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**FINAL REPORT ON ACCIDENT INVOLVING CESSNA A185F
AIRCRAFT VT-ETU OF M/S AGNI AERO SPORTS ADVENTURE
ACADEMY PRIVATE LIMITED ON 17.04.2022 AT JAKKUR
AIRFIELD, KARNATAKA.**

**Dinesh Kumar
(Investigator-In-Charge)**

**Ravi Ramakrishna
(On Job Trainee)**

FOREWORD

In accordance with Annex 13 to the Convention on International Civil Aviation Organization (ICAO) and Rule 3 of Aircraft (Investigation of Accidents and Incidents), Rules 2017, the sole objective of the investigation of an Accident/Incident shall be the prevention of accidents and incidents and not to apportion blame or liability. The investigation conducted in accordance with the provisions of the above said rules shall be separate from any judicial or administrative proceedings to apportion blame or liability.

This document has been prepared based upon the evidences collected during the investigation, opinion obtained from the experts and laboratory examination of various components. Consequently, the use of this report for any purpose other than for the prevention of future accidents or incidents could lead to erroneous interpretations.

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GLOSSARY

AAIB	Aircraft Accident Investigation Bureau
ADs	Airworthiness Directives
AMSL	Above Mean Sea Level
ARC	Airworthiness Review Certificate
AASAAPL	Agni Aero Sports Adventure Academy Pvt. LTd.
ATC	Air Traffic Control
ATPL	Airline Transport Pilot Licence
ASDA	Accelerate Stop Distance Available
AUW	All Up Weight
BIAL	Bangalore International Airport Ltd
BSR	Basic Safety Requirements
C of A	Certificate of Airworthiness
CAR	Civil Aviation Requirements
CFT	Crash Fire Tender
CG	Centre of Gravity
CAMO	Continuing Airworthiness Management Organisation
CPCP	Corrosion Prevention & Control Program
CPL	Commercial Pilot Licence
DGCA	Directorate General of Civil Aviation
ELT	Emergency Locator Transmitter
FDTL	Flight Duty Time Limitations
GFTS	Government Flying Training School
Hrs	Hours
IAF	Indian Air Force
IATA	International Air Transport Association
ICAO	International Civil Aviation Organisation
IMD	India Meteorological Department
LDA	Landing Distance Available
MEL	Minimum Equipment List
MLG	Main Landing Gear
MTOW	Maximum Take Off Weight
NCC	National Cadet Corps
NDB	Non Directional Beacon
NLG	Nose Landing Gear
NM	Nautical Miles
NOSIG	Not Significant

NTSB	National Transportation Safety Board
OLS	Obstacle Limitation Surfaces
OM	Operations Manual
PF	Pilot Flying
PIC	Pilot in Command
PM	Pilot Monitoring
QRH	Quick Reference Handbook
SB	Service Bulletin
TORA	Takeoff Runway Available
TODA	Takeoff Distance Available
VMC	Visual Meteorological Conditions
US	United States
UTC	Universal Time Coordinated
USPA	United States Parachute Association

Aircraft and Accident details of Cessna A185F Aircraft VT-ETU on 17 April 2022			
1.	Aircraft	Type	Cessna A185F Sky Wagon
		Nationality	Indian
		Registration	VT-ETU
2.	Owner	Agni Aero Sports Adventure Academy Private Limited.	
3.	Operator	Agni Aero Sports Adventure Academy Private Limited.	
4.	Country of Manufacture	USA	
5.	Pilot	ATPL	
6.	No. of Persons on board	02	
7.	Date & Time of Accident	17 April 2022 & 1212 Hrs UTC	
8.	Place of Accident	Jakkur Aerodrome	
9.	Co-ordinates of Accident Site	Lat: 13°04'38'' N Long: 077°.35'58'' E	
10.	Last point of Departure	Jakkur Aerodrome	
11.	Intended landing place	Jakkur Aerodrome	
12.	Type of Operation	Non-Scheduled Operation	
13.	Phase of operation	Landing	
14.	Type of Occurrence	Runway Excursion	
15.	Extent of Injuries	Nil	

(All the timings in this report are in UTC unless otherwise specified)

SYNOPSIS

On 17 April 2022, a Cessna aircraft VT-ETU belonging to M/s Agni Aero Sports Adventure Academy Pvt. Ltd (AASAAPL) met with an accident at Jakkur Aerodrome, Bengaluru at approximately 1212 UTC. The aircraft was piloted by a single pilot and had one passenger onboard. After a normal touchdown on runway 08, aircraft veered off to left and consequently toppled on the unpaved portion of the runway strip. The aircraft was substantially damaged. Both occupants aboard, the PIC and the passenger, remained uninjured in the accident.

Occurrence was classified as Accident as per the Aircraft (Investigation of Accidents and Incidents) Rules, 2017. Aircraft Accident Investigation Bureau vide its Order No. INV 11011/5/2022-AAIB dated 21 April, 2022 appointed Mr. Dinesh Kumar, Assistant Director as an Investigator-in-Charge. Mr. Ravi Ramakrishnan, Consultant was associated to this investigation to undergo his OJT.

Initial Notification of the occurrence was sent to ICAO and the NTSB, USA on 19 April 2022 as per requirement of ICAO Annex 13. No Accredited Representative was delegated by NTSB for this investigation. However, NTSB facilitated relevant information pertaining to the passenger (who is a US citizen) during the course of investigation.

Unless otherwise indicated, recommendations in this report are addressed to the regulatory authorities of the State having the responsibility for the matters with which the recommendation is concerned. It is for those authorities to decide what action is taken.

1. FACTUAL INFORMATION

1.1 History of Flight

On 17 April 2022, a Cessna A185F SkyWagon II aircraft while operating a local sortie at Jakkur Aerodrome met with an accident subsequently to landing at runway 08. The aircraft was under the command of a pilot holding an Open Rating as PIC and was accompanied by one onboard Skydiving Instructor as passenger.

As per the statement, crew reported for duty at 0430 UTC at AASAAPL and thereafter, MET briefing was gathered from the ATC. The crew underwent Breath Analyzer test prior to commencing the first sortie of the day. Aircraft Pre-Flight inspection was carried out and load and trim sheet was also prepared by the PIC prior to taxiing out the aircraft.

As per Jakkur ATC, aircraft gave startup request at 0830 UTC and subsequently it was approved as the weather was clear and no other traffic was on hold. As per weather forecast report, visibility of 6 km with no significant changes in weather condition was reported by the Met Department. Thereafter, Runway 08 was allocated for takeoff as wind reported was variable but favoring runway 08 operation.

As per ATC Jakkur, initially aircraft practiced taxi run on both sides of runway i.e. 08 and 26 for around 35 minutes before it requested for Takeoff at approximately 0908 UTC. After takeoff from runway 08, aircraft followed the Right Hand circuit pattern and finally landed at 0958 UTC after performing 07 circuit landings. Thereafter, PIC communicated to ATC that after 30 minutes they will get back to them for startup clearance.

During these sorties, a trained Skydiving¹ Instructor was onboard to observe and guide the PIC on sky-diving pattern overhead Jakkur airfield. As per the statement of Skydiving Instructor, PIC was advised on how to be aware of any parachutist after the pilot drops them and to keep an eye on them while the aircraft is descending and on final approach. In addition to this, PIC was briefed about how to identify and align with dropping zone, aircraft attitude required for safe dropping of skydivers and precautions to be taken to avoid drifting from the intended landing area.

As per ATC Jakkur, at 1040 UTC, the aircraft again requested for startup. After clearance from ATC, it took off from runway 08 and followed the same profile. After break, aircraft performed 10 landings between 1040 UTC to 1207 UTC and all were normal according to ATC personnel.

During the 10th Sortie, as per PIC statement, while the aircraft was on approach, flap 30 selected and approach speed 70 knots was maintained. Thereafter, aircraft reported on finals. ATC Jakkur cleared the aircraft to land on runway 08. Aircraft landing was normal and it touched down on runway 08 abeam intersection 'B' at 1212 UTC. While the aircraft was on landing roll, person manning the ATC Tower observed that aircraft got toppled.

