FINAL INVESTIGATION REPORT
ON
TAIL STRIKE INCIDENT OF M/S INDIGO A321 NEO AIRCRAFT VT-IML OPERATING FLIGHT 6E-203 ON 14.04.2023 AT NAGPUR.

DIRECTORATE GENERAL OF CIVIL AVIATION
OPPOSITE SAFDARJUNG AIRPORT, AUROBINDO MARG, NEW DELHI-110003

FOREWORD

This investigation has been carried out in accordance with Annex 13 to the convention on International Civil Aviation and under Rule 13(1) of Aircraft (Investigation of Accident and Incidents) Rules, 2017 of India. The sole objective of the investigation of an incident shall be the prevention of accidents and incidents and not to apportion blame or liability.

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

INDEX

GLOSSARY

AOCC	Airport Operations Control Center
AOG	Aircraft On Ground
AP	Auto Pilot
ARP	Aerodrome Reference Point
ATC	Air traffic control
A/THR	Autothrust
CAS	Calibrated Air Speed
CG	Centre of Gravity
CVR	Cockpit Voice Recorder
CVDR	Cockpit Voice and Data Recorder
DFDR	Digital Flight Data Recorder
DGCA	Directorate General of Civil Aviation
FCOM	Flight Crew Operating Manual
FCTM	Flight Crew Techniques Manual
FDTL	Flight Duty Time Limitations
FMS	Flight Management System
FR	Frame
FRTO	Flight Radio Telephone Operator
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
LDA	Landing Distance Available
LIH	Light Intensity High
ND	Navigation Display
PAPI	Precision Approach Path Indicator
PERF	Performance
PIC	Pilot In Command
SALS	Simple Approach Lighting System
STR	Stringer
TODA	Take off Distance Available (TODA)
TORA	Take off Run Available
UTC	Universal Time Co-ordinated
VLS	Lowest Selectable Speed
VMC	Visual Meteorological Conditions

INVESTIGATION REPORT ON TAIL STRIKE INCIDENT OF M/S INDIGO A321 NEO AIRCRAFT VT-IML OPERATING FLIGHT 6E-203 AT NAGPUR ON 14.04.2023

1. Aircraft
   - Type : Airbus A321-252NX
   - Nationality : Indian
   - Registration : VT-IML
2. Owner : Blackbird Capital II Leasing Limited
3. Operator : M/s Inter Globe Aviation Ltd. (Indigo)
4. Pilot – in –Command : ATPL Holder
   Extent of injuries : Nil
5. Co-Pilot : CPL Holder
   Extent of injuries : Nil
6. Place of Incident : Nagpur (VANP)
7. Geographical Location of Incident Site : 21^0 05' 30.14'' N & 079^0 02' 53.58'' E
8. Date & Time of Incident : 14.04.2023 & 09:42 UTC
9. Last point of Departure : Mumbai (VABB)
10. Point of intended landing : Nagpur (VANP)
11. Type of operation : Scheduled Operation
12. Person on Board : 233 (08 crew members and 225 passengers)
    Extent of injuries : Nil
13. Phase of operation : Landing
14. Type of incident : Abnormal Runway Contact (Tail Strike)

(All the timing in the report is in UTC, otherwise mentioned)

SYNOPSIS

On 14.04.2023, M/s Indigo A321 aircraft VT-IML was scheduled to operate flight 6E-203 (Mumbai-Nagpur). The aircraft was involved in an incident of tail strike while landing at Nagpur. The time of occurrence was 09:42 UTC. There were 233 person including 08 crew member on board the aircraft. There was no injury and no fire. The crew and passengers were able to disembark from aircraft normally. The aft lower portion of the fuselage was found damaged.

DGCA-India, vide Order No. DGCA-15018(06)/17/2023-DAS dated 24.04.2023 instituted investigation of the incident under Rule 13 (1) of Aircraft (Investigation of Accidents and Incidents), Rules 2017 by appointing an Investigator-In-Charge and Member.

The investigation concluded that the incident occurred due to "*Crew continued the approach which had become unstablised at 150 ft due to speed dropping below VLS as a result of variable winds, to land. The co-pilot did not point out the drop in speed and high pitch angle which contributed to the incident*".

