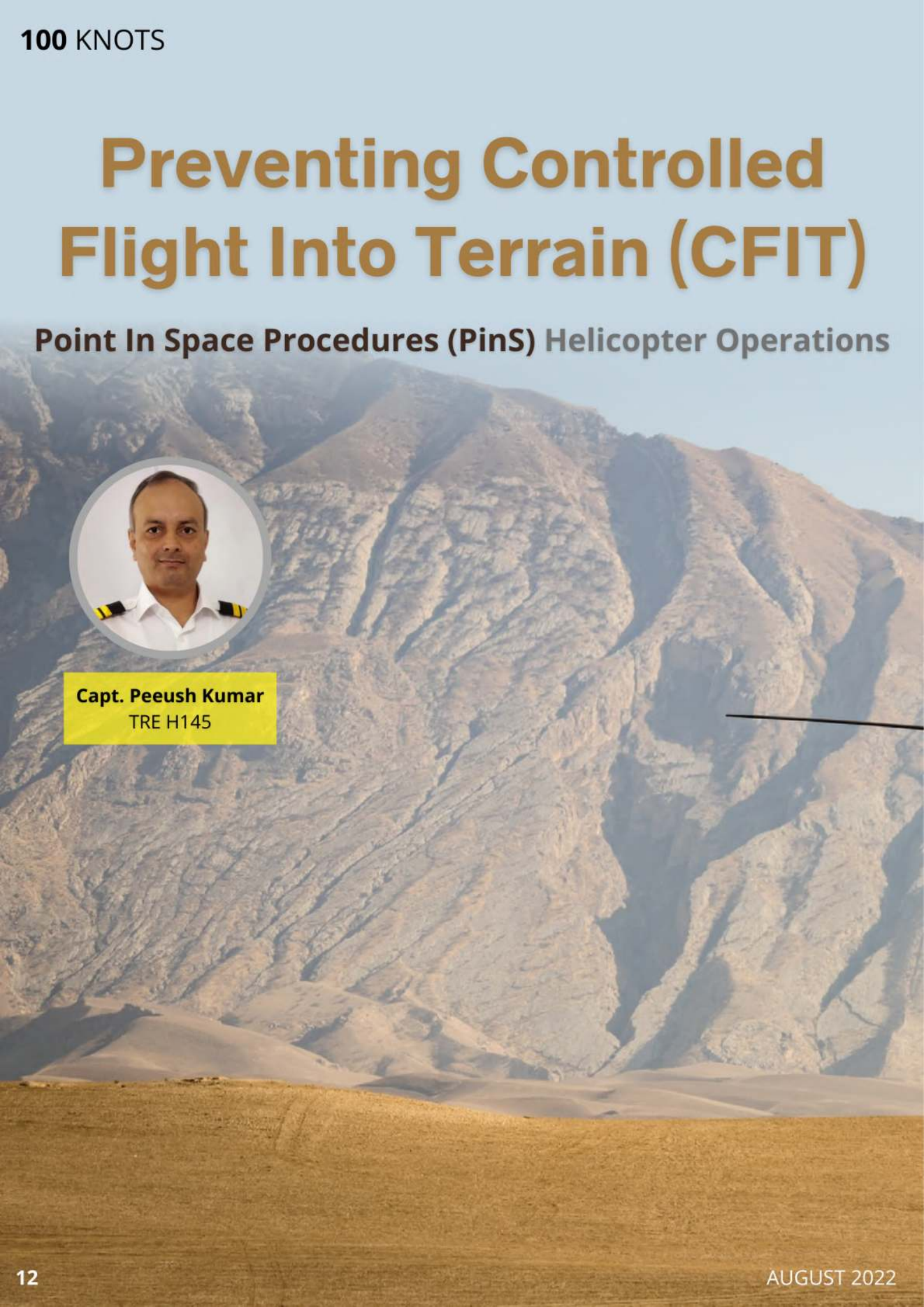
Success Stories



RECAT-EU is implemented at Charles de Gaulle airport (CDG//LFPG) in Paris. It is the largest international airport in France and the second largest in Europe by number of passengers, air operations and cargo. Since RECAT-EU has first been introduced at Paris-CDG in 2015, the airport has experienced a 5-10% (average 8%) increase in runway throughput during peak hours.

Preventing Controlled Flight Into Terrain (CFIT)

Point In Space Procedures (PinS) Helicopter Operations



Capt. Peeush Kumar
TRE H145

CFIT (Controlled Flight into Terrain) ensues when an airworthy aircraft responding to pilots' control inputs is unintentionally flown into ground/terrain. Weighing on prevention of CFIT for helicopter operations through contemporary advancements, this space intends to attract attention of pilots, operators and influencing offices of civil aviation. Explicitly, a prospect of helicopter operations under IFR (Instrument Flight Rules), now conceivable by through 'Point in Space (PinS)' procedures to favour flight safety is presented. It is with earnest hope that necessity and viability of subject proposal may echo in relevant corridors for its implementation and impetus for ongoing efforts.

Simplifying PinS (Point in Space), as 'What?' or 'How does it help?', it seems helpful to place contents in a question-answer format. Lest it goes unsaid, the motive force pivots on flight safety of helicopter operations against CFIT.

'PinS' Concept

'EuroControl' document on "Helicopter Point in Space Operations in controlled and Uncontrolled airspace [1] " offers a definitive explanation extracted as under. Subscript implications help surface the proposition: -

- The Point-in-Space (PinS) concept is a flight operation based on GPS (and GAGAN in India), and designed only for helicopters.
  Ground based navigation aids normally available at airports for IFR operations are expensive to install and maintain. Resulting absence of navigation aids at heliports, exposes helicopters to known vulnerabilities, including CFIT. Both, GPS and GAGAN are space-based signals and do not require ground-based installations like prevalent conventional navigation aids. Since PinS is based only on GPS and GAGAN signals, IFR procedures are feasible from heliports without conventional navigation aids. Safety of airport 'like' operations (under IFR) is therefore commercially and technically viable between heliports.

- PinS enables IFR (instrument Flight Procedures) procedures on non-instrument FATO (Final Approach and Take-Off) located on aerodromes or isolated heliports.
  Preparing a site for instrument-based operations invites major commercial implications, now excluded with aforesaid. Existing heliports under regular usage emerge as a viable proposition for deploying PinS procedures without a setback of commercial element or technical hinderance.