¹ Skydiving is defined as an activity- exiting an aircraft in flight, falling free and descending under gravity and using a canopy in the final stages for a controlled touchdown

According to PIC, after touchdown while the aircraft was deaccelerating, birds were observed on left of the runway and therefore, to avoid any bird strike aircraft was steered towards right. Immediately after turning towards Right, PIC noticed stray dogs approaching from right. Instinctively PIC applied left rudder and left brake to avoid the dogs. However, ATC did not notice any bird activities or any stray dog on the runway. Thereafter, aircraft started veering towards Left. As a corrective action, right rudder and right differential brake was applied to control the aircraft. However, aircraft continuously drifted towards left and exited the paved runway. As per PIC, during landing roll, the tail wheel steering was in locked position. Once the aircraft exited the paved runway, aircraft toppled near left of runway edge (Fig 1). PIC was immediately contacted on RT by ATC but no response was received. Thereafter, operator was informed about the accident.



Fig 1: Aircraft lying toppled at accident site

Before ATC team arrived at site, operator’s rescue team with fire extinguisher reached at site. As both onboard occupants were strapped with their seat in upside down position and couldn’t release themselves, rescue team released them by unlocking their safety harnesses. As per PIC, before leaving the aircraft, engine was switched off and fuel was shut OFF. First Aid was instantly provided to both, before the PIC was taken to a hospital for post-accident medical examination.

1.2 Injuries to persons

Injuries	Crew	Passengers	Others
Fatal	Nil	Nil	Nil
Serious	Nil	Nil	Nil
Minor/ None	01	01	Nil

1.3 Damage to Aircraft

The aircraft was substantially damaged.

1.4 Other damage

Nil

1.5 Personnel Information

1.5.1 Crew Information – PIC

Nationality	Indian
Date of Joining Organisation	Dec 2021
Age	38
License	ATPL
Date of Issue	04 March 2016
Valid up to	10 Oct 2026
Category	Airplane
Date of Class I Med. Exam	08 Apr 2022
Class I Medical Valid up to	05 Oct 2022
Date of issue FRTOL License	01 March 2016
FRTOL License Valid up to	19 Sep 2026
Endorsements as PIC	Boeing B737, Dornier 228, OPEN RATING
Total flying experience	5197:11 Hrs.
Total flying experience on type	35:21 Hrs.
Last Flown on type	Cessna A185F Sky Wagon on
Total flying experience during last 1 year	38:51 Hrs.
Total flying experience during last 6 Months	35:21 Hrs.
Total flying experience during last 30 days	02:20 Hrs.
Total flying experience during last 07 Days	2:20 Hrs.
Total flying experience during last 24 Hours	2:20 Hrs.
Rest period before flight	Last flight was on 20 Feb 2021
Whether involved in Accident/Incident earlier	No
Date of latest Flight Checks, Ground Classes & Refresher	10 Dec 2021

The PIC started his carrier as a 'Fighter Pilot' after commissioned in Indian Air Force (IAF). While serving in IAF, he was assigned the task of a 'Test Pilot' and 'Instructor' to impart 'Combat Flying Skills' to newly inducted cadets at IAF. Between Aug 2017 and March 2020, the PIC was employed with M/s Spice jet as a Captain on Boeing 737 NG & MAX variants prior to joining M/s Agni Aero Sports Adventure Academy Private Ltd. After joining AASAAPL, the PIC had undergone the first familiarisation flight on Cessna 185F aircraft on 15 Dec 2021.

Flying Experience of PIC at different Organisations is tabulated below:

Organisation	Period	Aircraft	Exp (Flying Hrs.)
Indian Air Force	June 1996- July 2017	Jet Trainer Aircraft & Fighter Aircraft	3097:10 hrs.
Spice Jet	Aug 2017- March 2020	B737700/800/900-	2061:10 hrs.

Organisation	Period	Aircraft	Exp (Flying Hrs.)
		Boeing MAX	
Garg Aviation	24 Sep 2021- 24 Sep 2021	Cessna 310	03:30 hrs.
AASAAPL	Dec 2021- April 2022	Cessna 185F	35:21 hrs.

The flying experience of PIC prior to joining the organisation shows that he had significant experience on operating fighter aircraft, trainer aircraft as well as narrow body commercial aircraft. He also had adequate rest as per the Flight Duty Time Limitations (FDTL) requirement prior to operating the accident flight.

During investigation PIC was asked to share his experience on how Cessna A185F aircraft is different from other previously flown aircraft. PIC submitted the following:

“I, like most of my peers in aviation (Including military aviation) have majorly flown nose wheel aircraft. Even for small propeller/ piston aircraft, most of the aviators have nose wheel experience. Cessna 185 being a tail wheel aircraft with a powerful piston engine and propeller combination made it little trickier to master even as compared to lighter weight much underpowered propeller aircraft. The fact that pivoting point is ahead of CG makes it very unstable directionally on ground thus prone to phenomena called ground looping. “

PIC has further submitted the following about handling of tailwheel aircraft:

“Thus, for a pilot who is used to conventional nose wheel aircraft, getting proficiency on Cessna 185 requires large effort & time. Also, because the tail wheel aircraft are typically made to operate from grasslands and soft soil, operating from hard paved surface may prove to be disadvantageous as far as losing energy after landing is concerned. Thus, making aircraft very susceptible to sudden inputs. The low take-off and landing speeds entails aircraft can be operated from very short airstrips, but the challenges during transition from nose wheel to tail wheel aircraft actually imposes very high work load for a very experienced nose wheel pilot with very less or no experience on tail wheel. Hence, longer and wider runways might help someone transitioning from nose wheel to tail wheel aircraft.

Due to extremely high pilot input requirements till sufficient experience is gained, it is always very risk prone to operate from shorter, narrower hard runways and any bird/animal interference may prove to be very catastrophic.”

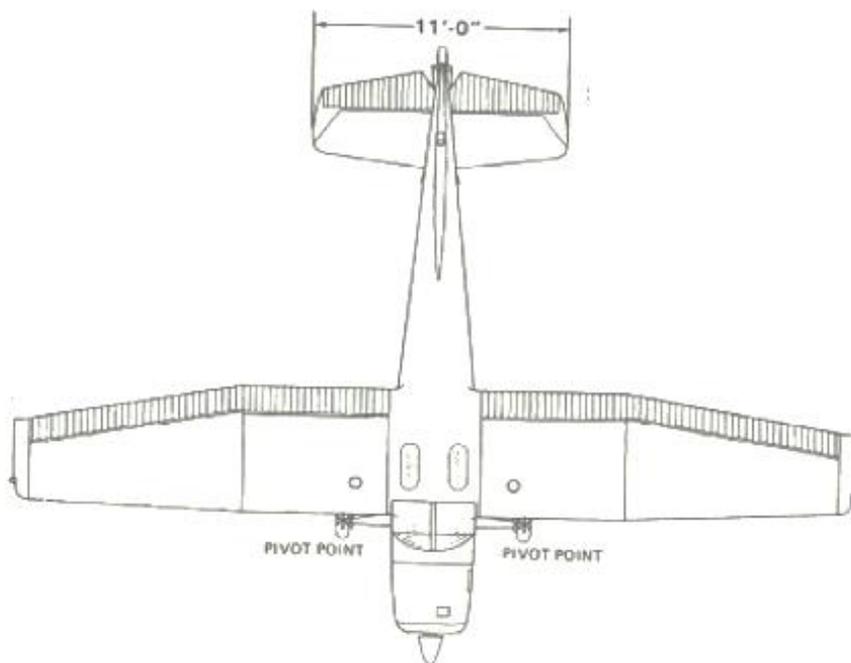
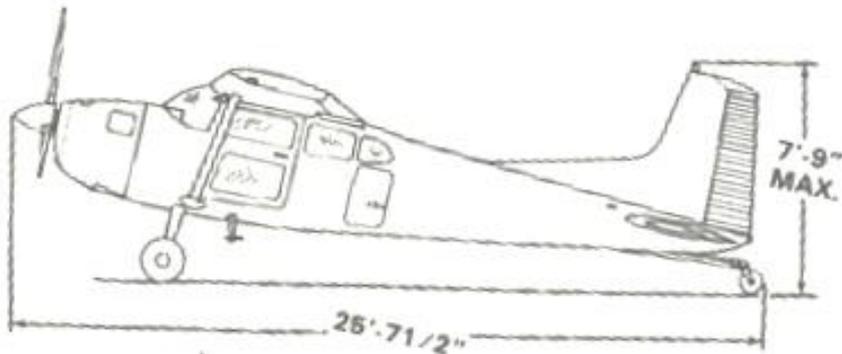
1.5.2 Passenger Onboard

The onboard passenger is a Skydiving Instructor in the USA and was on a tourist visa to India to advise on the aspects of Sky diving operations to the Company. On the day of accident, the passenger was on Right Hand seat and was giving briefing to the PIC on how to fly the sky-diving patterns.