1. FACTUAL INFORMATION

1.1. HISTORY OF THE FLIGHT*:*

On 14.04.2023, M/s Indigo A321 aircraft VT-IML was scheduled to operate flight 6E-203 from Mumbai to Nagpur. There were 08 crew members and 225 passengers on board the aircraft. This was the fourth sector of the day for the aircraft and first sector for both Captain and first officer on this aircraft. Before the incident flight, crew operated two sectors on another A321 aircraft (VT-IMW) on same day. The pre-flight medical examination to check for alcohol of both the crew was carried out at Mumbai and tested negative. The aircraft took-off from Runway 27 of Mumbai airport at 08:40 UTC.

PIC was the Pilot Flying during takeoff and landing and FO was the Pilot monitoring. During rest of the flight the First officer was the pilot flying and PIC was the pilot monitoring. The take-off, climb, cruise, descent and approach were uneventful.

During descent, crew carried out briefing for ILS approach on Runway 32 of Nagpur Airport. The approach for Runway 32 was planned with Flap Config 3. At approximately 09:24 UTC, crew requested left of track to avoid weather and thereafter ATC vectored aircraft for ILS approach on runway 32. At approximately 09:37, crew asked ATC for winds and ATC provided winds information as 230/06 kt. The aircraft was stabilized by 1000 ft and Autopilot was disengaged by flight crew at 700 ft. Continuous reduction of CAS was observed along with wind variation below 100 ft and during touch down winds were 120/13 kt. At 09:41:54 UTC, the aircraft touched down on both main landing gear with a vertical acceleration of 2.214 G and pitch attitude of 9.8 deg. During touchdown the tail of the aircraft struck the runway surface, aircraft bounced slightly and settled down. The aircraft speed at the time of touchdown was 122 kt (VLS-19 kt).

After landing the aircraft vacated the runway via taxiway B1 and parked at bay no. 3. Passengers were disembarked normally and during walk around inspection, AME observed scratch marks on tail of the aircraft. Further aircraft was declared on ground for inspection.

During runway inspection, the white-bluish coloured marks with metal scrapes were found on the runway with no damage to the runway surface.

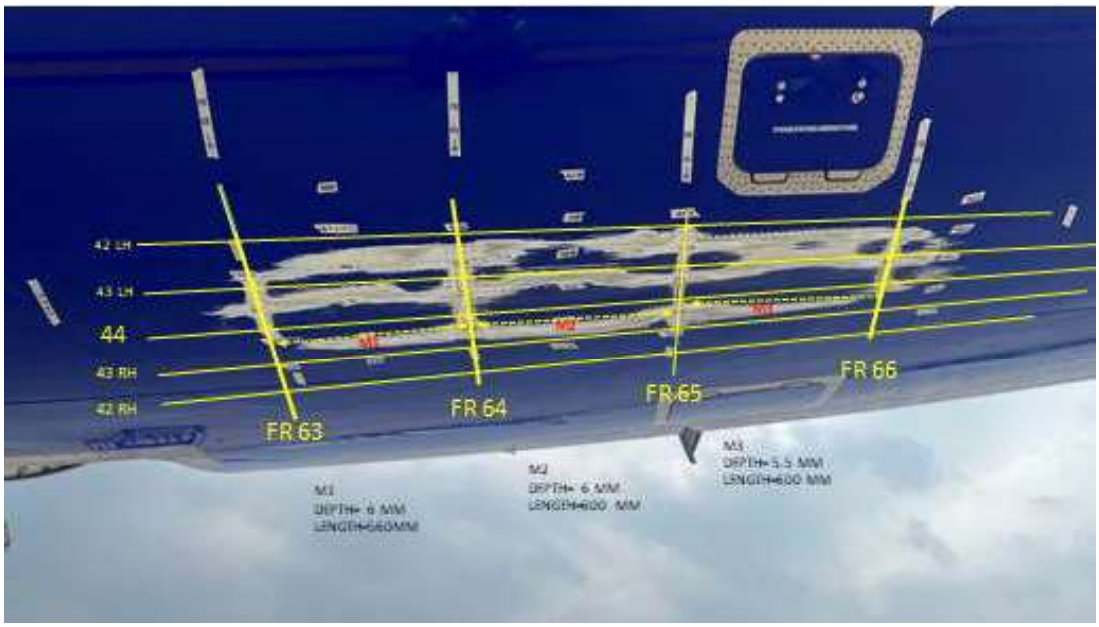
1.2. INJURIES TO PERSON:

INJURIES	**CREW**	**PASSENGERS**	**OTHERS**
FATAL	Nil	Nil	Nil
SERIOUS	Nil	Nil	Nil
~~**MINOR**~~**/ NONE**	08	225	

1.3. DAMAGE TO AIRCRAFT:

During post flight walk around inspection, AME observed scratch marks on tail of the aircraft. Detailed damage assessment revelled the following:

1. Fuselage Skin damage observed on Qty. 02 skin panels.
   a) Skin Panel P/No. D5347880922000 (Between FR47 - FR64 and between STR 32LH-STR 41RH).
   b) Skin Panel P/No. D5348001620000 (Between FR64 # FR70 and between STR 32LH-STR 41RH).
2. Damage was observed on Frames 63, 65 and 66.