- Major interest of the PinS concept is the flexibility to deal with heliports generally located in obstacle-rich environments.
  Conventionally, procedures under IFR, since designed to keep air traffic clear of obstacles are templated for aeroplanes. Employing these procedures is largely impractical for helicopter operations owing to limited endurance and lower speeds. Since PinS is design-oriented for helicopter operations, it customises manoeuvring areas to align with safety of instrument procedures as well as peculiarities of helicopter operations. A 'best of both worlds' option is therefore offered to enhance helicopter flight safety.

PinS Procedure to Prevent CFIT

Safety against CFIT is offered by operations under IFR (Instrument Flight Rules) that permit day and night, all weather operations (sic) operations at airports. Helicopter operations are incidental beneficiaries of such an ecosystem but only when operating from airports. Conventional IFR procedures since available only at airports do not extend this benefit at heliports, the core domain of helicopter operations. Fundamental capability of helicopters to operate from heliports therefore becomes restricted to daylight hours since operating under VFR (Visual Flight Rules) through 'Look and Avoid' principle.

Creative exploitation of helicopters is based on its unique operational capability from limited spaces. This domain typically extends 'ahead' of airports favouring travel time and commuter convenience. Traditionally limited to daylight operations in absence of 'airport like' facilities and mired with safety concerns, helicopters have thus traditionally underperformed in past. Operations under IFR through PinS procedures for helicopters now, guarantees safety against CFIT while facilitating 'around the clock' operations between heliports as a by-product.

Aforesaid proposition for Heliports scopes 'Regular Use' helipads defined by DGCA and at 'VFR only' airports (e.g., Jagdalpur). Temporary landing areas treated separately by DGCA shall still be operated under VFR (Visual Flight Rules) through 'Look and Avoid' principle.

PBN Concept in Relation to PinS Procedures

PBN (Performance Based Navigation) concept was largely a solution concentrating on ATM (Air Traffic Management) problem. Erstwhile procedures based on RNAV/Non-RNAV (RNAV; Area Navigation) hindered air space optimization owing to resultant track dispersion from undefined navigational performance. Under PBN concept, repeatable, reliable and predictable flight tracking translated into smaller obstacle assessment areas for higher traffic density. A pictorial representation [2] of track dispersion and advantages through of track containment at Atlanta/Hartsfield International Airport (KATL) is placed for better grasp of ATM problem.

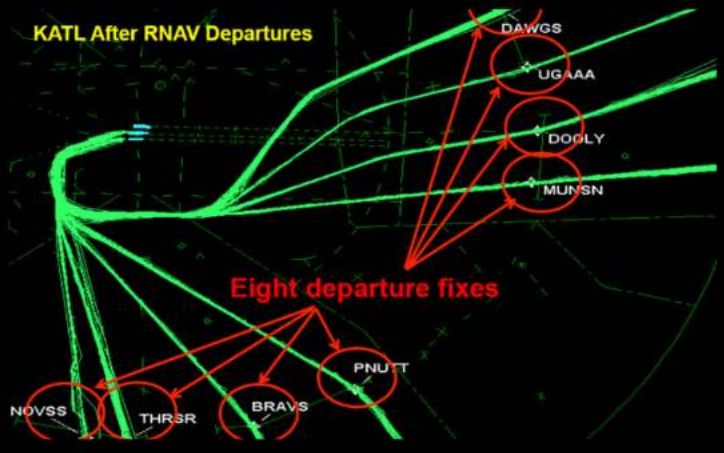
Alternatives for helicopter operations under PBN concept may have emerged as a by-product of said ATM problem, now covered under Navigation Specification (Nav Specs). PinS departures (and arrivals) are covered under RNP 0.3 Nav Spec and PinS approaches are included vide RNP APCH (augmented GNSS by SBAS) Nav Spec. These two Nav Specs are regulated by DGCA vide respective operations circulars and together offer a seamless IFR structure between heliports under PBN concept for helicopters.

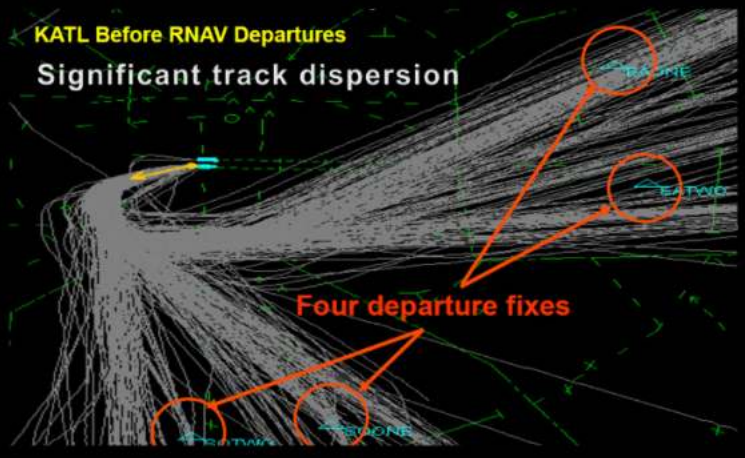
What are the estimated timelines for seeking approvals by a helicopter operator and promulgation of PinS procedures for helipads by AAI?

For approval under RNP APCH and RNP 0.3 Nav Specs, procedures vide DGCA CAR, Section 8, Series S, Part IV, along with respective operation circulars [3] apply. On a fair estimate, approvals from DGCA may be reasonably expected within 3-4 months from date of submission (authors' estimate).

Heliports intended to be covered under PinS procedures, need obstacle survey, procedure design & validation by AAI for final approval by DGCA. It should be fair to estimate a six-month period for 'pilot' projects, whereas, subsequent undertakings may have better time lines.

The above two processes, since assumed being undertaken parallelly, may be reasonably completed in a time period of six months for realising PinS based operations at heliports.





Conclusion

It should be agreeable that CFIT accidents are entirely avoidable for low flying helicopters using PinS procedures. Temporary landing sites, however would still be limited by visual procedures. Nevertheless, since crew trained for PinS procedures would naturally have a better operational outlook, it would indeed be beneficial, albeit indirectly even for temporary sites.

Flight safety merits that deployment of PinS procedures for helicopters in India is induced as an urgent reformist measure sooner than later. DGCA may consider PinS procedures as 'Preferred' for 'Regular Use' heliports. Only for VIP movements, it may mandate PinS procedures in favour of flight safety. DGCA may consider said proposal in the backdrop of recent unfortunate helicopter related events of Dec 2021 (CDS, Gen Bipin Rawat), and Jan 2022 (VIP transfer in Punjab).