1.6 Aircraft Information

1.6.1 General Information: Cessna A185 F Skywagon

The aircraft is a single piston engine aircraft manufactured by Cessna. The aircraft is a high-wing aircraft with non-retractable conventional landing gear. The main landing gears are ahead of centre of gravity whereas the tail wheel is positioned at aft of CG of the aircraft. Tail wheel is made much smaller in size and lighter than a nose wheel.



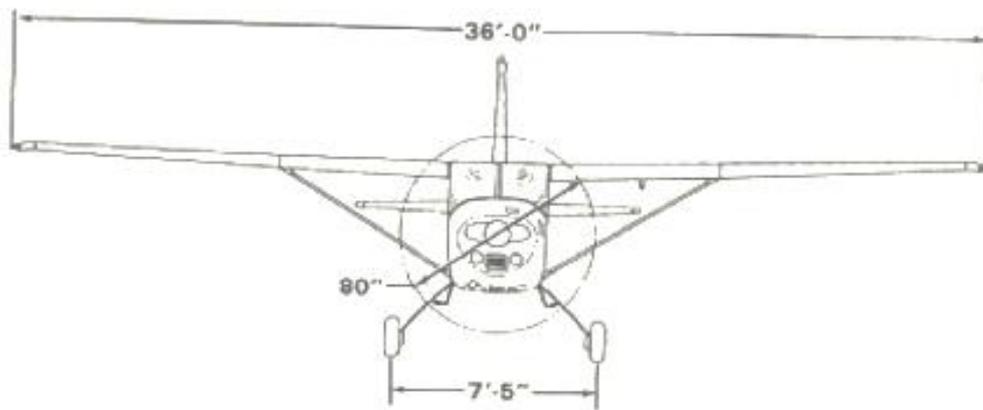


Fig 2: Aircraft Dimensions

Different Systems of the aircrafts which are relevant in context of this accident are briefly described below:

I. **Ground Control:** Aircraft's ground control while taxiing is accomplished through tail wheel steering by using the rudder pedals; left rudder pedal to steer left and right rudder pedal to steer right. When a rudder pedal is depressed, a cable and spring assembly (which is connected to the tail wheel and to the rudder cable system) will turn the tail wheel through an arc of approximately 24 each side of centre (after which it becomes free swiveling) with the tailwheel lock disengaged and 2.5 each side of centre with the tail wheel lock engaged.

II. **Tail Wheel Lock:** The steerable tail wheel incorporates a manual anti-swivel locking system. The locking lever, located on the cabin floor tunnel, controls a spring-loaded locking lug on the tail wheel assembly. To lock the tail wheel, move the lever aft to the 'LOCK' position. To unlock the tail wheel, move the lever forward to the 'UNLOCK' position.

III. **Brake System:** The airplane has a single-disc, hydraulically- actuated brake on each main landing gear wheel. Each brake is connected by a hydraulic line to a master cylinder attached to each of the pilot's rudder pedals. The brakes are operated by applying pressure to the top of either the left (Pilot's) or right (Co-pilot's) seat of rudder pedals, which are interconnected.

1.6.2 Aircraft Specific Information (VT-ETU)

The aircraft is registered under categorized 'Normal' with sub category 'Passenger/Aerial work'² (Sky diving- Towing operation) and the minimum number of crew specified to operate this aircraft is 'ONE', as per its C of A.

² Aerial work means any aircraft operation undertaken for an industrial or commercial purpose or any other remunerative purpose, but does not include operation of air transport service. An aerial work aircraft is generally modified and/or installed with suitable equipment for specialised operations such as aerial survey, geophysical survey, cloud seeding, agriculture, construction, photography, observation and patrol, search and rescue, aerial advertising, flight calibration of navigational aids, para dropping, external cargo operations, scientific research etc.

Aircraft Information

Aircraft Model	Cessna A185F Skywagon II
Aircraft S/N	18504421
Year of Manufacturer	1984
Name of Owner	Agni Aero Sports Adventure Academy Pvt Ltd
C of R	2563/4
C of A	2051/2
Category	Normal
C of A Validity	Valid as per ARC
ARC issued on	09 Sep 2021
ARC valid up to	09 Sep 2022
Aircraft Empty Weight	925 KG
Maximum Take-off weight	1497 KG
Date of Aircraft Weighment	05 Nov 2019
Empty weight CG	88 cm from datum
Max Usable Fuel	292 kg
Max Payload with full fuel	193 kg
Next Weighing due	N/A
Total Aircraft Hours	5382.29 Hrs.
Last major inspection	06 Months/50 hrs inspection on 16/01/2022
List of Repairs carried out after last major inspection till date of accident	Continuous Airworthiness Programme Inspection & Brake hose replacement carried out on 5380.09 Hrs.
Engine Type	Continental IO-520-D
Engine Sl. No.	1007514
Date of Manufacture	19 Nov 2012
Last major inspection	Annual Inspection on 18/07/2021
List of Repairs carried out after last major inspection till date of accident	Nil
Total Engine Hours	426.19 Hrs.
Aero mobile License	A089/01-RLO(SR) valid upto 28 Feb 2026
AD, SB, Modification	FAA AD 2020-21-22 dated 17 Nov 21/5342-10.

Corrosion Prevention & Control Program (CPCP) inspection was carried out as per procedure sheet on 16 Jan 2022. The tech-log of the aircraft had no entries of any defects/MEL and was serviceable on the day of the accident. However, it was found that ELT had not activated after the accident.

All concerned Airworthiness Directives and Mandatory Service Bulletins, DGCA Mandatory Modifications on this aircraft and its engine were complied with as on the date of accident.

1.7 Meteorological Information

Jakkur aerodrome is an uncontrolled aerodrome, hence, before the commencement of the first flight of the day, weather information in respect of Jakkur aerodrome is gathered primarily through IMD website. In addition to this, the local ATC at Jakkur aerodrome has the practice to collect weather information of two nearby airports. On the day of accident, weather record of HAL airport and Kempegowda International Airport (BIAL) is provided below:

Airports	Time (UTC)	Winds	Visibility	Clouds	Temp (°C)	QNH	Forecast
HAL	1300	VRB/02 Kt	6000 m	SCT 012	28	1011	NOSIG
	1200	230/06 Kt	6000 m	SCT 012	29	1009	NOSIG
BIAL	1230	060/02 Kt	6000 m	SCT 012 FEW025CB	30	1010	NOSIG
	1200	070/05 Kt	6000 m	SCT 012 FEW025CB	30	1010	NOSIG

No Significant weather change was reported by any ATC station.

1.8 Aids to Navigation

Jakkur Aerodrome with Runway orientation 26/08 is a “Visual Approach Runway” and no other navigation aid for landing is installed at the airport.

1.9 Communications

On the day of accident, positive two-way communication was available between ATC and the aircraft on local frequency 122.5 MHz. However, at Jakkur aerodrome, no mechanism is in place to record the communication between tower controller and the operating aircraft.