3. Drain mast installed on the skin found bent and rubbed.

DEEP RUBB MARKS AND BEND DRAIN MAST

1.4. OTHER DAMAGE:

Nil

1.5 PERSONNEL INFORMATION:

1.5.1. Pilot-in-Command

AGE	43 years
License	ATPL
Date of Issue	08.03.2022
Valid up to	07.03.2027
Category	Aeroplane
Date of Class I Med. Exam	13.06.2022
Class I Medical Valid up to	30.06.2023
Date of issue FRTO License	09.03.2010
FRTO license valid up to	11.05.2025
Total flying experience	5142:29 Hours
Total flying experience on type	A320: 3971:18 Hours A321: 362:58 Hours
Total flying experience during last 1 year	522:31 Hours
Total flying experience during last 6 months	146:45 Hours
Total flying experience during last 30 days	19:45 Hours
Total flying experience during last 7 days	11:56 Hours
Total flying experience during last 24 hours	4:27 Hours
Duty time last 24 hours	6:52 Hours

1.5.2. Co-Pilot

AGE	32 Years
License	CPL
Date of Issue	10.12.2019
Valid up to	07.12.2024
Category	Aeroplane
Date of Class I Med. Exam	25.08.2022
Class I Medical Valid up to	27.08.2023
Date of issue FRTO License	13.08.2014
FRTO license valid up to	22.08.2024
Total flying experience	3781:33 Hours
Total flying experience on type	A320: 3100:42 Hours A321: 412:11 Hours
Total flying experience during last 1 year	664:33 Hours
Total flying experience during last 6 months	326:39 Hours
Total flying experience during last 30 days	68:56 Hours
Total flying experience during last 7 days	14:18 Hours
Total flying experience during last 24 hours	5:39 Hours
Duty time last 24 hours	9:05 Hours

No Flight Duty Time Limitation violation was observed in respect of both cockpit crew. They were not involved in any serious incident/accident in recent past in India.

1.6 AIRCRAFT INFORMATION:

Manufacturer	Airbus
Type	A321-252NX
S. No.	10687
Year of Manufacturer	22.04.2022
Certificate of Airworthiness, date of issue and validity	04.05.2022 Till ARC valid
Category	Normal
Certificate of Registration no.	VT-IML
Owner	Blackbird Capital II Leasing Limited
Maximum all up weight authorised	89000 kg
Aircraft Empty Weight	47546.416 Kgs
Max fuel capacity	18510 kgs
Maximum Permissible number of Passengers	232 Pax
Last major inspection	A1 Check (Neo) 1000 FH / 700 FC / 04 MO Inspection Schedule Dated 12.01.2023
Last inspection	Layover Inspection schedule Dated 12.04.2023
Air frame Hrs since new	3616:03
Airframe Hrs since last C of A/ARC	3603:53

