No. HQCAA/1901/280/SIB

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CIVIL AVIATION AUTHORITY
PAKISTAN

ACCIDENT INVESTIGATION REPORT

ON

M/S STAR AIR AVIATION

DORNIER-228-200 AP-BGF

OCCURRED ON 19 FEBRUARY 2003

AT

JINNAH INTERNATIONAL AIRPORT

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FINAL REPORT

ACCIDENT INVESTIGATION: M/S STAR AIR AVIATION, DORNIER 228-200, REGISTRATION # AP–BGF ON 19TH FEBRUARY 2003 AT JINNAH INT'L AIRPORT, KARACHI

Authority: Director General Civil Aviation Authority Memorandum No. HQCAA/1901/281/SIB dated 22nd February 2003. (Appendix 'A')

SYNOPSIS

1. **Accident Notification**: On notification of the accident, the DG CAA ordered an investigation. The investigation team comprised Lt Col (Retd) Saleem Khan, Investigator Incharge and Engineer Azhar Akhtar, Technical Member. This report is being released on the authority of the Director General Civil Aviation Authority, Pakistan.

2. **Brief Resume**: On 19th February 2003, a Dornier-228-200 of M/s Star Air Aviation was on a charter mission from Karachi to Nawabshah and back with four passengers on board. The crew comprised Capt Tanvir Afgan (Pilot in Command), Capt Nadir Iqbal Mirza (Co-pilot) and Mr Anzar (Engineer). The aircraft taxied out to the apron and gave a call for returning without announcing any reason. When crossing through the second ASF security barrier on the return journey, the aircraft drifted to the right side of the taxi line by about 18.5 feet, which caused the right hand engine propeller (i.e. No 2 Engine Propeller) to hit the steel-pipe barrier gate. The aircraft continued drifting on to the same side until it collided with the wall and came to a halt. There were no physical injuries to any of the occupants. The aircraft, however, sustained engine/ structural damage.

3. FACTUAL INFORMATION

3.1 HISTORY OF THE FLIGHT

3.1.1 The aircraft was detailed on a charter flight from Karachi to Nawabshah and back.

3.1.2 The flight was authorized and had seven persons on board including the crew.

3.1.3 The aircraft was serviceable when it taxied out of the M/s Star Air Aviation parking area (Appendix 'G').

3.1.4 The aircraft taxied upto the apron and then returned back without assigning any reason.

3.1.5 While passing through the first ASF barrier gate, the aircraft drifted to the right and its right propeller hit the ASF barrier steel-pipe fence then collided with a wall and came to a halt.

3.1.6 In the post flight technical logbook write up, PIC made an entry of 'sluggish brakes', reduced hydraulic pressure and loss of aircraft braking (Appendix 'L').

3.2 **INJURY TO PERSONS:** Nil

3.3 **DAMAGE TO AIRCRAFT:** As given in the damage information in paragraph 3.12.

3.4 **OTHER DAMAGE:** One steel-pipe fence of the ASF barrier was damaged besides the electric pole erected on the wall of the car parking area for Isphani Hanger. The former is the property of HQ CAA, while the latter belongs to the PIA.

3.5 **PERSONNEL INFORMATION:**

3.5.1 **Pilot-in-Command:** Captain Tanvir Afgan.

3.5.1.1 Position in the Cockpit:: Left Pilot Seat.
3.5.1.2 Age: 54 Years.
3.5.1.3 Type of License held and No: ATPL # 796 valid upto April 2003.
3.5.1.4 Medical Certificate: Class-1 Medical valid upto 23 Oct 03.
3.5.1.5 Rating type held: B-737, F-27, DHC-6, Twin Otter, Dornier-228, Cessna-310, 150/152, 172, Piper Seneca PA-34.
3.5.1.6 Type current : Piper Seneca PA-34 and Dornier-228-200.
3.5.1.7 Assistant/ Flight Instructor Rating: FI -1 Single/M.E below 5700 Kg.
3.5.1.8 Flying Experience: As below

- Grand total: 5788:42 Hours
- Total in Command: 4222:39 hours
- Total in command on the type accident occurred: 11:30 Hours
- Total Co-pilot Hours on type : Nil

3.5.1.9 Date Last Flown Dornier-228: 09 Feb 03 Karachi - Sehwan - Karachi.
3.5.1.10 Training carried out with Star Air: 30 December 2002 to 08 January, 2003. Flew 05:00 hrs during training.