The communication between the ATC and the aircraft is made by means of a VHF handset with a range of 5 nm and a VHF station with a range of 25 nm. ATC at Jakkur is controlled by the Government Flying Training School, which is a state-owned organisation. ATC is manned by Cadets from GFTS who are qualified CPL holders with RTR (A) license.

As per the statement of PIC and ATC personnel, no information was communicated to the crew neither regarding any bird activities on runway nor any animal movement inside the aerodrome while the aircraft was on approach or even after touchdown prior to accident.

1.10 Aerodrome Information

Jakkur Aerodrome is an uncontrolled airport and its ICAO location Indicator code is VOJK. This aerodrome is owned by the Government Flying Training School (GFTS, Flying Training Organization), Government of Karnataka.

The geographical co-ordinates of the airport are 13° 04' 39" N & 77° 35' 50" E. The elevation of the airport is 918 m (AMSL) and the orientation of the runway is 08/26. There is an elevated Highway (flyover) of about 12.1 meters height on the Approach to runway 08. It resulted into displacement of threshold of runway 08 towards East. As per Aerodrome information, it is included in the list of obstacles for approach on runway 08.



Fig 3: Layout of Jakkur Aerodrome

The airport is primarily utilized to impart flying training to student pilots and to perform aero sports activities. However, on few occasions, some Non-scheduled operators also operate their flights from Jakkur with VIP's onboard. Furthermore, Jakkur Aerodrome also serves as a base for several private aviation companies including one NCC Air Squadron and this unit imparts flying and institutional training to Air Wing Cadets of the NCC.

Other than AASAAPL, the following operators operate from Jakkur Aerodrome:

S. no	Operators	Government/Private
1.	Government Flying Training School	Government
2.	Karnataka Air Squadron NCC	Government
3.	Confident Airlines	Private
4.	Jupiter Aviation Services	Private
6.	Bangalore Aero Sports Pvt Ltd	Private
7.	Deccan Charters	Non-Scheduled
8.	Aerial Works Aero LLC	Private
9.	Thumby Aviation Pvt Ltd	Non-Scheduled
10.	Davangere Sugar Company Pvt Ltd	Non-Scheduled

S. no	Operators	Government/Private
11.	Chipsan Aviation Pvt Ltd	Non- Scheduled
12.	Belgaum Sugars Pvt Ltd	Non Scheduled
13.	Kelachandra Logistics Pvt Ltd	Private
14.	Kalyan Jewellers India Ltd	Private
15.	IIC Technologies Ltd.	Non-Scheduled
16.	Durga Bearings Company Pvt Ltd	Private
17.	Sanmar Shipping Ltd	Private
18.	DY Uppar & Sons	Private

Notwithstanding the number of organisations operating from Jakkur Aerodrome, ATC is handled by CPL cadets of GFTS, who have completed their flying training and hold a CPL license. However, they have not undergone any basic course/training on ATC regulations or handling any emergency situation at the airport.

It is clearly mentioned in GFTS TPM that compound wall is not available for a small portion on the North East of the aerodrome and proper watch and ward arrangements have already been made by GFTS to prevent runway incursion during aircraft operations. Later, on further investigation about the perimeter wall, GFTS informed that a litigation is pending regarding that area due to which boundary wall cannot be constructed on that area. Furthermore, GFTS has submitted that approximately 144 meters gap is manned by a security guard permanently.



Fig 4: Open Area

As Air Force Station, Yelahanka exists at proximity of 3.45 Nm, flying activities at Jakkur are subjects to positive clearance from IAF prior to operating any flight.

During visit to Jakkur, the investigation team had also observed bird activities inside the controlled area of aerodrome during morning and evening hours. No dedicated CFTs are presently available with the airport operator. In order to tackle any exigency, they are dependent on external support from local administration.



Fig 5: Bird activities observed inside the aerodrome

The seat from the ATC tower provides a satisfactory view of the Runway and the area around the aerodrome including approaches above the elevated highway. However, no recording camera has been installed to capture the aircraft movements on the runway at the airport. During visit by investigation team, it was noticed that the glass panels of ATC tower were slightly grimy, therefore creating hindrance in clear view of the runway.



Fig 6: Outside view from ATC tower's front glass panel

On behest of Aerodrome Operator, an Obstacle Limitation Surfaces (OLS) survey was conducted by AAI from 10 Mar 2021 to 16 Mar 2021. The following were some of the salient findings of the report:

1. The runway length at Jakkur airport is 854 m X 20 m and runway orientation is 08/26.
2. During survey, the width of runway 08/26 was found to be 20 m whereas in the GSR 751 (E) the width is notified as 21 m. However, the Report stated that with this change of runway width from 21 m to 20 m, there is no impact on the obstacle assessment in and around the Jakkur Aerodrome for both Code 1 and Code 2 Non Instrument VFR operations.
3. In case an object has infringed the approach surface of the runway and the object cannot be removed, the runway threshold can be displaced by a suitable distance in accordance with DGCA Civil Aviation Requirement (CAR Section 4 Series B Part I) by the aerodrome operator concerned.
4. The runway length at Jakkur airport is 854M which is suitable for Code 1 aerodrome reference field length of the aeroplane.
5. Based on the survey, the declared distances for Code 1 runway were worked out as follows subject to pruning of trees to permissible levels:

RWY DESIGNATED	TORA (m)	TODA (m)	ASDA (m)	LDA (m)
RWY 08	854	854	854	612
RWY 26	612	612	612	854

6. The maximum infringement to Approach surface of Runway 08 is 12.1 m by a flyover, therefore for Code 1 non-instrument runway the displacement would be $12.1 \times 20 = 242$ m.
7. Therefore, threshold of the runway 08 was displaced 242 m and LDA available is 612.

1.11 Flight Recorders

No flight recorder was installed in the aircraft. DGCA's Civil Aviation Regulations does not mandate the same as per CAR Section 2 Series I Part V.

1.12 Wreckage and Impact Information

1.12.1 Impact Information

The total runway length is 854 m (2801 feet) and aircraft made a touchdown near runway intersection B. The first evidence of main landing gear tyre marks on runway was observed from 117 feet ahead of second aiming point. However, wheel marks were slightly on right of runway centerline. Thereafter, aircraft travelled for approximately 300 feet parallel to runway centerline on the right side.



Fig 7: Track followed by the aircraft

Ground marks of aircraft's tailwheel, continuously drifting towards left, up to 111 feet, crossing the runway centerline was observed on the runway. Thereafter, aircraft started rolling on left of the runway centerline. At this location, all three tyre marks were noticed on the paved surface of the runway and a gap of 7.2 feet was observed between extreme ground marks (main wheels marks). Thereafter, aircraft continuously drifted towards left and ground marks were

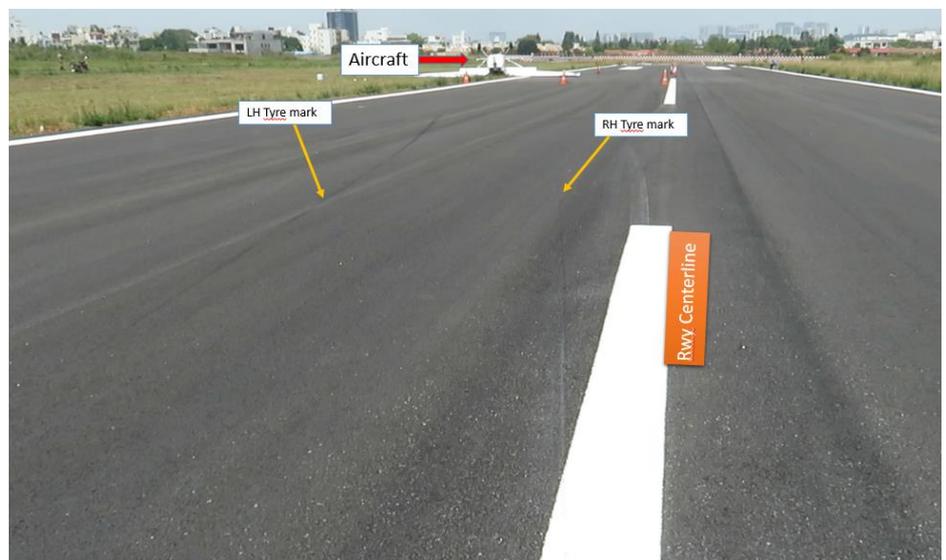


Fig 8: Tyre marks on the runway

observed for another 200 feet approx. However, no ground marks were observed ahead till the aircraft exited the paved surface.