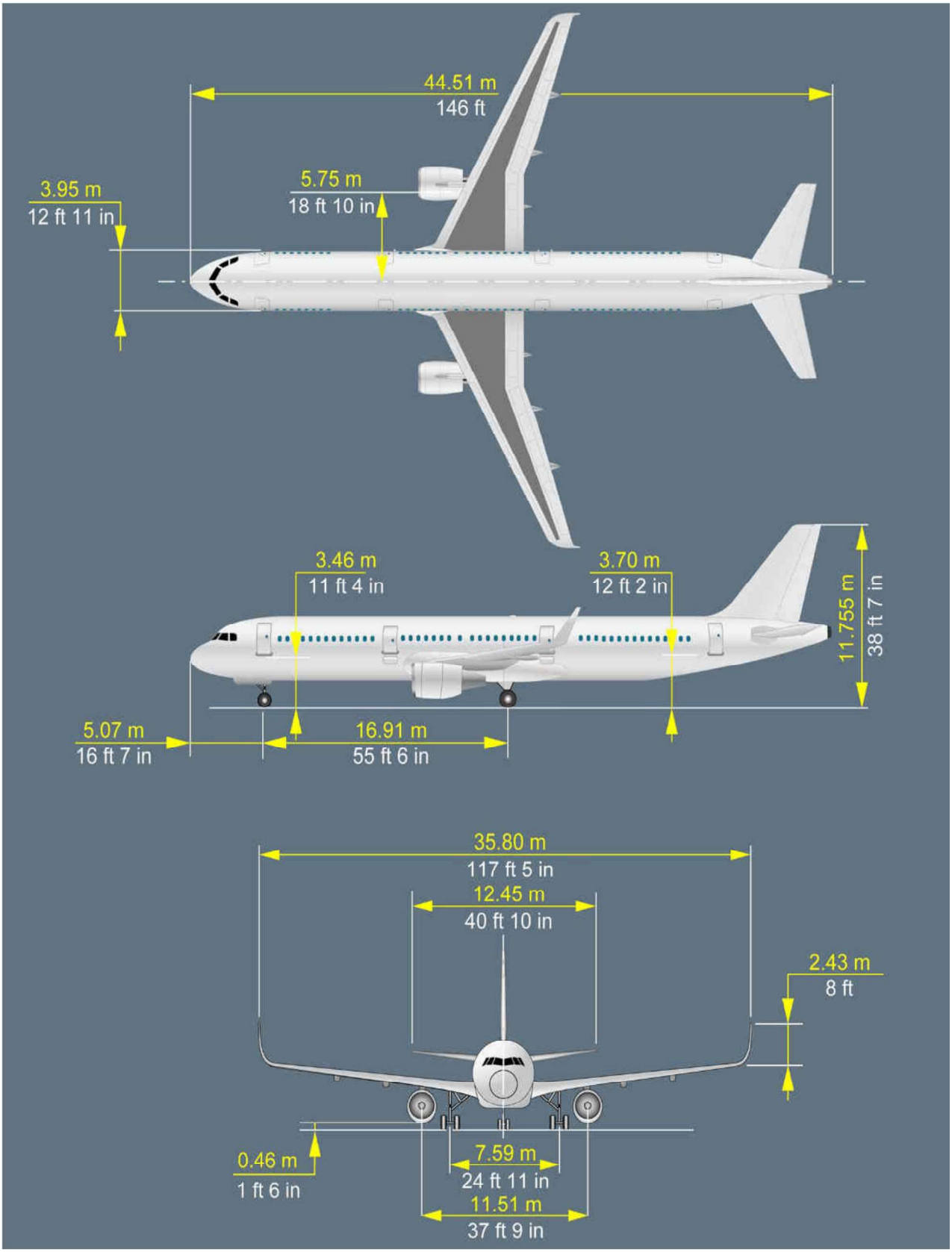
Engine Information	No. 1	No. 2
Manufacturer	CFM	CFM
Type	LEAP-1A30	LEAP-1A30
Serial No.	59A776	59A929
Hours done since new	3616:03	2042:58
Hours done since overhaul	3616:03	2042:58
Last major inspection carried out	A1 Check (Neo) 1000 FH / 700 FC / 04 MO Inspection Schedule Dated 12.01.2023	
Average oil consumption	0.101 Qtz (01.04.2023 to 30.04.2023)	0.109 Qtz (01.04.2023 to 30.04.2023)

Weight and Balance Information:

The Details of basic weight schedule were as follows:-

Weight	Actual Weights for 6E-203	Maximum Permissible
Take-off Weight	75212 kg	81657 kg
Landing Weight	72755 kg	79200 kg
Zero fuel Weight	69112 kg	75600 kg

CG was within the prescribed limit during the flight.


44.51 m
146 ft
5.75 m
18 ft 10 in
3.95 m
12 ft 11 in
3.46 m
11 ft 4 in
3.70 m
12 ft 2 in
11.755 m
38 ft 7 in
5.07 m
16 ft 7 in
16.91 m
55 ft 6 in
35.80 m
117 ft 5 in
12.45 m
40 ft 10 in
2.43 m
8 ft
0.46 m
1 ft 6 in
7.59 m
24 ft 11 in
11.51 m
37 ft 9 in

1.7 METEOROLOGICAL INFORMATION:

METAR report from time 09:00 to 10:00 UTC/14.04.2023 are as below:

METAR VANP 141000Z 07002KT 4000 HZ FEW020 SCT025 FEW030CB BKN100 39/12 Q1009 BECMG 3000 -RA

METAR VANP 140930Z 22002KT 4000 HZ FEW020 SCT025 BKN100 40/12 Q1009 NOSIG

METAR VANP 140900Z 19003KT 4000 HZ FEW020 SCT025 BKN100 40/12 Q1009 NOSIG

1.8 AIDS TO NAVIGATION*:*

All Navigational Aids available at Nagpur airport were serviceable at the time of incident. The aircraft was equipped with standard navigational equipment and there was no recorded defect with the navigational equipment prior to the flight.

