

HQCAA/1901/278/SIB



CIVIL AVIATION AUTHORITY

PAKISTAN

ACCIDENT TO EDHI AIR AMBULANCE

PIPER SENECA II REGISTRATION # AP-BFM

ON 20th SEPTEMBER 2002

AT

HYDERABAD AIRPORT

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FINAL REPORT

ACCIDENT TO EDHI AIR AMBULANCE **PIPER SENECA II REGISTRATION # AP-BFM** **ON 20th SEPTEMBER 2002 AT HYDERABAD AIRPORT**

Authority: Director General, Civil Aviation Authority Memorandum No. HQCAA/1901/278/SIB Dated 21st September 2002. The Ops Investigator was changed vide HQCAA/1901/278/SIB dated 05 May 2003.

SYNOPSIS

1. **Summary of the Incident:** The initial incident information was conveyed by Airport Manager Hyderabad. A CAA Pakistan team comprising Air Commodore Hashim Yamin, President SIB, as Investigator In-charge and Engr. Ahmed Bilal, Operations Engineer, Flight Standards Directorate as Technical Investigator, carried out the investigation. Representatives of the operator, M/s Edhi Air Ambulance, were also involved in the investigation. This report is being released under the authority of Director General Civil Aviation Authority Pakistan.
2. **Brief Resume of Circumstances Leading to the Incident.** The aircraft made a normal approach for landing at Hyderabad Airport and landed with landing gears in retracted position.

3. FACTUAL INFORMATION

- 3.1 History of the Flight The mishap aircraft took off Hyderabad airfield on 20th September 2002 at 01350 PST for a short overhead flight. The intended destination was Hyderabad.

The aircraft had proceeded to Hyderabad from Karachi for a three-hour stay. It landed at Hyderabad at about 1200 hrs local time. Before returning to Karachi the pilot was asked by his employer to take three passengers for a 15-20 minutes joyride over the city. The aircraft took off at about 1450 hrs and at 1510 hrs landed at Hyderabad runway 20 with undercarriages in retracted position.

Hyderabad airfield is at an elevation of 130 feet and located at N2519.4 E06821.7. Runway length is 7000 feet and it is 100 feet wide.

- 3.2 Injuries to Persons Nil.

- 3.3 Damage to Aircraft Both propellers impacted the ground with engines running and were bent (Appendix'M1'). The under fuselage reinforcement channels, wing attachment bolt heads, antennae and cowlings were damaged as a result of impact with runway surface.

- 3.4 Other Damages. Nil

- 3.5 Personnel Information

3.5.1 Captain: Col. Syed Sajid Ali

3.5.2 Type of License held and No: CPL # 1726A, CPL # 1726H

3.5.3 Validity of License: CPL A valid upto Dec 2003

3.5.4 Medical Certificate: Valid July 2003.

3.5.5 Rating type held: Cessna-402, PA-34, 680 FL Cessna, Heli Bell 206

3.5.6 Type Current: Cessna 402 – 1400:00 Hrs. 680 FL – 50:00 Hrs PA-34 - 1100: Hrs. J/R 206 – 1800:00 Hrs

3.5.7 Flying Experience: Grand total:- 7045:00 Hours including Cobra MD 530, Puma L-19, MFI-17

3.5.8 The duty / social schedule of the post 72 hours indicated that the PIC had adequate rest before flight.

3.6 **Aircraft Information**

3.6.1 The aircraft had a valid Airworthiness Certificate issued by CAA Pakistan (Appendix-'E').

3.6.2 It had flown 2705 hrs since new and 53 hrs since last Airworthiness Annual Inspection. Operation of landing gears retraction / extension and gear warning horn was checked on ground and in air during this inspection (Appendix 'F', 'G', 'H').