Later, aircraft travelled on soft ground for approximately 11 feet before it toppled parallel on runway edge. Ahead of toppled aircraft, two ground marks were also observed. And out of these two, one was created due to nose cone impact and the other one was of propeller blade hitting the soft ground (Fig 9).



Fig 9: Ground marks

1.16.2 Aircraft Damage

The aircraft sustained substantial damage in the accident. Following damages were observed on the aircraft during damage assessment.

Damages observed on the aircraft fuselage

- 1) Dent noticed on lower cowling at nose section of the aircraft and the measurement of dent was Length- 11.5 cm, Height- 7.5 cm & Depth- 1.5 cm (approx.).



Figure 10: Clockwise - Nose Section; Dents observed on the Fuselage; Vertical Stabilizer and Rudder damaged

- 2) RH side aft of cabin section was found bulged and multiple dents were also noted. The paint was found flaked approximately 1.5 inch in length.
- 3) Due to impact on Vertical Stabilizer and Rudder, both found crushed approximately 18 inches from the top.
- 4) Left Side Wing Strut was found bent at 51 inches away from Wing-Strut joint.

Damages observed on Propeller

- 1) Propeller cone crushed due to impact with ground.
- 2) Rub marks observed on two propeller blades. One propeller blade found bent rearwards about 1/4th from root hub. And the other one was found curved along the length of the blade.
- 3) Nick noticed on tip of one propeller blade. Score mark noticed on blade.



Fig 11: Propeller cone damaged (above), Nick and score marks on propeller blade (below)

Damages observed on Wings

- 1) A small dent along with bulge area was noticed on lower surface of Left Wing.
- 2) Lower surface of Right Wing near Inspection Panel was found bulged.
- 3) A small dent observed on Leading Edge of Right Wing towards tip side.



Fig 12: Broken Antenna

4) Rubbing marks along with few dents observed all over wing span on upper surface.

5) Further, Communication Antenna No.1 and No.2 were also found broken.

1.13 Medical and Pathological Information

The PIC was subjected to a BA test prior to undertake the first flight of the day and was tested negative. In accordance with DGCA regulations, Crew shall undergo post flight medical examination, if he is found involved in any accident or serious incident. Therefore, PIC was subjected to post flight medical examination subsequently after the event. The PIC was taken to two different private hospitals for sample collections prior to admitting in a government hospital for medical examination. Blood sample of the PIC was collected and post flight medical examination was carried out, the tests showed negative results.

1.14 Fire

There was no pre or post impact fire.

1.15 Survival Aspects

The accident was survivable.

1.16 Tests and Research

Nil

1.17 Organizational and management information

1.17.1 Agni Aero Sports Adventure Academy

Agni Aero Sports Adventure Academy was established in the year 1994 at Jakkur, a small satellite airfield on the outskirts of Bangalore. The organization comprises of a Board of Directors and an Accountable Manager. The Company owns two Cessna Skywagons namely C 180H and C A185F aircraft (including VT-ETU) utilized for recreational activities from M/s Jakkur Aerodrome.

To carry out maintenance activities, the organisation has established their CAMO & maintenance hangar at Jakkur Aerodrome headed by an approved CAM & Maintenance Manager respectively.

1.17.1.1 Operations Manual of AASAAPL

Company's Operations Manual Issue 01 Rev 00 which contains operational instructions to be complied by all relevant personnel for the safe operations of operator's aircraft was issued on 22 July 2019. Operation Manual states that it follows the guidelines of DGCA CAR, Section 08 Series O Part VII, Section 03 Series N Part I, OPS CIRCULAR 05/2019 and DAT Circular 01/2019.

Scrutiny of the Operations Manual revealed the following:

- As per the OM Chapter 3 Para 3.2.1, Accountable Manager has to supervise the Flight Operations and shall ensure that Section 8 Series 'A' Part 1 regarding 'Aerial Work' must be complied. Relevant section of the CAR is reproduced at Additional Information Para 1.18.1 of this investigation report.
- Furthermore, Operations Manual Chapter 6 Section 2 states that the organisation will adhere to the Basic Safety Requirement (BSR's) as recommended by the USPA. (Refer Appendix A).
- In Chapter 8 of OM, guidelines are laid down to ensure that requirements of CAR on FDTL are complied so that PIC shall not fly fatigued. In this chapter, operator has stated that AASAA Pvt Ltd will monitor DGCA website for new FDTL requirements pertaining to Single Pilot Operations, until then current time limits will be adhered to.
- The Company has an Operational Manual approved by the DGCA dated 22 July 2019. No revisions have been included till date.

1.17.2 Government Flying Training School

GFTS was established in the year 1949. This organisation is functioning under Youth Empowerment and Sports Department of Government of Karnataka at Jakkur Aerodrome.

It is a DGCA approved Flying Training Organization and provides *ab-initio* training for different licenses and conversion courses. Also, GFTS is an approved maintenance organization under CAR M Subpart F & G. ATC Jakkur is headed by a Safety Manager/ Aerodrome Supervisor appointed by GFTS.

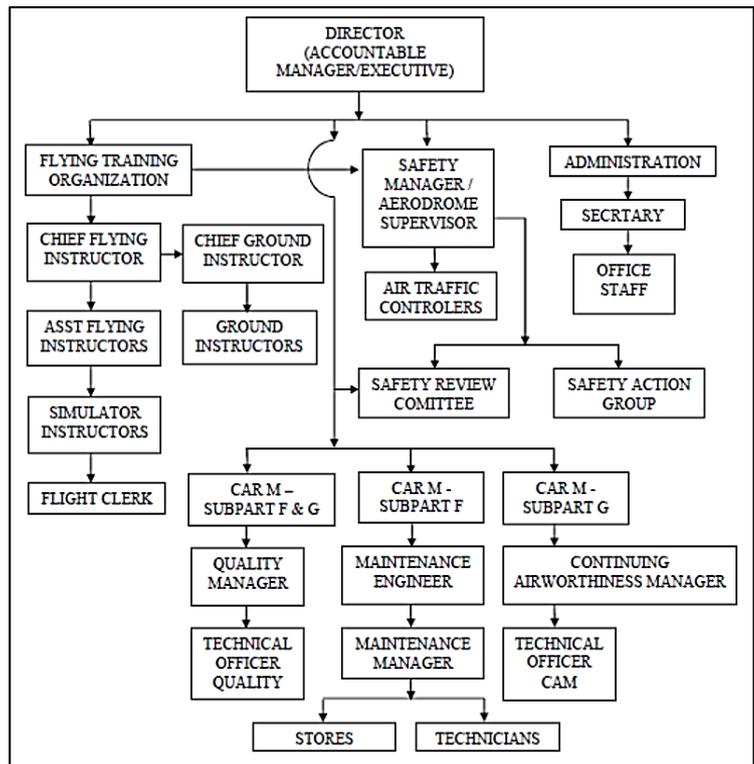


Fig 13: Organization Chart

1.18 Additional Information

1.18.1 Civil Aviation Requirements

CAR Section 3 Series N Part 1

This section of CAR deals with the requirements for undertaking aerial work operation. Given below is the relevant extract from CAR:

- The applicant shall comply with relevant CAR on flight duty time limitation for flight crew.
- An operator shall not assign a pilot-in-command or a co-pilot to operate at the flight controls of a type or variant of a type of aircraft, unless the pilots are current in the conduct of aerial work operation as per defined tasks in the operations manual.
- Carriage of passengers onboard and/or task specialists on an aerial work flight shall be permitted only after approval by DGCA under the relevant SOPs and provided the aircraft is certified for the purpose.