1.9 COMMUNICATIONS:

Two-way communication was established between the aircraft and ATC throughout the flight. The aircraft came in contact with ATC Nagpur on 118.1 MHz frequency. At around 09:39:15 UTC, ATC cleared the aircraft for landing on runway 32 and reported wind calm.

1.10 AERODROME INFORMATION:

Dr. Babasaheb Ambedkar International Airport, Nagpur is owned and operated by Mihan International Pvt. Ltd. Nagpur Airport has a Runway orientation 32/14 with length of 3200 meters. Nagpur airport has latitude 210^0 05' 30.14'' N and Longitude 079^0 02' 53.58'' E with an ARP elevation of 314.86 meters (1033 ft) above mean sea level. Runway 32/14 has a bituminous surface with dimensions 3200 X 45 meters. It is provided with runway strip of 140 meters width on either side of runway centreline and runway end safety area (RESA) for Runway 32/14 is 240 X 90 meters. The runway 32 is served with Runway Edge Lights, Runway End Lights, Runway Threshold Lights, Taxiway Lights and PAPI. Simple approach lighting system for Runway 32 is CAT I, 900 M, LIH and for Runway 14 is SALS, 420 M, LIH. The airport rescue and fire fighting services was category 8. At the time of incident, Nagpur airport had a valid license.

1.11 FLIGHT RECORDERS:

The aircraft VT-IML is equipped with L-3 Communications Avionics Systems CVDR part no. 7100-0200-00 which records the communications to and from the cockpit and the flight data. The recorded data, of incident flight in the CVDR was preserved and made available for the purpose of investigation. The salient observations made during analysis of CVDR is appended below:

1.11.1 DFDR:

The FDR data was forwarded to manufacturer for detailed operational analysis. The salient observations made in the analysis report received from manufacturer are as follows:

From 1000ft RA to ~270ft RA:

At 1000ft RA (stabilization height recommended in IMC) and 500ft RA (stabilization height recommended in VMC):

- The aircraft was on the correct lateral and vertical flight path.
- The aircraft was in the landing configuration.
- The aircraft was at target speed (148 kt) for approach.
- No excessive flight parameter deviation was recorded.

At ~700ft RA, the flight crew disengaged both APs. Then final approach was manually handled by the Pilot Flying with the A/THR active in SPEED mode. The speed target was managed.

From ~270ft RA to touchdown:

From ~270 ft RA to ~115 ft RA, most probably to counter glide slope deviation, several nose-down and nose-up orders were applied with a nose-up tendency and led the pitch angle to increase up to +6 degree and the rate of descent to progressively decrease from ~950 ft/min to ~550 ft/min.

In the last 200 ft, a significant longitudinal wind gradient of ~30 kt was encountered and led the CAS to decrease under its target. As a result, the A/THR commanded an increase in thrust.

However, due to the significant longitudinal wind gradient, the CAS continued to decrease and reached a minimum of 122 kt (VLS-19 kt) prior to touchdown.

Then several pitch orders were applied leading:

- The pitch angle to vary between +4 degree and +5.5 degree.
- The rate of descent to progressively increase to ~750 ft/min.

At ~40 ft RA, the flare was initiated by Pilot Flying with a full back stick order, released most probably due to PITCH PITCH callout, and then increased again to a full back stick order in the last 20 ft. Consequently:

- The pitch angle increased up to +9.8 degree.
- The rate of descent decreased to ~450 ft/min prior to touchdown.

Note: Just before touchdown, due to high pitch attitude, the predictive pitch (pitch angle value reached after one second if pitch rate is maintained) reached its threshold, therefore the PITCH PITCH automatic callout was recorded in the FDR.

The aircraft touched down with a vertical acceleration (VRTG) of 2.214 with the pitch angle of +9.8 degree. A tail strike occurred at first touchdown. The energy of the first touchdown partially restored by shock absorbers led the aircraft to slightly bounce.