Monetary cost of such initiatives weighed against stakes of non-implementation would be a one-sided debate. Relating to High-Net-Worth Individuals (HNIs), trained pilots, expensive machinery (procurement period and monetary value) & known aftermath of unfortunate avoidable CFIT cases are substantive justifications to clear resistance against implementation of PinS procedures for helicopter operations.

A silver lining helping monetary costs may lie in it being a one-time expense (limited maintenance costs) with amortization possibility and building long-term infrastructure asset for business and tourism sectors.

References / Citations

[1] Para 3.1, Part – I, Section 3 of Eurocontrol, 'Helicopter Point in Space Operations in controlled and Uncontrolled airspace, Generic Safety Case'.

[2] Slides 6 & 7 of No 4 PBN Airspace workshop by ICAO and IATA on 'Designing Routes'. {Link - https://www.icao.int/MID/Documents/2014/PBN%20Go-Team%20Visit/04%20-%20PBN%20Airspace%20Workshop.pdf}

[3] Operations Circular 03 of 2016, Rev 1 for RNP APCH (Augmented GNSS) and Operations Circular 01 of 2022 for RNP 0.3

About the Author

Capt. Peeush Kumar is a certified experimental test pilot for rotary wing aircrafts and a Type Rating Examiner on H145 (M/s Airbus) helicopter. Currently working for a non-scheduled category operator, he has a flying experience on more than 20+ helicopters and aeroplanes. His solo initiative @ IndianRotors.in has active support of Rotary Wing Society of India (RWSI). Presently pursuing PBN (Performance Based Navigation) based helicopter operations in India, Capt. Peeush can be reached at Peeush_Saini@yahoo.co.in.

Musculoskeletal Injuries In Flight Crew

Dr. Sanjay Bhargava MD
Consultant Aerospace
Medicine Specialist

The physical and functional musculoskeletal demands on aviators have changed vastly with the development of ultramodern aircraft; where earlier muscular strength was a necessity, the most important ability now is fine motor skills. The musculoskeletal conditions for aircrew flying commercial aircraft and that for private aviators are the same but should be applied with due regard to the different demands of different genera of aircraft. To perform the tasks involved in overseeing, flying, and evacuating an aircraft safely and effectively, airmen must be free of pain and have sufficient strength and range of movement in the backbone and limbs.

Common Musculoskeletal Abnormalities

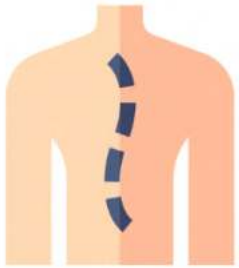
1. Any abnormality of the bones, joints, muscles, and tendons, born with or acquired, which is likely to obtrude with the safe exercise of the privileges of the applicable license.
2. Insufficient sitting height, leg and arm length, and muscular strength.
3. Incomplete functional use of the musculoskeletal system including all four limbs.
4. Significant sequelae from disorder, injury, or congenital abnormality with or without surgery.

The use of medicines in the treatment of musculoskeletal diseases must be assessed following DGCA rules.

Musculoskeletal Requirements for Flight Crew License

Neck movement is essential to keep a satisfactory lookout and the aircrew must show a good range of flexion, extension, lateral flexion, and rotation of the cervical spine.

Self-examination of lumbar spine movements will help to identify painful conditions which might beget a distraction in flight. You should demonstrate a good range of flexion, extension, lateral flexion, and gyration of the lumbar chine.



A good range and effortless movement of the ankle joint is essential for the safe operation and control of aircraft. There are numerous conditions, e.g. trauma or infection, that could vitiate this function. Painful foot or ankle injuries caused by sporting activities are common problems. They may lead to a temporary or long-term unfit assessment.

You need to ensure that, your knee joint is stable and there is a minimum, effortless, range of movement from 0 to 90°. The knee joint is presumably most prone to injury and thus important to aviators.

Osteoarthritis or degenerative joint disease is the most common hip disorder affecting as you age. A minimal effortless range of at least 90° of flexion from the extended position in the hip joint is needed. In case you have an orthopedic surgical operation of the hip area , it will need post-operational physiotherapy, thus a minimal period of three months of temporary inappositeness will be needed.

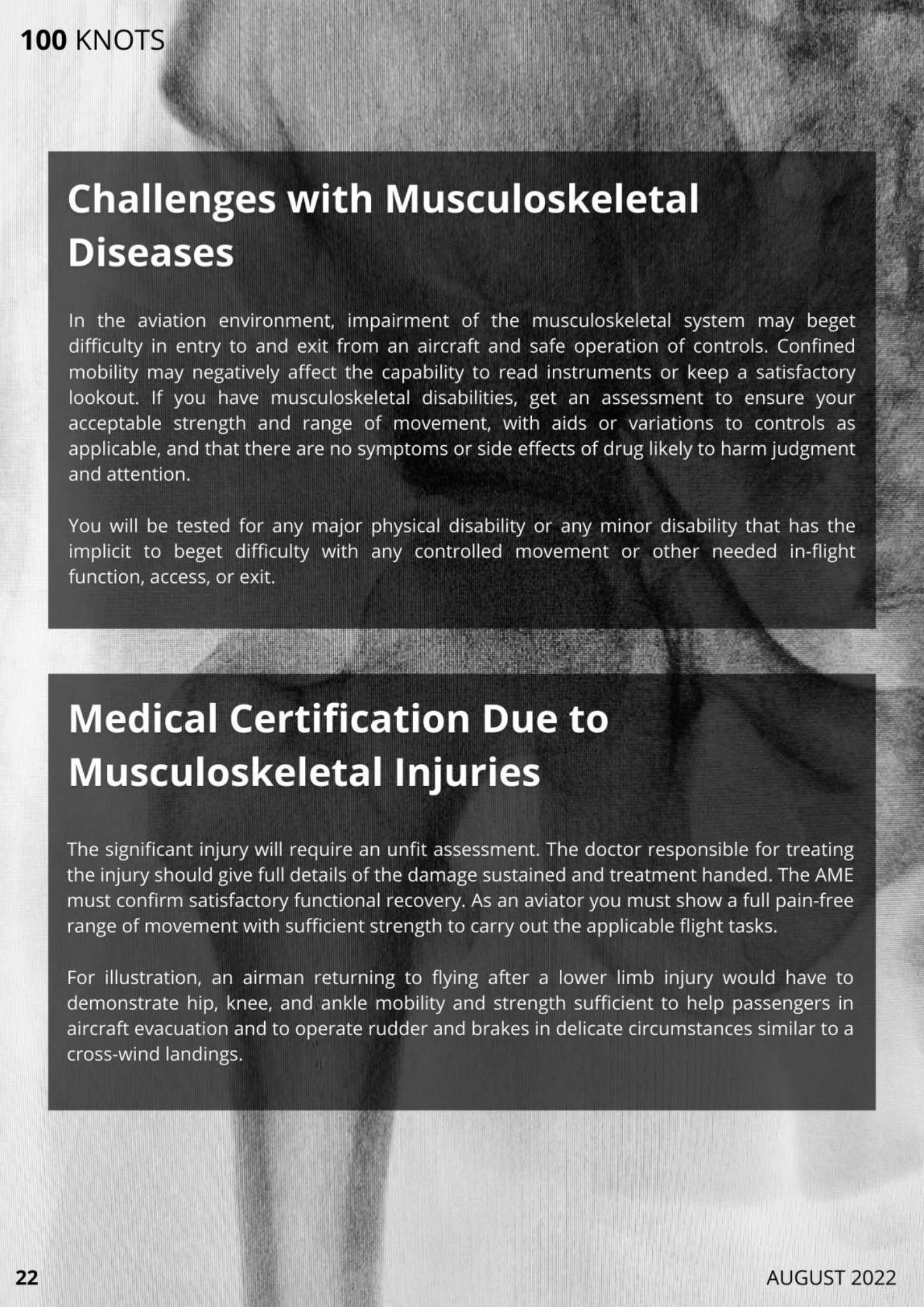
Your shoulder requires a good range of movement which is essential for operating controls located in overhead panels and side consoles.