3.6.3 Fuel used was Aviation Grade 100LL

3.7 **Landing Gear System Information** Piper Seneca II aircraft has a dedicated hydraulic system for landing gear operation. It is powered by a hydraulic pump, which is driven by an electrical motor and controlled through a selector switch in the cockpit. The switch has two positions for up and down movement of the gears. There is no mechanical up lock and the gears are held in up position by the hydraulic pressure of

the system in the up chamber of the gear actuating jacks. While in retracted position, the main gears do not flush completely with the wing structure and the tyres remain slightly out of the wheel-wells. The gears indication system consists of three green lights for gear "down and locked" and a red light for gears "unsafe" or "in transition" position. There is also a convex mirror on the left engine cowl for visual check of nose gear position.

3.8 **Gears Warning Horn Information** The gear warning horn and the "unsafe" red light are activated if the landing gears are up and the throttle levers are moved below the position corresponding to 14in Mercury inlet manifold pressure. This is achieved through a micro switch on the throttle quadrant.

3.9 **Maintenance Information** The landing gear retraction test is carried out during 100 hrs or yearly airworthiness inspection. The ground check includes the check to ensure that the landing gears operation is normal and the warning horn is activated at a lower throttle position with gears retracted. The exact throttle position where the horn should start to blow is determined in air at an altitude of 1000 feet and 14inch Hg.inlet manifold pressure. The throttle micro switch is then adjusted on ground to activate at that throttle position. The check of horn serviceability is a part of pilot's approach checklist procedure.

3.10 **Meteorological Information** The meteorological information was available to the pilot.

3.10.1 Visibility was 5 km and wind was light / variable.

3.10.2 The incident took place in sunlight condition.

3.11 **Aids to Navigation** Not a factor in the accident.

3.12 **Communication**

3.12.1.1 PIC had normal radio communication while departing from Karachi, however, after take off radio reception was not very clear.

3.12.1.2 The landing at Hyderabad was without ATC as it is an uncontrolled airfield.

3.12.1.3 Take off during mishap joyride sortie was again without ATC, however, clearance from Karachi was obtained while operating overhead Hyderabad

3.13 **Aerodrome Information**

3.13.1 Hyderabad airfield is at an elevation of 130 feet and located at N 2519.4 E 06821.7.

3.13.2 The airfield has a "Scaled Down" status which means that no ATC facilities are available and pilots are to exercise own judgment/ responsibility while operating to and from this airfield.

3.14 **Flight Data/ Cockpit Voice Recorders.** Flight recorder and Cockpit Voice Recorder are not installed on this aircraft due to weight classification.

3.15 Wreckage and Impact Information (Appendix'J')

- 3.15.1 The aircraft came to a stop 1691 feet from threshold of Runway 20 and about 27 feet to the left of centerline (Appendix'M2'). The first impact mark was at a distance of 664 feet from threshold of Runway 20 and 13 feet to the right of center line. Initially it was a single line and then became a wide scrape mark of approximately the same width as that of the aircraft fuselage. The impact marks were continuous from the point of initial impact to the point where the aircraft came to stop. The left propeller came in contact with the runway after 16 feet of the first impact and the right propeller after 61 feet. At the point of first contact of propeller the main impact mark was a single line. Distance between first two blade cut-marks for the left propeller was 2 ft. 9 in. and for the right propeller 2 ft. 2 in. Except for about 10 feet rubber scrapes mark, all impact marks were made by metal to concrete contact. The impact marks on the aircraft were mostly restricted to fuselage under surface and propellers. The left tyre and wheel hub showed slight scraping marks on the left side. There were no marks on any of the main landing gear doors.
- 3.15.2 The main gears were found in retracted position and the flaps were up (Appendix'M3'). The footstep on the right wing trailing edge was bent under load and the fuselage was resting flat on its undersurface (Appendix'M4').

3.15.3 All electrical switches in the cockpit were found in OFF position (Appendix'M5') and all circuit breakers were IN (Appendix'M6). The landing gear lever was found in DOWN position (Appendix'M7'). Throttle, propeller and mixture control levers were fully back (Appendix'M8'). The flap lever was in retracted position (Appendix'M9').