Wind conditions as recorded in DFDR

- FDR recorded between 100ft and 200ft: wind from 341 degree at 5kt.
- In the last 200 ft, the longitudinal wind component reversed from headwind to tail wind (significant gradient of ~30 kt).

1.11.2 CVR

Salient observations made from the CVR tape transcript are given below:

- At 08:39:40 UTC, ATC issued take-off clearance from runway 27 at Mumbai.
- During flight, crew carried out briefing for ILS32 and decided Config 3 landing at Nagpur.
- At approx. 09:24 UTC, crew requested left of track to avoid weather and there after vectored for the ILS approach runway 32.

- At 09:37:11 UTC, PM asked for tower observed winds and ATC advised 230/06 kt.
- At 09:39:21 UTC, crew got landing clearance and Tower reported winds calm.
- At 09:39:30 UTC, you have controls call is heard.
- At 09:40:42 UTC, 1000ft Autocall heard.
- At 09:41:06 UTC, Autopilot disconnected.
- At 09:41:48 UTC, 50/40/30/20/ Autocall heard.
- At 09:41:54 UTC, Autocall of retard followed by a Thud sound. Further "Pitch Pitch" Followed by Retard is heard.
- At 09:42:18 UTC, crew got taxi instructions from ATC (make a free wheel turn any convenient position backtrack runway 32 vacate via B1).
- At 09:45:18 UTC, PF called out "Mereko dekhna hai load report kya bolta (I want to see what load report reflect)".
- At 09:48:30 UTC, Post parking, PF called out "1.58 only really?''.

1.12 WRECKAGE AND IMPACT INFORMATION*:*

Runway inspection revealed that marks on runway abeam taxiway A where the tail of the aircraft touched the runway surface. There were 02 Nos. marks on the runway. First mark was white in colour at 157m from Runway 32 threshold and was about 8.90m long and 10cm wide. Second mark was light white-bluish colour (appears to be aircraft colour) which was at a distance of 161.80m from the Runway 32 threshold and was about 8.30m in length and 32 cm in width. Main landing gear impressions were also found in the said area. However, runway surface was in intact condition.

1.13 MEDICAL AND PATHOLOGICAL INFORMATION*:*

The crew had undergone pre-flight medical including BA (Breath Analyzer) Test at Mumbai as per requirements. The test results were negative.

1.14 FIRE:

There was no pre/post incident fire.

1.15 SURVIVAL ASPECTS:

The incident was survivable.

1.16 TESTS AND RESEARCH:

Not applicable.

1.17 ORGANIZATIONAL AND MANAGEMENT INFORMATION:

M/s Interglobe Aviation Limited (Indigo) is an Indian registered Scheduled airline with its headquarter in Gurugram, Haryana, India. It has a fleet of 302 aircraft including 81 A321, 182 A320 and 39 ATR as on date of incident. The first A321 aircraft was inducted in its fleet on 16.01.2019. It operates scheduled flights to both domestic and international sectors. Indigo has total destinations count of 106 with 78 domestic destinations and 28 international destinations.

1.18 ADDITIONAL INFORMATION:

1.18.1 Extract from Crew Statements:

The flight was uneventful from take-off till descent. During descent the aircraft encountered weather and appropriate deviations were sought from ATC. The approach was gusty due to the thermals and wind variations as observed on the ND. Therefore constant side stick input was given by PF to maintain the glideslope. Winds were shifting from headwind to crosswind and then changed to tailwind. The aircraft speed dropped below Vapp with increase in angle of attack and subsequently pitch increased. Around flare height, the aircraft encountered sudden sink and side stick was pulled to arrest the same. The aircraft PITCH PITCH call was heard and acknowledged but no call for go around was given by First Officer.

1.18.2 Tail strike avoidance as per FCTM

FCTM Extract

A318/A319/A320/A321 FLIGHT CREW TECHNIQUES MANUAL	PROCEDURES NORMAL PROCEDURES STANDARD OPERATING PROCEDURES - LANDING

TAIL STRIKE AVOIDANCE

Although most of tail strikes are due to deviations from normal landing techniques, some are associated with external conditions such as turbulence and wind gradient.

DEVIATION FROM NORMAL TECHNIQUES

Deviations from normal landing techniques are the most common causes of tail strikes. The main reasons for this are due to:

- Allowing the speed to decrease well below VAPP before flare.