Take care of your elbow as it is prone to musculoskeletal injury. A certain quantum of restriction at the elbow joint may be passable because some impairment can be compensated for by the shoulder movements.

A self-assessment of the functional capacity of the hand and fingers is essential and should be made with a good knowledge of the complex aircraft control manipulations needed for safe flight. Complete intact sensibility and good finger and thumb movements on both sides are also essential for the operation of computer displays and keyboards in your aircraft. In case one has a severed thumb then, he should be able to be evaluated by a medical flight test, though, a single finger amputation is generally of no concern.

Your sitting height, arm, and leg length may be affected by different kinds of musculoskeletal injuries. Thus, generally when you go for flying training, you are assessed bearing in mind the ergonomic demands of the cockpit. You must be fit to reach readily and operate effectively all controls during both normal and exigency conditions.

Muscular forces demanded to operate aircraft controls vary greatly. Utmost switches and knobs can be moved with one finger and ultramodern aircraft, using electric or hydraulic selectors, demand minimum hand or foot movement and muscular power. In aged aircraft, with line-controlled ailerons, elevators, and rudder muscular forces demanded during a normal flight are also moderate, but exigency procedures performed in asymmetric flight may bear considerable muscular strength. Any insufficiency in your muscular power may lead to a critical situation.



Challenges with Musculoskeletal Diseases

In the aviation environment, impairment of the musculoskeletal system may beget difficulty in entry to and exit from an aircraft and safe operation of controls. Confined mobility may negatively affect the capability to read instruments or keep a satisfactory lookout. If you have musculoskeletal disabilities, get an assessment to ensure your acceptable strength and range of movement, with aids or variations to controls as applicable, and that there are no symptoms or side effects of drug likely to harm judgment and attention.

You will be tested for any major physical disability or any minor disability that has the implicit to beget difficulty with any controlled movement or other needed in-flight function, access, or exit.

Medical Certification Due to Musculoskeletal Injuries

The significant injury will require an unfit assessment. The doctor responsible for treating the injury should give full details of the damage sustained and treatment handed. The AME must confirm satisfactory functional recovery. As an aviator you must show a full pain-free range of movement with sufficient strength to carry out the applicable flight tasks.

For illustration, an airman returning to flying after a lower limb injury would have to demonstrate hip, knee, and ankle mobility and strength sufficient to help passengers in aircraft evacuation and to operate rudder and brakes in delicate circumstances similar to a cross-wind landings.

How to Reduce Musculoskeletal Injuries?

Be active. Keep a goal in mind at beginning of the day and try achieving it.

Keep weight under control by taking healthy food and beverages.

Have a physical fitness program running and have a healthy share of aerobic coupled with anaerobic exercises.

Stop smoking.