3.5.2 **Co-Pilot:** Name: Captain Nadir Iqbal Mirza.

3.5.2.1 Position in Cockpit : Right Pilot Seat (Co-Pilot).
3.5.2.2 Age: 48 Years
3.5.2.3 Type of License held and No: ATPL # 778, valid till Dec 2003.
3.5.2.4 Medical Certificate: Class-1 Medical valid upto 30 Dec 2003.
3.5.2.5 Rating types: Cessna-150/152, 172, 402, and 421, Piper Seneca, Cherokee-II, DHC-6, BN-2A, and Dornier-228.
3.5.2.6 Type current: Dornier-228-200.
3.5.2.7 Assist/Flight Instructor rating: FI -1, Single/Multi Engine Land, AUW 5700 Kgs & Below.
3.5.2.8 Flying Experience: As below

- Grand Total: 5136: 30 hours
- Total in Command: 5032 hours
- Total on type: 32:20 hours (As PIC 17:45; Trg: 7:30 hours, P-2: 07:05 hours)

3.6 AIRCRAFT INFORMATION:

3.6.1 **General:** The aircraft, Dornier Model Do-228-200, registration No. AP-BGF, S. No.8016 and manufacture date 1983 is being operated by Star Air Aviation (Pvt) Ltd under lease arrangement since 06.08.02. The first flight in Pakistan was operated on 03.09.02. The aircraft is being maintained to meet CAA (Pak) Airworthiness standards. The Airplane was operating under valid C of A at the time of the accident. The aircraft is fitted with two Turbo Prop Power Plants Type TPE-331-5-252 and associated Hartzell (4 blades) propellers Type HC-B4TN-5ML/LT. The aircraft is equipped with a DFDR and a CVR. Aircraft has TSN 22508 flight hours and 37517 landings. The aircraft had 1800 Lbs. fuel on board at the time of departure.

3.6.2 Ground Handling Difference: In most of the multi-engine aircraft operating in general aviation the taxi procedure involves the use of throttle control, the rudders and brakes. In the Dornier 228-200, however, there are variables. There is a combination of Power Levers and Speed Levers for control of engine thrust, and Nose Wheel Steering (NWS) system operated by a button on the left-hand control wheel (PIC side only). The allowance of NWS authority is from 0-8° or 0-45° at different Speed Lever selections. For normal taxi, the speed levers are to be set at low position, which give sufficient thrust for normal taxi speeds and allow NWS authority upto 45° with NWS button depressed. The NWS restricts the nose wheel deflection up to 8° either side when any one Speed Lever is selected above 'Low' position. When rudder is applied

without the NWS button pressed, the nose wheel moves up to 8° only. If the NWS button is pressed following any rudder input, the nose wheel deflects to match the rudder input rapidly. In addition, there are two positions of power levers i.e. Ground Idle and Air Idle ranges for taxi and air operations respectively. Therefore, more attention/practice is required by the pilots who convert on to this aircraft and simultaneously operate other types of aircraft (Appendix 'J1' to 'J13').

3.7 **METEOROLOGICAL INFORMATION:** Non factor in the accident.

3.8 **AIDS TO NAVIGATION**: Non Factor.

3.9 **COMMUNICATIONS:** (Refer to Appendix 'D').

3.9.1 PIC asked for start up permission from ATC.
3.9.2 The pilot did not ask for taxi instructions before proceeding to the apron.
3.9.3 While returning from the apron the pilots did not give any reason on the R/T for their return.
3.9.4 After the accident the ATC was not informed of the accident on R/T.