CAR Section 7 Series J Part IV

This section of CAR deals with regulations on FDTL and rest period of Flight Crew engaged in Scheduled, Non-scheduled and General Aviation (including State Govt. and PSUs) fixed wing operations effective from 23 March 2021.

Scope: Private and Aerial Operators operating non turbojet aero planes with less than 5700 kg AUW will use the requirements given in this CAR as guidelines and prepare their respective FDTL Schemes based on their type and size of operations. The scheme shall be included in Ops Manual and submitted to DGCA for approval.

Relevant extracts from CAR Section 7 Series J Part IV are reproduced below:

- No operator / flight crew engaged in such operations shall operate beyond 30 September 2021 unless the requirements of this CAR are complied with.
- The FDTL scheme shall be submitted to DGCA for approval. The scheme shall form part of the Operator's Operations Manual.

NOTE: Existing Operators, holding approval of FDTL scheme as per CAR Section 7 Series J Part III, issue II, dated 11th August 2011 need to implement the stipulated requirements w.e.f 30 September 2021 and accordingly amend their respective Operations Manuals.

Guidelines on FDTL for Single pilot operations

The maximum flight time and maximum flight duty period during any 24 hrs are indicated in the following Table.

Sub Para (CAR)	Max Flight Time	Max Flight Duty Period (in hours)	Max no. of Landings
8.1.1	7 hrs	08:30	08
8.1.2	8 hrs	09:30 11:00	06 04

CAR Section 8 Series A Part I

The requirements contained in this CAR are applicable to aeroplanes and helicopters engaged in scheduled, non-scheduled and other public transport operations including State Government operations and aerial work operations.

This section of CAR specifies the Minimum Flight Crew Requirements. It states that no operator may use any person nor may any person serve as a Pilot-in Command for the type of operations mentioned in Para 2 of this CAR for single pilot operation unless that person had at least **100 hours Pilot-in-Command** experience on the type and model of the aircraft to be flown and has met all other applicable requirements.

1.19 Useful or effective Investigation Techniques

Nil

2. ANALYSIS

2.1 Serviceability of Aircraft

The aircraft had a current Certificate of Airworthiness and its ARC was valid up to 09.09.2022. Scrutiny of records revealed that no snag or MEL was pending on the aircraft. Further, during preceding sorties, PIC did not observe any anomaly in aircraft and was responding according to control inputs.

The last major inspection 06 months/50 hours was carried out on the aircraft on 16.01.2022. The aircraft had flown 30:42 hours after the last major inspection, before it met with an accident. As per the records, all ADs, SBs and Major Modification were complied on the day of accident.

Notwithstanding the fact that the aircraft was manufactured in 1984, the serviceability of the aircraft does not appear to be a factor in the accident.

2.2 Weather

On the day of accident, other than the IMD website weather report from HAL airport and Kempegowda International Airport (BIAL) were also obtained and recorded as Jakkur is an uncontrolled airport. At 1212 UTC, visibility of 6000 meters and winds variable favouring runway 08 operation with no significant weather changes was reported at Jakkur airport. Hence, local weather conditions at Jakkur had no contribution during the accident.

2.3 Crew Flying Experience and Qualifications

PIC had a total experience of around 3097 hours as a flying crew on Fighter aircraft. Apart from operating Fighter jets, PIC served as Combat Flying Training Instructor to impart training to newly inducted cadets. PIC is also an ATPL holder, while employed as Captain at M/s SpiceJet and operated narrow body Boeing B737 variants.

Prior to obtaining authorisation to operate a Cessna 185 aircraft, as per the laid down requirement of CAR Section 7 Series B Part V XVII, PIC had completed his ground classes and

also underwent familiarisation flight on the same aircraft on 15 Dec 2021. Further, PIC has endorsement of Open Rating on his license which was current on the day of accident and therefore complied with the requirements to operate an aircraft having AYW less than 1500 kgs.

The pilot also had flying experience of only 35 hours as pilot-in-command on the type, which is way below the minimum requirements of 100 hours of pilot-in-command experience on type to undertake single pilot operations as laid down in CAR Section 8 Series A Part I.

Therefore, the pilot was qualified to operate the Cessna 185 aircraft, however, he was not qualified to operate the accident flight.

PIC total accumulated experience on Cessna 185 aircraft (which is a tailwheel aircraft) is only 35 Hrs. His most of the experience was on Nose wheel aircraft while serving at IAF & Spicejet. PIC has therefore shared his observation and submitted that a crew requires to put a lot of efforts in case crew is transitioning from a nose wheel aircraft to tail wheel aircraft even though if the crew is a highly experienced pilot on a nose wheel aircraft.

However, as per the passenger onboard, who is a skydiving instructor and also a pilot, during all previous sortie's aircraft operation appeared normal under the command of PIC.

From the above, it can be inferred that PIC was qualified to operate the aircraft, but lack of experience on the aircraft resulted in Pilot not handling the emergency situation properly which contributed to the accident.

2.4 Jakkur Aerodrome

Jakkur Aerodrome is an uncontrolled aerodrome owned by Government of Karnataka whereas ATC services are provided by GFTS. Therefore, the responsibility for maintenance and security of the aerodrome lies with Government of Karnataka.

The airport is primarily utilized by GFTS to impart flying training to student pilots. Although scheduled flight operations are not permitted from here, the aerodrome is being used by other Non-Scheduled operators, NCC Airwing, State Government aircrafts and hobby flyers subject to prior permission.

As the boundary wall of the aerodrome was broken and not properly secured by means of any fencing or net, the possibility of any stray animal to approach the active runway/operational area could not be ruled out. Further, slightly grimy glass panel of ATC tower also likely hindered the clear view of the runway. Investigation team had observed a lot of bird activities inside the aerodrome, which is a threat to safe operations of aircraft.

Therefore, there was all possibility of hazards present at airport which may have contributed to the accident.

2.5 Organizational aspects & Non-Adherence to CAR Requirements

During the investigation, it was observed that there is no supervision of the flying activities being carried out in the organisation. The Accountable Manager is entrusted with the

responsibility of supervising the flight operations and to also ensure that the relevant DGCA CAR regarding 'Aerial Work' is complied with. However, it was observed that none of these procedures as laid down in the company OM are being followed in the organisation.

Furthermore, it was observed that the organisation has not developed any procedure as per the requirement/guidelines given by DGCA regarding FDTL for single pilot operations. DGCA CAR Section 7 Series J Part IV clearly states that no operator is allowed to operate beyond 30 Sep 2021, if the latest FDTL scheme provided by DGCA as per CAR Section 7 Series J Part IV is implemented and the Operations Manual is amended accordingly. However, the operator has neither implemented the latest guidelines for FDTL nor amended their OM, but were carrying out the flying operations even after 30 Sep 2021 which is a gross violation of the DGCA requirements. Further, crew has exceeded the number of landings specified in the said Section of CAR and instead of 8 landings, a total of 16 landings were performed on the day of accident which is again a violation of the said CAR.

During the accident flight, a passenger was carried on board the aircraft, for which no prior approval/permission was taken from DGCA, as per the requirement laid down in DGCA CAR Section 3 Series N Part 1, which is a gross violation of DGCA CAR requirements.

Operator's Operations Manual has contained the guidelines on Basic Safety Requirements which are laid down in context of organization or crew operating in USA and therefore approved by an agency other than DGCA.

The Operations Manual clearly defines that it is the responsibility of the Accountable Manager to ensure that all relevant regulations laid down in CAR must be complied during the Aerial Work. Hence, the Accountable Manager failed to comply with the aforesaid regulations contained in the DGCA CAR.

2.6 Circumstances leading to the Accident

All previous circuit and landing flights were uneventful and neither the ATC nor the PIC noticed any bird activity or animal movement near the active runway during these circuits.