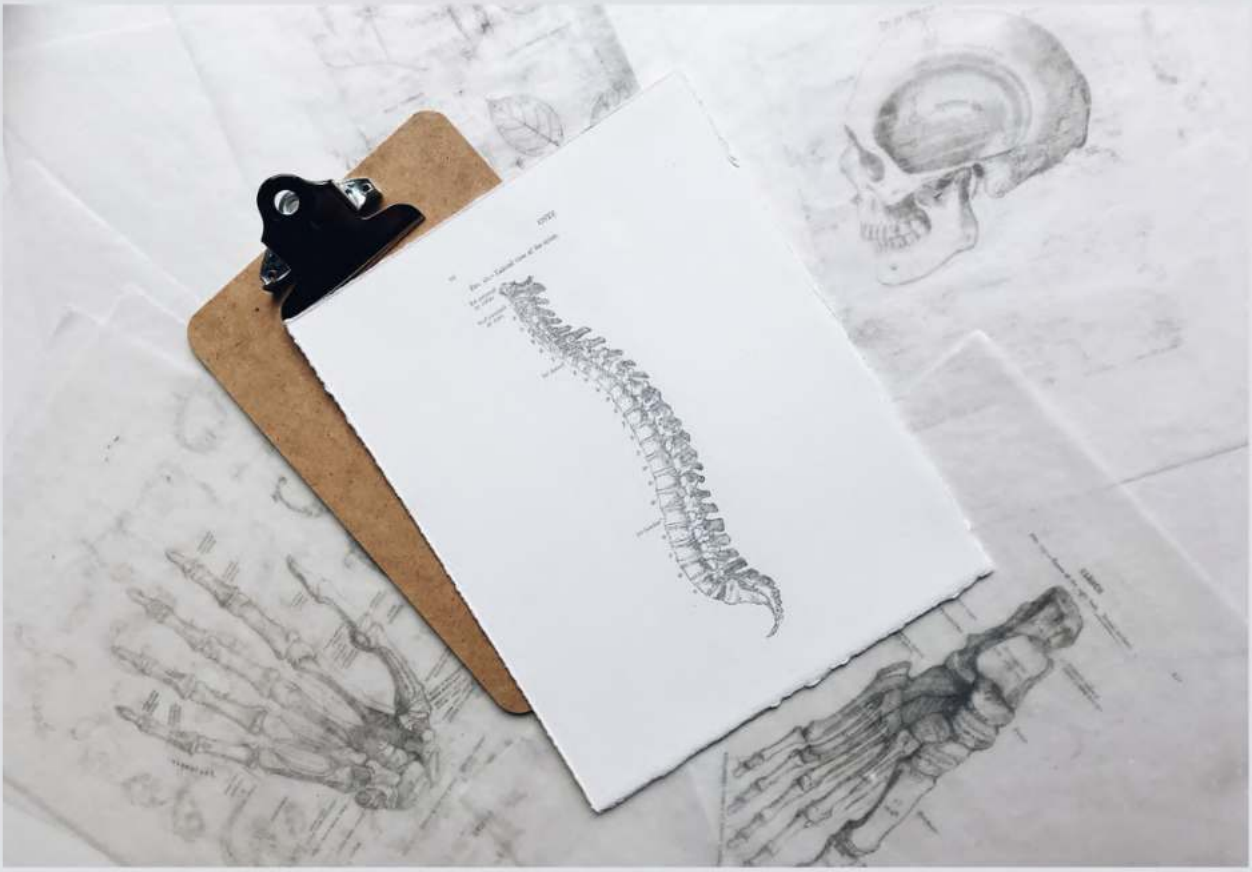
Maintain correct posture at work place and do spinal strengthening exercises. Yoga in your life helps.

Maintain a minimum level of activity which increase till a predefined goal is reached

Aerobic fitness	Core exercises	Strengh training	Balance training	Flexibility and streching
				
Running, walking, using stairs	Muscles of the abdomen, lower back and pelvis	Push-ups, squats, exercise with weights	For example, standing on one leg and switching	Stretching exercises when the muscles are warmed up

Conclusion

This composition provides a broad picture of the nature of musculoskeletal disabilities that affect aircrew in this country. A close follow up is required by you to maintain a good level of fitness to avoid musculoskeletal injuries thus avoiding a period of unfitness.



About the Author

Sanjay Bhargava is a consultant Aerospace medicine specialist is a renowned Class 1 medical examiner empanelled with DGCA. He is an alumnus of Armed Forces Medical College Pune. After completing his post-graduate in Aerospace medicine from the Institute of Aerospace medicine Bangalore, he worked as a specialist in Aerospace medicine in various appointments in Indian Air Force. He is a DGCA Class 1 examiner with extensive experience at AFCME, Delhi, AFS Tambaram, and as President MEC (EAST), Jorhat. He has been responsible for finalizing various policies at DGCA. He was the lead doctor for starting civil medical centres for class 1 medicals for DGCA. Over a while, he has been assisting aspiring pilots and solving their DGCA related medical issues through his website http://dgcamedical.in. He has a large following in social media and is respected for his advice given to pilots for the last 3 decades. Dr. Sanjay can be reached at:

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Siddharth Ganesh
Flight Instructor

Flying Clean and Quiet

Flying Electric Pipistrel Velis Electro

You push the plane out of the hangar by hand, strap in, run through the entire checklist – remember you have no engine really to crank and start, and once that's done get your clearance and all you do is flick a power-on switch and off you go. You do a brief run-up before taking off and all in all, it takes not more than a few minutes to get airborne.

The Pipistrel Velis Electro is the world's very first fully electric airplane to receive a Type Certification (From EASA) enabling flying schools to use the aircraft for flight training and issue of licenses. Recently, the first all-electric PPL has reportedly been issued to a Swiss trainee pilot. I first flew the type in the early months of 2022 and ever since have been carrying out difference training and instruction on it, a conversion program so to say as per EASA. The aircraft itself flies just like its conventional counterpart with power but upon bringing the power to idle it turns into a glider. As a new pilot on this, it's slightly challenging to slow her down and descend on profile due to its high lift drag ratio, you've got to be patient initially but after a couple of flights, you'll see it's a really fun plane to fly given its high maneuverability.

The aircraft's foundation is two high voltage liquid-cooled Lithium batteries that power the electric motor through a power controller, this is what we call the 'engine' collectively on the Velis. The Battery management system (BMS), monitors and controls various parts of the battery. So, you don't have several hundred parts moving against each other like on a Lycoming or Continental piston engine. What happens then? You have barely any noise, another big win for the Velis. Even while flying, it's much like how a bee buzzes and at times you can't really hear it at all when it's a couple of thousand feet above you, just sight. The Velis can operate in cold, hot, and rain.

Training

So, the difference training as such is for those who come to get rated on the Velis Electro and begins with a flight to the training area, just basic handling, steep turns, and some stalls. We then move on to circuits to get them to land the aircraft safely within its rather tight flap operating speed restrictions. Once that's done, we move on to emergencies while in the circuit followed by more intense ones in the training area and this is where things take a different path, it's not your conventional combustion engine. So, if you did have an electrical fire inside the cockpit and turn off the master as you'd do on a conventional plane, you'd kill the engine here.

The aircraft power setting is read in kW (kilowatt) and has a corresponding RPM. After the power check on take-off, we verify if 50kw is deliverable and then reduce it to 48kW for the climb which is the max continuous. For the cruise part, you could fly at 20kW or 25kW. The more conservative you are, the slower you go but increase your endurance. A planned descent can be done at idle. In terms of traffic circuits, you can go power idle on late downwind and easily make it.

The Big Question

Endurance

In brief, a local training flight with cruise power between 20 and 25Kw gives you between 45-50 mins of flying time at a cruise speed of 90 knots without 10 min additional reserve. For a cross-country flight with the same power setting, you get anywhere between 27-32 min of flight time with an additional reserve of 30min. If you plan to do just circuit training, you'll probably get around 7 shots at it of course it depends on how large the circuit is for that aerodrome. One factor to consider however is the battery operating limitation temperature which is 38C OAT and makes it unsuitable for use in most of India during summertime.