3.10 **AERODROME INFORMATION:**

3.10.1 Aircraft proceeding out from general aviation parking area have to pass through two ASF barriers before entering the apron area and subsequently to the runway for take off. When returning from the apron to the general aviation parking area they again pass through same security gates.

3.10.2 The security procedure for entry and exit through these two barriers dictates that aircraft stop before entering the first barrier and once the gate is opened the aircraft enters in the area between the two barriers and stops again. The second gate is then opened and the aircraft is allowed to go through. This means that an aircraft has to come to a complete stop at least twice before it crosses the two security barriers.

3.10.3 Since this aircraft crossed the barriers twice, it must have come to a complete stop at least 4 times before the accident. In addition, it must have made at least one turnabout and a number of smaller turns.

3.11 **FLIGHT RECORDERS:**

3.11.1 This aircraft is equipped with a Digital Flight Data Recorder (DFDR), which could not be downloaded for its information due to lack of requisite software with the PIAC (Appendix 'E'). As such no

information could be retrieved through the DFDR. The same could be done from abroad but the costs would be prohibitive for this investigation. Further more, the parameters available on DFDR i.e. speed, height, heading, warning lights press to test; are considered non-factor in this ground accident (Appendix 'F'). There is no compulsory requirement of DFDR in this weight class by CAA rules.

3.11.2 The CVR readout facility is not available in the country. There is no requirement of CVR in this weight class.

3.12 DAMAGE INFORMATION:

3.12.1 Preliminary Aircraft damage assessment report showed the following:

- Major internal damage to R/H engine and propeller,
- Damage to right hand wing leading edge structure,
- Damage to propeller spinner cone,
- Damage to Nose Radome,
- Damage to battery/electrical power receptacle,
- Damage to radar antenna,
- Damage to right hand flap actuator/carriage,
- Buckling of fuselage skin on L/H side near # 2 window.

3.13 POST ACCIDENT OBSERVATIONS:

3.13.1 Engine # 2 Speed Lever found above low position (5^{th} red graduation on the pedestal) and ahead of Engine No. 1 Speed Lever (which was at mid third red graduation marking on pedestal). This indicates differential power setting (Appendix 'P1' & 'P2').

3.13.2 Both the power levers were at Flight Idle (FI) position (Appendix 'P1' & 'P2').

3.13.3 EPU switch was left on with corresponding green light illuminated indicating non adherence to shutdown checklist.

3.13.4 Control column wheel turned full right.

3.13.5 Parking/emergency brake lever found in off position.

3.13.6 Left-hand rudder pedal found slightly depressed.

3.13.7 Nose wheel found turned few degrees towards left-hand side.

3.13.8 Rudder showing slight left deflection.

3.13.9 Right aileron in up position and left aileron in down position corresponding to control column wheel position in cockpit.

3.13.10 No uneven wear or drag marks found either on nose and main tyres or on the taxiway.

3.13.11 No hydraulic/fuel leak observed on aircraft internally/externally or on ground in the vicinity.

3.13.12 Hydraulic reservoir and accumulator were filled to required capacity.

3.13.13 Paint marks observed on wall structure at point where nose radome impacted.

3.14 **MEDICAL AND PATHOLOGICAL INFORMATION:** Medical and Pathological information on the pilots is at Appendix 'Q1' & 'Q2' and indicate no abnormality.

3.15 **FIRE:** No fire was caused as a result of the accident, nor fire contributed towards the accident.