During the last circuit, while the aircraft was on approach, as per PIC, landing checklist was followed and subsequently landing clearance was taken prior to landing at Jakkur airport. Thereafter, landing was performed with tailwheel lock, flap selected 30, maintaining an approach speed of 70 knots. As per PIC, approach was stabilized and touchdown was normal. Aircraft landed ahead of displaced threshold near intersection B. While the aircraft was on landing roll, crew observed bird activities on left side of runway, and to avoid them, PIC veered the aircraft slightly towards right. This was confirmed by the tyre marks observed on the runway that aircraft was rolling on right of runway centreline. As the PIC focus was on avoiding birds on the active runway, he noticed few dogs approaching from right. To avoid them, an intuitive action was taken and immediately left rudder was applied. Aircraft deviated quite viciously towards left. Thereafter, efforts were made by the PIC to correct the deviation with right rudder and right brake.

As the tailwheel locking lever of the aircraft is at cockpit floor and not possible to access while aircraft is in motion hence tailwheel remained in the locked position. Therefore, the only option available with the PIC was rudder deflection along with differential braking. However, as speed was low hence rudder deflection was not effective and therefore, PIC could not efficiently control the steering of aircraft towards left. This resulted into continuous drifting of aircraft towards left and finally the left main wheel exited the paved surface of the runway.

The left main wheel tyre started rolling on soggy and uneven shoulder of the runway (due to heavy rain on previous night) and this amounted to left wheel braking and as the right wheel was already being braked to apply correction to right, this resulted into sudden braking condition of both main wheel tyres simultaneously. This sudden braking action while the aircraft had momentum lead to aircraft to topple head on.

3. CONCLUSION

3.1 Findings

3.1.1 General

- 1) The Certificate of Airworthiness, Certificate of Registration and Airworthiness Review Certificate of the aircraft were valid on the day of accident.
- 2) All concerned airworthiness directives, mandatory service bulletins, mandatory modifications on the aircraft and its engines as on date of accident had been complied with.
- 3) No snag was pending for maintenance prior to the accident flight.
- 4) The PIC had an Open rating and had undergone the requisite familiarisation training on Cessna A185F aircraft and was therefore meeting the requirements to operate the said aircraft.
- 5) The PIC had carried out 16 circuit landings preceding accident flight. However, as per CAR guidelines on FDTL for single pilot operation a maximum of 8 landings are permitted in maximum flight time of 7 hours.
- 6) The PIC was an experienced pilot with a total of about 5197 flying hours majority of which had been on Tri-cycle landing gear aircraft and was relatively new to the Conventional Landing gear aircraft on which he had only about 35 hours of flying experience.
- 7) The pilot was not meeting the minimum requirement of 100 hours of flying experience on type to operate the 'Aerial Work' flight. Hence, pilot was not qualified to operate the flight.
- 8) The aircraft had one passenger on-board. CAR Section 3 Series N Pt 1 specifies that carrying passengers and/or task specialists on-board on an aerial work flight shall require a prior approval of the DGCA. Though the name of the Passenger is on the Manifest, approval of the DGCA as required by the CAR was not obtained.

- 9) A portion (approximately 144 m) of periphery wall on the North Eastern side of the airfield, left of runway 26, is open. This open area is manned and ward by a security guard but no measure has been taken to secure this area by means of barbed wires or fencing. Therefore, hazardous situation in the operational area due to a stray animal cannot be ruled out.
- 10) Excessive bird activity was observed on the runway during the day and no measures have been taken to restrict this.
- 11) The Operations Manual of the aircraft operator included FAA guidelines and requirements which are applicable for operators operating under US regulations.
- 12) The Accountable Manager at AASAAPL did not ensure that regulations laid down in CAR are being complied before the aircraft was released to undertake 'Aerial Work'.

3.2 Probable causes of the accident

The accident probably occurred due to vicious inputs given by the pilot after touchdown to avoid stray animals approaching the active runway, which led to non-recoverable veering of the aircraft and subsequently exiting from the paved surface & topple.

Contributory Factors:

- Inadequate experience of PIC on the aircraft type
- Area near the broken perimeter wall not fully secured
- Animal movement in operational area was not identified by ATC

4. SAFETY RECOMMENDATIONS

It is recommended that

- 4.1. DGCA shall instruct the aerodrome operator to take all necessary actions to ensure that
 - i. Broken Perimeter wall area is secured
 - ii. No bird activity inside the aerodrome in operational area
- 4.2. DGCA shall instruct the aircraft operator and other operators conducting Aerial Work operations to update their Operations Manual in line with the prevailing requirements of CAR before they are allowed to undertake Aerial Work Operations.
- 4.3 DGCA shall conduct an audit of the aerodrome to address the issues raised in this report and any other discrepancy for conduct of safe operations at Jakkur aerodrome.



Dinesh Kumar
(Investigator -In- Charge)

SECTION 2-1—

BASIC SAFETY REQUIREMENTS

Note: Every BSR requires full board approval if a waiver is requested, unless the BSR has a marginal notation of [S] or [E], which identifies its waiverability by others as indicated in Section 2-2.

A. APPLICABILITY

1. These procedures apply to all jumps except those made under military orders and those made because of in-flight emergencies. Voluntary compliance with these procedures will protect the best interests of both the participants and the general public.
2. A "skydive" is defined as the descent of a person to the surface from an aircraft in flight when he or she uses or intends to use a parachute during all or part of that descent.
3. All persons participating in skydiving should be familiar with the Skydiver's Information Manual and all federal, state, and local regulations and rules pertaining to skydiving.

B. COMPLIANCE WITH FEDERAL REGULATIONS

1. No skydive may be made in violation of Federal Aviation Administration (FAA) regulations.
2. FAA regulations include the use of restraint systems in the aircraft by all skydivers during movement on the surface, takeoff, and landing. [FAR 91.107]

C. MEDICAL REQUIREMENTS

1. All persons engaging in skydiving must:
 - a. Possess at least a current FAA Third-Class Medical Certificate; or
 - b. Carry a certificate of physical fitness for skydiving from a registered physician; or
 - c. Agree with the USPA recommended medical statement in Section 4-3.
2. Any skydiver acting as parachutist in command on a tandem jump must possess a current FAA Third-Class Medical Certificate or equivalent medical certificate acceptable to USPA, or, if residing outside the United States or its territories or possessions, a current Aviation Medical Certificate recognized by the Civil Aviation Authority of the residence country.

D. AGE REQUIREMENTS

1. For skydives made within the U.S. and its territories and possessions, skydivers are to be at least 18 years of age.
2. For skydives made outside the U.S. and its territories and possessions, the minimum age is specified by the country's (or its national airport control's) requirements. Such skydivers who are under 16 years of age will not be issued a USPA license.

E. ALCOHOL AND DRUGS

No person may make a parachute jump, or attempt to make a jump, if that person is or appears to be under the influence of either;

- a. alcohol.

- b. any drug that affects that person's faculties in any way contrary to safety.

F. STUDENT SKYDIVERS

Note: All references to USPA instructional rating holders apply to higher rating holders in that training discipline.