  Flying at too low speed means high angle of attack and high pitch attitude, thus reducing gound clearance. When reaching the flare height, the pilot will have to significantly increase the pitch attitude to reduce the sink rate. This may cause the pitch to go beyond the critical angle.

Extract 1 – FCTM PR-NP-SOP-250 TAIL STRIKE AVOIDANCE

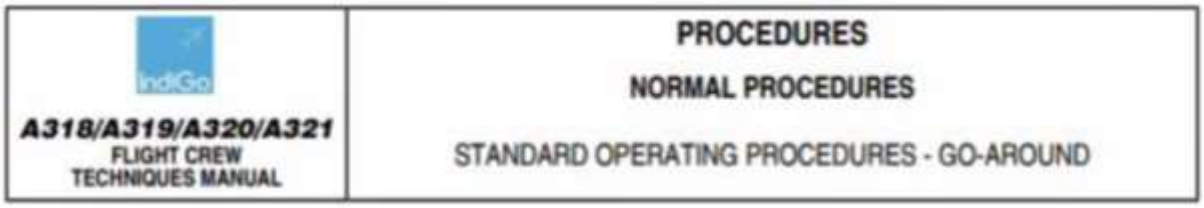
Note: Just before touchdown, the current angle of attack significantly increased due to flare orders and thus was above α_{PROT} value. Therefore, the high angle of attack protection was briefly activated at touchdown without consequences on the tail strike.

1.18.3 Consideration about Go-Around as per FCTM

Destabilization occurred prior to touchdown: In the last 150ft, CAS was below speed target-5kt and decreased well below VLS (up to VLS-19kt). The aircraft was thus no more stabilized in terms of speed.

As recommended in the following FCTM extract, the flight crew must consider to perform a go-around if stability is not maintained until landing.

FCTM extract



GENERAL

Failure to recognize the need for and to execute a go-around, when required, is a major cause of approach and landing accidents. Because a go-around is an infrequent occurrence, it is important to be "go-around minded". The decision to go-around should not be delayed, as an early go-around is safer than a last minute one at lower altitude.

CONSIDERATIONS ABOUT GO-AROUND

DECISION MAKING

The flight crew must consider to perform a go-around if:

[….]

- The approach is unstable in speed, altitude, or flight path in such a way that stability is not obtained by 1000 ft AAL in IMC or (500 ft AAL in VMC), or is not maintained until landing,

Extract 2 – FCTM PR-NP-SOP-260 CONSIDERATIONS ABOUT GO-AROUND

1.18.4 STANDARD CALLOUTS (As given in FCOM)

IndiGo **A318/A319/A320/A321** FLIGHT CREW OPERATING MANUAL	**PROCEDURES** **NORMAL PROCEDURES** STANDARD CALLOUTS

Approach

During approach, the PM announces:

- "SPEED" if the speed decreases below the speed target -5 kt or increases above the speed target +10 kt
- "PITCH" when pitch attitude becomes lower than -2.5^0 or higher than $+7.5^0$

Landing

During landing, the PM announces:

- "PITCH PITCH", if the pitch attitude approaches the tail strike pitch limit indicator, or reaches 7.5^0.

Extract 3 – FCOM PRO-NOR-SCO-C STANDARD CALLOUTS

1.19 USEFUL OR EFFECTIVE INVESTIGATION TECHNIQUES:

Nil

2. ANALYSIS:

2.1 Serviceability and Performance of the Aircraft:

A321 aircraft VT-IML was manufactured by M/s Airbus, France. The aircraft had a valid Certificate of Airworthiness at the time of incident. All relevant DGCA and manufacturer MODs for airframe and the engine were complied with as on 14.04.2023. Scrutiny of the snag register did not reveal any snag relevant to the incident. Last A1 Check was carried out on 12.01.2023.

Load and Trim sheet of the sector indicated that the weight of the aircraft was well within the prescribed limit and CG of the aircraft was also within the prescribed limits. Hence aircraft and its performance were not a contributory factor to this incident.