3.16 **SURVIVAL ASPECTS:** N/A

3.17 **TESTS AND RESEARCH:** Nil

3.18 **ORGANISATIONAL AND MANAGEMENT INFORMATION:** The Pilot in Command (PIC), Capt. Tanvir is not an employee of M/s Star Air Aviation. The Co-pilot, however, was the Chief Pilot of M/s Star Air Aviation. The PIC was flying on the basis of a "To Whom It May Concern" letter having nil reference # (Appendix 'R') issued by Operations Manager of OMV Pakistan. The letter to General Aviation Companies authorized Capt Tanvir Afgan "to carry out check flights or flights where requisite experience level was not available with the aviation company" and "to ensure that CAA standards of the private charter companies are provided". The letter was handed over to many General Aviation Companies in person by Capt Tanvir Afgan. The demands raised are contrary to CAA Rules as check flights can only be taken by CAA/CAA designated inspectors. In addition, operators are to employ regular pilots and ensure their fitness/training for flying, which can not be ensured for a client's employee. Star Aviation is in violation of CARs 94, Rule 97 (2) (c). Client Company can, however, demand any experience/standard from an aviation company through a contract. It seems that this letter has been used for undefined reasons instead of a proper contract. The Captain of the aircraft was an experienced pilot but he had low experience on the type. He had only eleven hours thirty minutes (11:30Hrs) in command of Dornier-228-200. The Co-

pilot, who was the Chief Pilot of Star Air, had more experience than Captain Tanvir on Dornier 228-200.

4. ANALYSIS

4.1 OPERATIONAL DISCUSSION.

4.1.1 Why did the aircraft return from the Apron?

If the intention was to return to the General Aviation Area due to 'sluggish brakes', the following aspects need attention.

- Firstly, the brakes are to be checked before leaving the parking area at the time of the initial taxi.
- Secondly, if there is the slightest doubt that the brakes are not fully serviceable, the aircraft should not be taxied out.
- Thirdly, if it appears at any stage during the taxi, that the brakes' performance is not reliable, the aircraft engines must be switched off for safety reasons, wherever the aircraft may be, and towed back to its repair area.

The evidence available does not support the pilot statement and his post-flight write up.

4.1.2 Could the Brakes be Faulty?

As mentioned earlier, if the brakes were performing below the desired performance level, the aircraft should not have been taxied out initially. If the problem arose during the taxi-phase, the aircraft should have been switched off at the first sign of such a snag and this fact should have been reported to the ATC. The aircraft should then have been towed back manually. Safety should have taken precedence over other activities as per airmanship. The aircraft had come to a complete stop atleast four times (if not more) before crashing into the wall (procedure for crossing through the ASF barriers, para 3.10 above refers). Further more, if the brakes were 'sluggish' the aircraft would continue to go in a straight line after brakes application. It may, however, have taken longer to bring the aircraft to a complete stop. Only if the brakes are uneven in application (differential braking) i.e. pilot induced, or one of the brakes is catching, the aircraft will veer or turn towards any one side and leave tell-tails on tyres, brake assembly and on ground. The hydraulic and brake systems were checked after the accident and found serviceable. Since the aircraft had visibly gone to the right

when seen after the accident, brakes could not have been responsible for the aircraft collision with the wall. In addition, NWS and use of emergency brakes could prevent a drift of 18.5 feet while initiating taxi from a halted position. Neither evidence, nor logic provides an explanation for brake failure. Possibility of hydraulic failure is completely ruled out as the PIC (Captain Tanvir) specifically stated pressure at 'lower (level) end of the spectrum' (green band on the gauge) (Appendix 'B3', Answer to Question 3 by PIC).

4.1.3 Was the aircraft on the correct taxi path?

Had the aircraft been on the correct taxiing line, there was no likelihood of the propellers hitting the pipe of the barrier gate. In its fully open position, which is always the case when aircraft taxi in or out through the barrier gates, the distance between the two nearest edges of the fences is over 70 feet. (Sketch Appendix 'N2'). The distance between the taxi line and the closest edge of the steel pipe fence on the right side is approximately 29 feet 9 inches. The distance of the propeller blade, where it engaged the steel pipe fence, from the centre of aircraft is about 10 feet 10 inches. The wingspan of the aircraft is 55 feet 8 inches (Appendix 'M'). With these measurements, there is no chance of the aircraft propellers striking the steel-pipe fence if the aircraft is maintaining the taxi line. For the right engine propeller to engage the steel pipe fence the aircraft has to be about 18.5 feet to the right of taxi line. This indicates that the aircraft was to the right of the taxi line and thus #2 Engine propellers (right side) struck the fence.