3.16 **Medical and Pathological Information.** Blood and urine lab tests of the pilot were satisfactory and detailed report is at Appendix'K'

3.17 **Fire.** There was no fire during or after the impact.

3.18 **Survival Aspect.** Non Factor

3.19 **Tests and Research:**

3.19.1 **Retraction Test** During the removal from the runway, the aircraft was placed on the jacks with undercarriage in the same position in which they were found after the accident. The gear selector lever was already in down position, and as soon as the electrical master switch was put ON the gears extended and locked in down position. Subsequently the retraction cycle was repeated several times and no abnormality in the system operation was observed.

3.19.2 **Warning Horn Test.** The warning horn was checked with the aircraft on jacks and gears in

retracted position. The horn activated with throttle position close to its minimum stop position.

- 3.19.3 **Propeller RPM Determination** Propeller RPM at the time of impact were determined from the distance between the cut marks and assuming the ground speed of the aircraft as 90 knots. Left propeller RPM was calculated as 1652 the right engine RPM could not be calculated, as the forward speed of the aircraft would have reduced considerably by the time the propeller blade contacted the runway surface.
- 3.20 **Organization and Management Information** The aircraft is operated by an organization whose senior management is not aviation oriented. This can lead to decisions at higher level without considering their impact to human factor in aviation safety.
- 3.21 **Additional Information** The pilot of the aircraft was in an irritated state of mind because he was forced to come to this flight while he was preoccupied with an AOC inspection of his organization.

4. **ANALYSIS**

4.1 The following aspects have been discussed:

- Technical Aspects
- Operational Aspects

4.2 Technical Aspects

4.2.1 Sequence of Touchdown The touchdown analysis was carried out from the impact marks on the runway surface and on the aircraft. The lowermost structural portion which made the first impact line was identified as the footstep at the right wing trailing edge. It made contact about 13 ft to the right of the centerline and 664 ft from the threshold of Runway 20. Immediately after the first impact the aircraft rolled to left and left propeller made contact with the runway surface about 16 ft. from the first impact. Then as the aircraft straightened, the right propeller contacted the runway. Subsequently, the fuselage settled down on it's under surface making wider marks on the runway. The aircraft veered slightly to the left and came to rest on the left side of the runway centerline about 1691 ft from the threshold and 1027 ft from the first impact. During this left veer, the left wheel briefly scrapped the surface of the runway leaving a tyre impact mark and scrape marks on left side of the wheel. No evidence was found to suggest that the landing gears were partially or fully extended before or during touchdown.

4.2.2 Hypotheses. Various hypotheses were considered for determination of the cause of the accident. They are discussed below:

4.2.2.1 Failure Of Landing Gear To Extend The landing gear system of Piper Seneca II is fairly

simple and any malfunction in air would have duplicated on ground. The system functioned without any abnormality several times on ground after the accident. All electrical connections hydraulic lines and fluid quantity were checked and no discrepancy was found. Possibility of a mechanical or system failure in the landing gear extension is therefore ruled out.

4.2.2.2 **Collapse Of Landing Gear After Touchdown**

The landing gears have mechanical down locks. They are released by hydraulic pressure, which is supplied when the gear selector lever is placed in UP position. In this case if it is assumed that the gears were down and locked prior to touchdown, there is no possibility that they could have retracted or collapsed without any damage to the up locks or any part of the landing gear. In case the gears were partially extended, there would have been some impact marks on wheels or gear doors. This hypothesis is also ruled out.

4.2.2.3 **Inadvertent Electrical Master Switch off** The

pilot has stated that he might have accidentally put the electrical master switch in off position with his elbow. The electrical master switch is located to the left of the pilot next to alternator switches. In case the electrical master switch is put off prior to lowering of landing gears, the gears will not extend and red gears unsafe

warning light, the gear warning horn and all electrical indications in the cockpit including the radio would be unavailable. The engines would keep operating in this case. Although this hypothesis is technically possible but it is very unlikely because the pilot would have to be totally oblivious of the fact that all his electrical power is not available. In addition, he would not have been able to communicate with other occupants. Further more, while lower landing gears the complete electrical system failure should have been noticed immediately.