2.2 Operational Aspect:

2.2.1 The flight crew was duly certified and qualified to operate the flight. They had undergone the requisite pre-flight medical examination and tested negative before the flight. The analysis of CVR data revealed that during takeoff and landing the PIC was the Pilot flying (PF) and first officer was pilot monitoring (PM). Takeoff, climb, cruise and approach was uneventful. Crew planned for an ILS approach for RWY 32 at Nagpur with Flap Config 3. ATC cleared the aircraft for landing on runway 32 and reported wind calm. At 09:39:30 UTC, first officer handed over the controls to PIC. At 09:41:06, a chime for autopilot disconnection was heard. Subsequently, speed auto callouts were heard. At 09:41:54 UTC, auto call of retard was heard along with the thud sound followed by a pitch-pitch callout. No callout was heard in the CVR from the pilot monitoring during critical phase of the flight just prior to the touchdown for increased pitch attitude and for reduction in speed. As per the Standard Callouts Procedure given in FCOM, during approach and landing, the PM shall announce “SPEED” if the speed decreases below the speed target -5kt or increases above the speed target +10kt, “PITCH” when pitch attitude becomes lower than -2.5 degree or higher than +7.5 degree.

The DFDR data analysis revealed that the aircraft was stabilized at 1000ft and target speed was 148kt. At 700ft, the crew disengaged both APs and final approach was manually handled with A/THR active in Speed mode. From ~270ft RA to ~115ft RA, most probably to counter glide slope deviation, several nose-down and nose-up orders were applied with a nose-up tendency and led the pitch angle to increase up to +6 degree and the rate of descent to progressively decrease from ~950ft/min to ~550ft/min. In the last 200ft, a significant longitudinal wind gradient of ~30kt was encountered and led the indicated airspeed to decrease under its target and reached a minimum of 122kt prior to touchdown and the pitch angle increased up to 9.8 degree. The aircraft touched down with a vertical acceleration (VRTG) of 2.214 with the pitch angle of +9.8 degree. A tail strike occurred at first touchdown. The energy of the first touchdown partially restored by shock absorbers led the aircraft to slightly bounce.

In the last 150 ft, CAS exceeded its callout value and continued to decrease under target speed. The aircraft was thus no more stabilized in terms of speed. As per the procedure given in FCTM, the flight crew must consider to perform a go-around if stability is not maintained until landing.

From the above it is evident that the handling of the aircraft by the crew is a factor to the incident.

2.3 Weather Factor:

As per the METAR published 11 min before the incident the conducive weather prevailed during the time of incident. However, the analysis of DFDR data revealed that the aircraft experienced the longitudinal wind gradient of approx. 30kt in the last 200ft due to which CAS decreased and reached 122kt. It indicates that weather is a contributory factor to the incident.

3. CONCLUSIONS:

3.1. FINDINGS:

1) The aircraft was holding valid C of R, C of A and ARC on the day of incident.
2) The CG of the aircraft was within the prescribed limits.
3) The flight crew was duly certified and qualified to operate the flight. They had undergone the requisite pre-flight medical examination and tested negative.
4) All navigation and approach aids were functional and operating normally at the time of incident.
5) There was no evidence of defects or malfunction in the aircraft which could have contributed to the incident.
6) Aircraft was stabilized at 1000ft and target speed was 148kt. At 700ft, the crew disengaged both APs and final approach was manually handled with A/THR active in Speed mode.
7) The pitch orders with a nose-up tendency applied in the last 270ft led to a higher pitch attitude and the flare orders applied in the last 40ft led the pitch angle to increase upto +9.8 degree prior to touchdown.

8) The longitudinal wind gradient of approx. 30kt encountered by the aircraft in the last 200ft led the CAS to significantly decrease.

9) In the last 150ft, CAS exceeded its callout value and continued to decrease under VLS. The aircraft was thus no more stabilized in terms of speed. However the flight crew continued the approach and did not perform a go-around as required by the FCTM procedure.

10) The CAS decreased well below the target speed led to higher pitch attitude during touch down.

11) The aircraft touched down with pitch up attitude of 9.8 degree and vertical acceleration of 2.214. The higher pitch attitude during touch down reduced the ground clearance which resulted in tail strike.

12) The PM did not give the callout when the aircraft speed decreased below target speed and the pitch increased above threshold value.

13) During post flight inspection by the AME, the aft lower portion of the fuselage was found damaged.

3.2 PROBABLE CAUSE:

Crew continued the approach which had become unstablised at 150 ft due to speed dropping below VLS as a result of variable winds, to land. The co-pilot did not point out the drop in speed and high pitch angle which contributed to the incident.

4. SAFETY RECOMMENDATIONS:

- Suitable corrective action as deemed fit be taken based on findings and probable cause.

(Prashant Kumar Jangid)
Member

(Babu Lal Meena)
Investigator-In-Charge

Place: New Delhi
Dated: 20.03.2024