The aircraft's endurance is battery limited, it's much like your mobile phone, it's recharged to 100% before the flight through a charging unit (takes approx. 2 hours to fully charge) and drains depending on how much load you put on it. A 1000ft climb at 48Kw can drain nearly 8% (which is quite a lot), so if you climb from the ground to 2500 ft with two people on board, you're already at around 80-81% on the remaining state of charge. As batteries get older, their state of health also goes down and affects the state of charge likewise.

Emergencies

Every time I get in, I have to tell myself that the functioning and emergencies are handled differently so I'm recharging my situational awareness before every take-off on this aircraft. The two predominant areas where serious problems could occur are from either the batteries or the engine. Something you really don't want is a battery fire, they're lithium and hence cannot be extinguished, you can only delay and slow the burning with an extinguisher, that too only on the ground, if in the air, just ditch immediately. You could also have over currents and voltages across the batteries or a coolant line failure. In regard to the engine, you can again have rising temperatures of the electric motor or controller that could cause serious problems. However, the Pipistrel Velis electro has an extremely smart and reliable warning system. There are two, one digital that even tells you the problem so you know how to diagnose it, and another basic annunciator panel with lights that illuminate as a backup. To keep the battery temp within limits you've got a coolant l the last part of the difference training, we actually fly the electric cross country and now we also explore the range and endurance capabilities.

Where does the aircraft fit in Indian Flying Institutions?

India has abundance of solar energy that could make Electric flying 100% emission-free. Electric flying is still in its infancy years and these aircraft will get several upgrades over the year. Besides, newer models from different manufacturers are already on the horizon like the electric Diamonds DA40. Nevertheless, flight schools in India should surely eye the type, given the low operating cost as you completely eliminate the need for fuel. This is particularly important nowadays, given the sky-high prices making up the majority of the expense. Of course, we can't' use it for the entire VFR training phase but for the initial training and traffic circuits, it's surely a winner in terms of operating costs and sustainability. The navigation phase can be complemented with the Pipistrel Virus 121, which is on a related type certificate and has basically the exact same airframe powered by a Rotax 912 engine until the next set of fully electric aircraft can make this a reality too. The aircraft goes for a little over Euro 200,000, rather pricy for its size and range but you have to consider that you'll never spend a penny on fuel.

Pros and Cons

The pros are sure to overshadow the cons, first and most important you're being extremely sustainable - absolutely emission-free, and if you're also producing the electricity through a sustainable way be it solar, wind etc, you make the entire chain 100% emission-free - something that's very doable in India given it's excess solar.

Second, noise, it's an extremely silent aircraft given it's powered by an electric motor, so you don't have to worry about overflying your neighbourhood and annoying them. Another positive is electric motors are rather simpler compared to combustion engines, which makes maintenance easier.

Cons for the moment are range/endurance. Energy storage in the batteries is still on the lower end and this limits the flight time significantly, but can't really

complain, it's the first step and so far so good, it'll only get better. If you'd consider lithium batteries as a con, then that too.

Specifications Pipistrel Velis Electro

engine	Pipistrel E-811 EASA Type-Certified
max power	57.6 kW MTOP
wingspan	10.71 m (35.1 ft)
length	6.47 m (21.3 ft)
height	1.90 m (6.23 ft)
wing area	9.51 m^2 (102.4 sqft)
basic empty weight – with batteries	428 kg (941 lb)
max take off weight, MTOW	600 kg (1,320 lb)
payload weight	172 kg (378 lb)
cruising speed (at 35 kW)	90 KCAS
takeoff run – grass/asphalt	246/241 m (807/791 ft)
service ceiling	3,660 m (12,000 ft)
endurance	up to 50 minutes (plus VFR reserve)

About the Author

Siddharth is an aviator at heart, and most things during his day revolve around aviation, be it flying, writing, or just being an avgeek. Siddharth holds a European pilot's license, and he is currently Flight Instructing on a mixed fleet of aircraft, right from the Cessna 150/172, Piper, Diamond 40, and most importantly the Pipistrel Velis Electro, all on the same day. During the evenings, he brings out his paper and pen, that's when journalism starts. He writes for a couple of leading Aviation publications across the globe in English and other languages - mostly focused on airlines and airports in detail,
including interviews with the CEOs. He is also certified by IATA as an Aviation Management Person. Siddharth is based in Germany.

AIR INDIA 101

When Kanchenjunga met with Mont Blanc

Preet Palash
Editor

For more than six decades, Air India followed a very beautiful tradition initiated by its founder J R D Tata. Before the airline took delivery of a new aircraft, it gave the fresh arrival a name, a very Indian name. Why the tradition was stopped remain a mystery after the arrival of the Dreamliners. Anyways, the very first jet aircraft in the airline's arsenal was a Boeing 707-420 registered VT-DMN was called Kanchenjunga, proudly named after the third highest mountain peak in the world standing tall in the north-eastern Sikkim.

On a very fateful morning on 24th January 1966, the aircraft was operating as Air India Flight 101 from Sahar Airport, Bombay(now Chhatrapati Shivaji Maharaj International Airport, Mumbai) to London Heathrow. As the non-stop flying range was restricted, flight was planned with three stops in Delhi, Beirut and Geneva. During the descent into the third and final stop into Geneva, the aircraft collided into Mont Blanc, France killing all 117 souls on board. The crash was almost at the exact spot where an Air India Lockheed 749 Constellation, Malabar Princess, registered VT-CQP operating Air India Flight 245 on a charter flight, had crashed in 1950.

Victims

Among the 106 passengers who were killed was Dr. Homi Jehangir Bhabha, Founder and chairman of the Indian Atomic Energy Commission, who was on his way to Vienna. The remaining passengers were Indian nationals, 46 of whom were sailors. Six were British.

The 11 crew member included two pilots, one flight engineer, one navigator, seven hostesses and attendants. The flight was commanded by Capt. Joe T. D'Souza, a newly married Mumbaikar who had been with the company since 1947. He completed his flying training at Bombay flying club, holding CPL no. 241 and endorsed with DH-2, DC-3, Viking, Super Constellation and Boeing 707. The co-pilot Capt. Geoffrey Charles Wilks from Calcutta(now Kolkata), was an Indian Air Force veteran, a Vir Chakra awardee that was presented to him on the Republic day in 1950 for his bravery in Indo-Pak war of 1947.