4.2.2.4 **Failure Of Pilot To Put the Gear Selector**

Down. All impact marks are consistent with aircraft touching down with gears in retracted position. Despite the fact that the gear lever was found in down position, and with elimination of hypotheses (a) and (b) above, the most likely possibility is pilot's failure to put the gear selector lever DOWN prior to touchdown.

4.2.2.5 **Serviceability of warning horn**

The serviceability check of landing gear warning horn has remained inconclusive because the check requires the aircraft to be flown at an altitude of 1000 ft at a power setting of 14 in Hg inlet manifold pressure. Although the operation of the warning horn has been checked on ground and the horn did activate close to the

minimum stop position of the throttle, but it cannot be ascertained if this throttle position corresponds to 14 in Hg inlet manifold pressure setting at 1000ft.

4.3 **Operational Aspects**

4.3.1 **Landing Gears Extension: Cockpit Indications/Controls.** The landing gears system is an electrically actuated and hydraulically operated system in Seneca II. Like any other aircraft there are several indications in the cockpit which indicate failure of electrical system, though, failure of landing gear hydraulic system is not indicated by any gauge or light. Although the failure of hydraulic pump / system is manifested in the failure of landing gears operations. While the landing gears' safe extension, after selecting the landing gears lever in down position, is indicated by following:

- 4.3.1.1 Illumination and extinction of landing gear warning light,
- 4.3.1.2 Silencing of the Landing Gear unsafe horn provided one of the engine power is below 14" boost and illumination of three greens.
- 4.3.1.3 Visual inspection of nose gear down and locked position through a reflective mirror.
- 4.3.1.4 The landing gear actuation by electrical system is also possible by battery power alone incase of both alternators failure. Alternator failure is indicated by illumination of alternator light and readings on the respective ampere-meters. In case of a failure on any one alternator other alternator is fully capable of supporting aircraft electrical system during day flight in good weather at 2000 RPM i.e. up to 65 amperes.

- 4.3.1.5 A fully serviceable and charged battery is capable of supporting same load for half of an hour. The inference can thus be drawn that in case of both alternator failures all landing gear indications and operation would be available for about half of an hour.
- 4.3.1.6 The technical investigation did not reveal malfunction of any landing gear system or possibility of one intermittent operation or one-time failure in landing gear and associated systems. From the statement of the PIC following hypotheses are drawn, which have been discussed in the light of landing gear system and its operation.
- 4.3.1.7 Electrical Failure leading to non extension of landing gear.
- 4.3.1.8 Landing gears partial extension.
- 4.3.1.9 Inadvertent / intentional retraction of landing gear.

4.3.2. **Hypothesis 1 (Electrical Failure).** The PIC in his statement implied the possibility of an electrical failure as he saw Alternator light flickering on departure from Karachi. In addition, he suspected that he might have switch off Master Switch inadvertently during joy ride over Hyderabad is also considered as a possibility. The aircraft had a Radio conversation with Karachi while operating over Hyderabad. Furthermore, if both alternators had failed, the battery would have supported the VMC flight for at least brief duration of the flight. This failure would have been preceded by Alternator light and readings on the two amp-meters, though, failure of both alternators simultaneously is highly improbable. PIC's inability to monitor these Indications throughout the sortie is again highly unlikely Technical investigation has also ruled out such an eventuality. The location and importance of Master Switch makes it

highly improbable for an inadvertent switching off by PIC. Even if it happens, then lowering of landing gears and completely missing all safe indications also would raise doubts on PIC competency in spite of experience and position in his company.