1. General [E]
 - a. All student training programs must be conducted under the direction and oversight of an appropriately rated USPA Instructor until the student is issued a USPA A license.
 - b. A person conducting, training, or supervising student jumps must hold a USPA instructional rating according to the requirements that follow.
2. First-jump course [E]
 - a. All first-jump non-method-specific training must be conducted by a USPA Instructor or a USPA Coach under the supervision of a USPA Instructor.
 - b. All method-specific training must be conducted by a USPA Instructor rated in the method for which the student is being trained.
3. All students must receive training in the following areas, sufficient to jump safely [E]:
 - a. equipment
 - b. aircraft and exit procedures
 - c. freefall procedures (except IAD and static-line jumps)
 - d. deployment procedures and parachute emergencies
 - e. canopy flight procedures
 - f. landing procedures and emergencies
4. Advancement criteria
 - a. IAD and static line [E]
 - (1) All jumps must be conducted by a USPA Instructor in that student's training method.
 - (2) Before being cleared for freefall, all students must perform three successive jumps with practice deployments while demonstrating the ability to maintain stability and control from exit to opening.
 - (3) All students must be under the direct supervision of an appropriately rated instructor until completing one successful clear-and-pull.
 - (4) Following a successful clear-and-pull, each student must be supervised in the aircraft and in freefall by a USPA Coach or Instructor until demonstrating stability and heading control prior to and within five seconds after initiating two intentional disorienting maneuvers involving a back-to-earth presentation.
 - (5) All ground training must be conducted by an instructor in that student's training method, until demonstrating stability and heading



SECTION 2-1—BASIC SAFETY REQUIREMENTS ... CONTINUED

control prior to and within five seconds after initiating two intentional disorienting maneuvers involving a back-to-earth presentation.

- b. Harness-hold program
(1) All students must jump with two USPA AFF rating holders until demonstrating the ability to reliably deploy in the belly-to-earth orientation at the correct altitude without assistance.
(2) All students must jump with one USPA AFF rating holder, exit safely, maintain stability, and deploy at the planned altitude without assistance prior to attempting disorienting maneuvers.
(3) All students must jump under the direct supervision of an appropriately rated USPA Instructor until demonstrating stability and heading control prior to and within five seconds after initiating two intentional disorienting maneuvers involving a back-to-earth presentation.
c. Tandem training jumps [E]
(1) Any USPA member conducting a tandem jump must have been certified by the appropriate parachute manufacturer or tandem course provider as being properly trained on the use of the specific tandem parachute system to be used, and must hold a current USPA Tandem instructor rating.
(2) For progressive training requirements following tandem jumps, refer to "Crossover training."
(3) Intentional back-to-earth or vertical orientations that cause tandem freefall speeds exceeding that of droguefall are prohibited.
(4) Tandem equipment instruction must be conducted by an individual approved by the tandem equipment manufacturer of that system.
(5) All student tandem skydives must be conducted in accordance with the specific manufacturer's age requirements for the tandem system used for that jump.
(6) Use of any extendable or fixed pole camera mounts, attached or handheld by the tandem instructor or student, is prohibited.
(7) Any person acting as parachutist in command on a tandem skydive is required to conduct system-handles checks as defined by the manufacturer of the specified tandem equipment being used immediately after deploying the drogue.
(8) Any person making a tandem skydive may not perform a turn of more than 90 degrees below 500 feet AGL.

- 5. Crossover training [E]
a. Students may transfer after the first or subsequent jumps to another training method after demonstrating sufficient knowledge and skill in the areas of equipment, aircraft, exits, freefall maneuvers, deployment, emergency procedures, canopy

control, and rules and recommendations to enter into that program at a comparable level of proficiency and training.

- b. Students previously trained in a tandem program may continue in a harness-hold program or must demonstrate a solo exit and practice deployment with stability in the IAD or static-line program prior to advancing to freefall.
c. Students who have completed at least two tandem jumps and demonstrated the ability to reliably pull the drogue release at the correct altitude, maintain heading and a stable body position, without requiring any control or altitude prompts from the tandem instructor, may progress to single instructor AFF jumps after completion of solo ground training.
d. Students previously trained in a harness-hold program must have exited stable without assistance or performed a stable IAD or static-line jump with a practice deployment supervised by a USPA IAD or Static-Line Instructor prior to performing freefall jumps with any non-AFF-rated USPA Instructor.
6. Students training for group freefall [S]
a. Student freefall training for group freefall jumps must be conducted by either a USPA Coach under the supervision of a USPA Instructor or;
b. USPA D license holders provided there is a minimum ratio of one D license holder to one student with a maximum of a 4-way.
7. Instruction of foreign students [E]
a. Foreign non-resident instructional rating holders appropriately and currently rated by their national aero club may train students from that nation in the U.S., provided the instruction is conducted in accordance with the USPA Basic Safety Requirements.
b. Appropriately and currently rated USPA instructional rating holders may assist in this training.
8. No skydiver will simultaneously perform the duties of a USPA instructional rating holder and pilot-in-command of an aircraft in flight.
9. All student jumps, including tandems, must be completed between official sunrise and sunset.

G. WINDS [S]

Maximum ground winds

- 1. For all solo students
a. 14 mph for ram-air canopies
b. 10 mph for round reserves
2. For licensed skydivers are unlimited

H. MINIMUM OPENING ALTITUDES

Minimum container opening altitudes above the ground for skydivers are:

- 1. Tandem jumps—4,500 feet AGL [E]
2. All students and A-license holders—3,000 feet AGL [E]
3. B-license holders—2,500 feet AGL [E]
4. C- and D-license holders—2,500 feet AGL [S]

**SECTION 2-1—BASIC SAFETY REQUIREMENTS ... CONTINUED**

(waiverable to no lower than 2,000 feet AGL)

I. DROP ZONE REQUIREMENTS

1. Areas used for skydiving should be unobstructed, with the following minimum radial distances to the nearest hazard: [S]
 - a. solo students and A-license holders—100 meters
 - b. B- and C-license holders and all tandem skydives—50 meters
 - c. D-license holders—12 meters
2. Hazards are defined as telephone and power lines, towers, buildings, open bodies of water, highways, automobiles, and clusters of trees covering more than 3,000 square meters.
3. Manned ground-to-air communications (e.g., radios, panels, smoke, lights) are to be present on the drop zone during skydiving operations.

J. PRE-JUMP REQUIREMENTS

The appropriate altitude and surface winds are to be determined prior to conducting any skydive.

K. EXTRAORDINARY SKYDIVES

1. Night, water, and demonstration jumps are to be performed only with the advice of the local USPA S&TA, Instructor Examiner, or Regional Director.
2. Pre-planned breakaway jumps are to be made by only class C- and D-license holders using FAA TSO'ed equipment. [E]
3. Demonstration jumps into Level 2 areas require a D license with a USPA PRO Rating for all jumpers, including both tandem jump participants. [E]
4. Contact canopy formation activity is prohibited on tandem jumps. [E]
5. Tandem jumps into stadiums are prohibited. [E]
6. Any person performing a wingsuit jump must have at least 200 skydives, and hold a current skydiving license. [E]

L. PARACHUTE EQUIPMENT

1. FAA regulations [FAR 105.19] require that when performing night jumps, each skydiver must display a light that is visible for at least three statute miles from the time the jumper is under an open parachute until landing.
2. All students are to be equipped with the following equipment until they have obtained a USPA A license:
 - a. a rigid helmet (except tandem students)
 - b. a piggyback harness and container system that includes a single-point riser release and a reserve static line, except:
 - (1) A student who has been cleared for freefall self-supervision may jump without a reserve static line upon endorsement from his or her supervising instructor.
 - (2) Such endorsement may be for one jump or a series of jumps.
 - c. a visually accessible altimeter (except tandem students)

- d. a functional automatic activation device that meets the manufacturer's recommended service schedule
 - e. a ram-air main canopy suitable for student use
 - f. a steerable reserve canopy appropriate to the student's weight
 - g. for freefall, a ripcord-activated, spring-loaded, pilot-chute-equipped main parachute or a bottom-of-container (BOC) throw-out pilot chute
3. Students must receive additional ground instruction in emergency procedures and deployment-specific information before jumping any unfamiliar system.
 4. For each harness-hold jump, each AFF rating holder supervising the jump must be equipped with a visually accessible altimeter.
 5. All skydivers wearing a round main or reserve canopy and all solo students must wear flotation gear when the intended exit, opening, or landing point is within one mile of an open body of water (an open body of water is defined as one in which a skydiver could drown). [S]

**M. SPECIAL ALTITUDE EQUIPMENT
AND SUPPLEMENTARY OXYGEN**

Supplementary oxygen available on the aircraft is mandatory on skydives made from higher than 15,000 feet (MSL).