Final Moments

Transcription of Messages between Geneva Radar and AI 101 on 127.3 MHz, 12 Jan 1966

(Note: Unrelated Transmissions have been omitted)

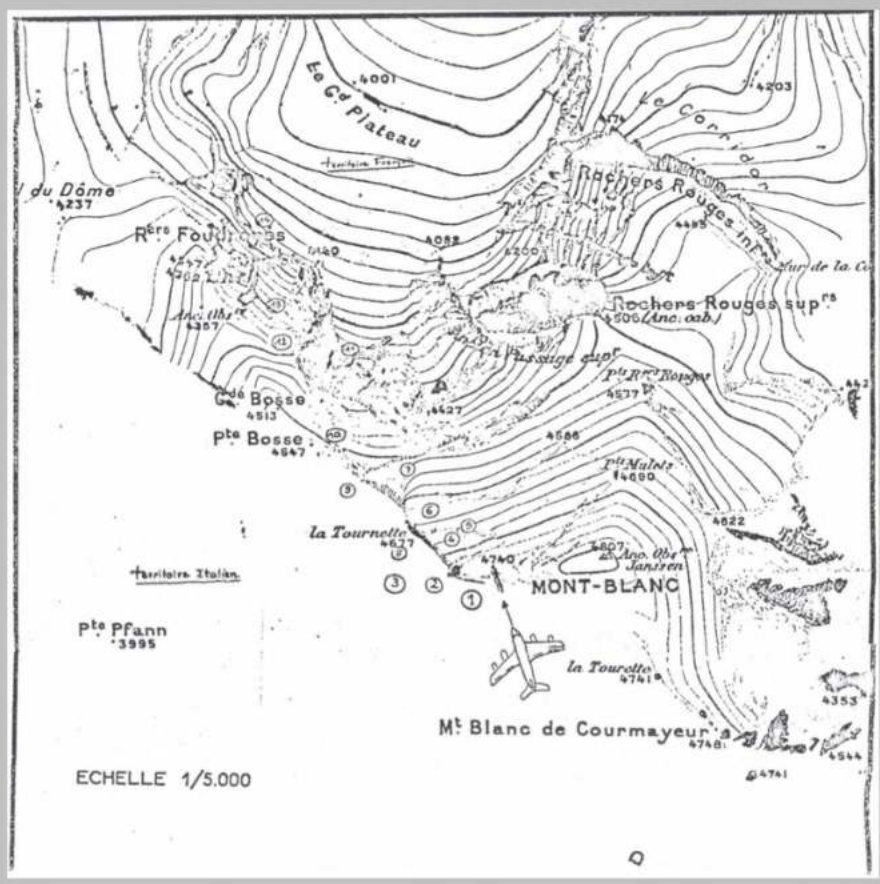
06.51.13"	AI 101:	Geneva Control, Air India 101.
	Geneva:	Air India 101, Geneva, good morning, go ahead.
	AI 101:	Good morning, 101 is reporting Torino at 51, 310, Mont Blane 02, Gland next. Request descent clearance.
	Geneva:	Air India 101 is cleared to Gland, to descend to flight level 200. The time 51 and a half, the runway 23, go ahead.
06.51.41"	AI 101:	101 is cleared down to two hundred, Roger.
06.52.10"	Geneva:	Air India 101, Radar, squawk alpha one one.
06.53.18"	Geneva:	Air India 101, squawk alpha one one.
	AI 101:	Alpha one one.
06.55.33"	Geneva:	Air India 101, I do not get your squawk at that time.
	AI 101:	Roger, Sir. How do you get it now?
06.55.49"	Geneva:	Geneva: Ah, Roger. Squawk Ident.
	AI 101:	101, identing.
06.56.00"	Geneva:	Identified, Air India 101.
	AI 101:	Roger.
06.58.54"	AI 101:	Geneva, 101 is approaching 210.
	Geneva:	Air India 101, continue your descent to flight level 190.
06.59.02"	AI 101:	101, recleared to 190.
07.00.35"	AI 101:	101 is approaching 190,
	Geneva:	Roger, maintain, unless you are able to descend VMC one thousand on top.
07.00.43"	AI 101:	OK, Sir, will do that. Descend one thousand on top. And I think, we are passing abeam Mont Blane now.
07.00.48"	Geneva:	You have five miles to the Mont Blanc.
	AI 101:	Roger.
	Geneva:	Geneva QNH 1013.
07.00.55"	AI 101:	1013 and we are leaving 190 this time.
07.04.15"	Geneva:	Air India 101, did you squawk off?
07.04.26"	Geneva:	Air India 101, Geneva.
07.04.45"	Geneva:	Air India 101, Radar.
07.04.12"	Geneva:	Air India 101, Radar.
07.05.16"	SR 972:	Air India 101, Geneva is calling you this frequency (SR 952, Zurich-Geneva).
07.05.57"	Geneva:	Air India 101, Radar.
07.06.24"	Geneva:	Air India 101, do you read?
07.06.56"	Geneva:	Air India 101, Radar.
07.08.47"	Geneva:	Air India 101, do you read?
07.09.00"	Geneva:	Air India 101, do you read?
07.09.26"	Geneva:	Air India 101, Radar.
07.22.40"	Geneva:	6029, we suppose having lost an aircraft over the Mont Blanc, could you accept to go to make a turn over the Mont Blanc?
07.32.08"	I 6029:	For your information about Mont Blane, we noticed a black clouds, the black cloud was at about 1600 feet, it was appearing as to low cumulus clouds (?) it was boiling up Through low cumulus clouds.
	Geneva:	6029, say again the end of your message.
	I 6029:	Roger, for your information, it was heard 101. The black clouds was at about 1600 feet, it was appearing us as low cumulus clouds. it was boiling up through low cumulus clouds.

Investigation

Rescue teams found wreckage scattered on the south-west side of the mountain, about 1,400ft (427 metres) below the summit. Gerard Devoussoux, a mountain guide who was one of the first to arrive at the disaster scene, said: "Another 15 metres (50ft) and the plane would have missed the rock. It made a huge crater in the mountain". After a few hours, the search was called off due to poor weather, and the authorities radioed back the news that "there was no hope for the passengers"

he investigation of the fatal accident went on for over 2 years by Bureau d'Enquêtes et d'Analyses (BEA), the French aviation safety enquiry agency. The commission concluded that the most likely hypothesis was the following:

a) The pilot were aware before departing Beirut that one of the VORs was unserviceable, they miscalculated their position in relation to Mont Blanc and reported their own estimate of this position to the controller; the radar controller noted the error, determined the position of the aircraft correctly and passed a communication to the aircraft which, he believed, would enable it to correct its position.;
b) The correction was mis-understood by the pilot who, under the mistaken impression that he had passed the ridge leading to the summit and was still at a flight level which afforded sufficient safety clearance over the top of Mont Blanc, continued his descent." Flight 101 then started to descend from FL190 until it struck the Mont Blanc at an elevation of 15585 feet (4750 m).