4.3.3. **Hypotheses II (Partial Extension of Landing Gears)** The possibility of partial extension of landing gears has been studied as the landing gears selection lever was found in down position. When the landing gears lever is selected in down position the hydraulic pump operates in reverse flow and the landing gears, which are held in up position by hydraulic pressure in the lines, start to extend. The Nose Gear is locked by the air stream pressure while the main ears are mechanically locked in down position. When landing gears are in intermediate / transition i.e. from up to down position, the landing gears warning red light remains illuminated and three greens do not appear. In addition, the warning horn keeps blowing if throttle position is below 14" boost. The possibility of landing gears going to partial extension from locked position without selecting the landing gear lever down is completely ruled out as nose wheel should have been found in extended position after the accident. The visual inspection of nose gear down from the mirror is another indication of gears down. The runway contact marks on the belly of the aircraft and position of nose gear at the time of landing (as per physical inspection) suggest the landing gears in fully retracted position, though the landing gears selector lever was found in down position.

4.3.4. **Hypothesis III (Landing Gears Not Selected Down)** The possibility of PIC forgetting to lower the landing gears despite vast experience exists, if he followed a non-standard approach pattern or there was an interruption and resumption of approach at a critical

stage where landing gears were suppose to be lowered. Lowing of landing gears is one of the most important checks in the approach pattern and therefore, the pilots hand books recommend checking of landing gears more than once i.e. firstly in the down wind when gears are selected down, secondly in the base leg and /or on final approach. This sortie was a short joy ride over the airfield where pilot was, in visual contact with the runway all the time. Furthermore, Karachi directed PIC to remain overhead and restricted to maximum 1000 ft. It can therefore be assuming that aircraft remained at or below 1000 feet/ at or below circuit attitude during the flight. In addition, PIC followed a modified approach for landing (own statement). Under these circumstances possibility of making a direct approach with throttles at idle to meet correct speeds from higher attitudes exists where continuous blowing of horn would have acclimatized the PIC and he would have ignored the horn and, missed landing gears lowering. Other possibility is that he set himself on final approach from an altitude lower than circuit attitude. Thus, power remained above horn blowing detent till flare out. In addition, PIC reported birds on final approach in his statement, through deleted later. These two factors give strength to the assumption that PIC followed a non standard approach, which was interrupted, and he, probably, wanted to discontinue the approach and yet, he pressed on with the same, leading to landing gears up approach and landing. The landing distance, with that all-up weight, is about 2000 feet with normal brakes. In this case the touch down is at 664 from beginning of the runway and aircraft came to a stop 1091' i.e. dragging for 1027', suggesting a higher touch down speeds. The touching of foot rest first followed by propellers hitting the runway immediately shows that the aircraft was at a shallow attitude while touching down. As the aircraft was directed to stay strictly overhead thus PIC decided to land from

closer base leg i.e. throttling to idle for control of speeds, less time in the base leg, and final approach with an interruption due to birds might have been the cause of forgetting the lowering of landing gears. The possibility of forgetting is also strengthened by the fact that pilot did not select the flaps also, which are purely mechanical in actuation and operations both.

- 4.4 **Analysis of Hypotheses.** The analysis of three hypotheses in the light of PIC statements and technical investigation rules out the possibility of landing gears system extension malfunction. The PIC gave two statements, one on the evening of the accident and the other after few days, though date given is 20 September. In the first statement PIC insisted on selecting the gears down without mentioning monitoring of safe indication. In addition, he implied malfunction in the electrical system. Later, he shifted his emphasis on partial extension of landing gears. The two probabilities contradict each other. In his third statement (in defense of apportion of blame) he adopted a third course, which was mentioned in second statement, switching off the Master Electric Power Switch inadvertently. The location and shape of Master Switch rules out the possibility of inadvertent switch off. Within third hypothesis three possible scenarios have been discussed. The touch down point, dragging distance and propeller marks on the runway suggest a high speed flare out and touch-down, though PIC was in a haste to come back to parking which is only 3500' down the landing direction. These indications show that either it was a power on dragging approach where warning horn did not sound or a close pattern where throttles were retarded at an earlier stage and PIC got acclimatized to blowing of warning horn. In his second statement PIC has implied his pre-occupation with inspection of the company by CAA and his disapproval for being detailed to undertake flight to Hyderabad in general and joy ride in particular. The bad mood and pre-occupation coupled with non-standard landing pattern increase the chances of forgetting vital