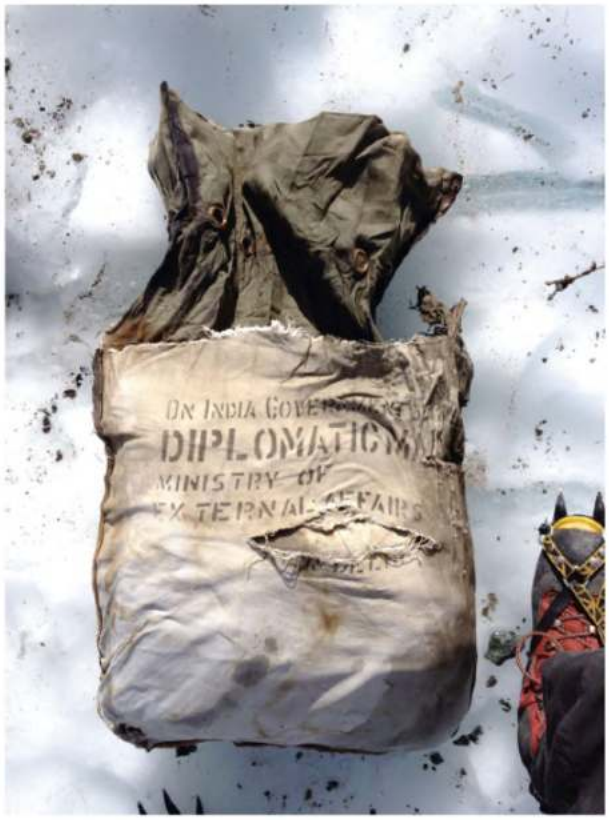


Pilots were told to maintain that flight level "unless able to descend VMC one thousand on top". The pilot confirmed this and added that they were passing abeam Mont Blanc. The controller noted that the flight wasn't abeam Mont Blanc yet and radioed "you have 5 miles to the Mont Blanc", to which the pilot answered with "Roger." Flight 101 then started to descend from FL190 until it struck the Mont Blanc at an elevation of 15585 feet (4750 m).

Melting Glaciers and Revelations

Lately glaciers at Mont Blanc have started melting at an alarming rate due to global warming. While it is worrisome for everyone, hiking enthusiasts have spotted wreckage of the aircraft along with passenger belongings at the crash site. In September 2013 a French alpinist found a metal box marked with the Air India logo at the site of the plane crash on Mont Blanc containing rubies, sapphires, and emeralds worth more than $300,000, which he handed in to the police to be returned to the rightful owners. As no rightful owners were found, however, in December 2021, the gems were divided up equally between the alpinist and the Chamonix commune: each receiving 75,000 euros.

Several efforts have been made recently to recover articles of any significance by the Indian High Commission in France. More recently, Indian newspapers were found in perfectly good condition glorifying Indira Gandhi, being the first woman Prime minister of India.



Conspiracy Theories

As the black box was never recovered, there is no way to verify that the pilot descended before Mont Blanc. This lead to a lot of speculations and conspiracy theories. Most notable ones were:

Philippe Réal, editor at ORTF, France's public broadcaster

Philippe didn't buy the official narrative and sent his own camera crew to investigate, from the Italian side of Mont Blanc. France's then-interior minister rang up the head of ORTF and asked him to immediately stop their investigation and confiscated the wreckage the journalists had brought down. Réal's team found two strange pieces of evidence — first, one part of the wreckage that was stamped with the date 1 June 1960, whereas the Boeing 707 had come into service only in 1961, and second, a yellow section of a fuselage, 25cm by 12cm, bearing bunches of wiring, circular switches and rusting brackets with the letters "USAF" (United States Air Force) printed on it above numerical codes. According to him, Air India 101 had crashed after colliding with another aircraft.

Jean-Daniel Roche, a French businessman

Roche went on to become an aviation disaster enthusiast making dozens of trip to the site in an attempt to unearth the truth. Roche has over the years collected more than 3 tons of wreckage. Initially, Roche propagated the idea that the 1966 flight had been downed by a missile. But later paralleled with the theory put out by the ORTF team, that the Air India flight crashed after colliding with another aircraft, an American made F-104G Starfighter fighter jet.

CIA

The theory of CIA involvement in the crash was based on alleged confessions of Robert Crowley, second in command of the CIA's Directorate of Operations (in charge of covert operations) at the time of the crash. In 1993, Douglas conducted a series of interviews with CIA officer Robert Crowley, later published in a 2013 in his book Conversations with the Crow. Crowley claimed the CIA had assassinated Indian nuclear scientist Homi Bhabha on board the flight, thirteen days after Indian Prime Minister Lal Bahadur Shastri in order to thwart the Indian nuclear programme. This was done by setting up and exploding a bomb inside the cargo area of the plane. Bhabha had two years before the crash, publicly claimed that India could develop its own nuclear device in less than 18 months. In the book, the CIA officer refers to Bhabha and the alleged incident by saying: "That one was dangerous, believe me. He had an unfortunate accident. He was flying to Vienna to stir up more trouble when his Boeing 707 had a bomb go off in the cargo hold."

Aftermath

Regardless of Roche and others' conspiracy theories, the Bossons glacier continues to reveal more and more about the Air India crashes every year. Many of the discoveries at Mont Blanc have been sold to make money and many picked up by local residents and café-restaurant owners, who have displayed them as part of the décor. Many of these cafes are now Air India-themed.

After the accident, Vikram Sarabhai, succeeded Bhabha at the Indian Atomic Energy Commission. Subsequently, India successfully tested its first nuclear bomb at Pokhran in 1974.

In 2019, PM Modi unveiled a memorial for the victims of the two Air India plane crashes in Saint Gervais, near the French Alps. The Prime Minister also paid tribute to Dr Homi Jehangir Bhabha.

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