checks during flight. The assessment on not lowering landing gears and there being no malfunction in the electrical / landing gears system is further strengthened by the fact that PIC did not even lower flaps, which are purely mechanical, in this landing gear up landing.. Such a state of forgetfulness is a clear indication of PIC's adverse emotional/ psychological health on the day of the accident. An aviator from military background is often subjected to uncertainties and work pressures, and that is also manifested in training. In this case PIC was, it seems, subjected to adverse emotional trauma, which led to the landing gears up landing.

5. CONCLUSION

5.1 Findings

- 5.1.1 The aircraft had a valid Certificate of Airworthiness.
- 5.1.2 PIC held valid License and rating on type.
- 5.1.3 The aircraft was serviceable on 20 September 2002, before the mishap flight.
- 5.1.4 The weather was good for VMC Flights.
- 5.1.5 Hyderabad is an unmanned airfield with no ATS.
- 5.1.6 Earlier in the day the aircraft had been flown to Hyderabad from Karachi by the same PIC.
- 5.1.7 The flight was undertaken for a joy ride of 10 minutes over Hyderabad after clearance from Karachi.
- 5.1.8 PIC was not in right frame of mind for being directed to undertake flight to Hyderabad.
- 5.1.9 PIC was in haste for return to Karachi, therefore, he objected for being ordered to fly a joyride
- 5.1.10 PIC was in a hurry to land back.

- 5.1.11 PIC made an overhead circling approach where he was acclimatized to landing gear unsafe horn or he made a power on approach, which prevented horn blowing.
- 5.1.12 PIC neither lowered landing gears nor did he select manual flaps. Forgetting to select manual flaps indicates following of a non-standard landing pattern
- 5.1.13 The aircraft belly landed with landing gears and flaps fully retracted at 614 feet on runway 20 and came to a halt 1694 feet from beginning of the runway.
- 5.1.14 In post accident technical investigation complete landing gears system and electrical systems were found serviceable and functional.
- 5.1.15 The aircraft suffered minor damage to the airframe and both propellers were bent after contact with ground.
- 5.1.16 PIC was not in 'fit for flying' state of mind on the day of accident and particularly during the mishap flight due to pressures from his employer.
- 5.1.17 PIC was fatally injured in an air crash on 24 February, 2003.
- 5.2 **Cause** The accident was a result of psychological pressures, pre-occupation and bad mood of the PIC during the flight. Due to bad mental emotional health he forgot to lower landing gears and flap, and belly landed in a non-standard landing pattern. The cause of the accident is finalized as failure of the pilot to lower the landing gears for landing.

6. **SAFETY RECOMMENDATIONS**

- 6.1 The owners of general aviation companies may be made aware of Human Factor phenomenon leading to accidents.

- 6.2 Director of Operations may issue Safety Alert for aircraft operations at unmanned airports.
- 6.3 The operations from unmanned airfield in retractable landing gears equipped aircraft may be considered with two pilots.

Appendix 'M'

Appendix 'M1'



Damage to Propeller

Appendix 'M2'



Aircraft Final Position

Appendix 'M3"



Gear and Flap Position

Appendix'M4'



Foot Rest

Appendix'M5'



Electrical Switches

Appendix 'M6'



Circuit Breakers

Appendix 'M7'



Landing gear Switch

Appendix 'M8'



Engine Controls

Appendix'M9'



Flap Lever

Appendix'M10'



Nose Gear Doors