4.1.4 Could high power setting play a role?

The nose wheel steering (NWS) is available upto 45° with the steering switch pressed and speed lever at Low settings. If the speed lever is beyond 'low', the NWS authority is limited to 8° (Appendix 'J4'). This is an inbuilt safety feature to reduce the risk of turning excessively while on a take off run. On post accident inspection, one of the speed levers was found above the 'low' position. In addition, Power Levers were at Air Idle. These facts raise the question that with a problem of brakes being 'sluggish' would a pilot select higher thrust setting, which would restrict his NWS command and increase his taxi speed? Had the speed lever been on 'Low' the collision with the wall could have been avoided with 45° NWS authority after the propeller engaged the steel barrier pipes. Higher power setting, therefore, restricted the NWS to maximum 8^0 and collision with the wall could not be avoided.

4.1.5 Did the aircraft swing to the right?

The statements of witness # 1, 2 and 4 show that the aircraft swung to the right after hitting the steel pipes and before collision with the wall. Witness # 1 and 2 state that they heard the engine sound increasing as if the aircraft was about to take off. From this it is inferred that after striking the steel pipe fence the propeller shaft broke and unloaded the engine, as a consequence of which the right engine started over speeding. Witness # 4, the Co-pilot, states that he thought engine # 1 (left engine) had started speeding up and the aircraft was going to the right. Being a pilot (co-pilot for this flight) he pulled the left speed lever back. This is a clear indication that after hitting the fence the propeller mounted on # 2 Engine (right side) was not deriving any power from the engine and the left propeller (# 1 Engine propeller) was producing power. Power differential existed and the aircraft swung to the right.

4.1.6 When did the aircraft drift to the right?

If the aircraft had been following the yellow taxi line all along, there was hardly a chance of its collision either with the fence or with the wall. It may be debated that the aircraft swung first and the propeller engaged the fence later. When an aircraft stops for the second barrier to open, it is safe to assume that it would stop at least 10 to 15 feet before the barrier. Two hypotheses were worked on.

4.1.6.1 **Hypothesis 1.** The aircraft might have swung to the right viciously and traversed a distance of 26 feet to the right in a short time if the following conditions were met:

- right rudder was applied fully,
- the power levers were at flight idle,
- the speed levers were at 'low',
- and these inputs were coupled with pressing the NWS button .

Such an eventuality would cause the nose wheel to align with the rudder input. The rate of turn would be rapid (the aircraft would turn at 'rocket speed' as pointed out by the Dornier Instructor). If that had happened, the swing would have caused the propeller to engage the fence. After engaging the fence and losing power out put from the right engine, the swing would become more vicious due to the engine power out put from the left engine. As a result of this, the swing would have been so sharp that the aircraft nose would have hit the wall much closer to the fence and more squarely head-on than it has actually done now (Appendix 'P3'). Besides, the impact on the nose would have been more severe than the present impact seen on the aircraft.

The position of speed levers (Appendix 'P1' & 'P2') show that aircraft could not have gone sharply towards right due to NWS restricting the nose wheel deflection to 8° only. The Nose Wheel was also found showing a turn opposite to the drift direction.

4.1.6.2 **Hypothesis 2.** The other hypothesis is that the aircraft was already right of the yellow taxi line when it stopped before the second barrier. A plausible explanation for this drift may be misjudgement or an intention to turn around for the apron area immediately after crossing the second barrier. The assumption for this last possibility could be taxi-out without permission i.e. violation of an ATC procedure, about which ATC had inquired. The only way to correct this error without apologising to the ATC (which would be recorded), was to restart the outward journey from the beginning with the taxi permission obtained from the ATC before entering the barrier gate. Whatever the reason, if the aircraft had drifted to the right before it stopped for the second barrier to open, then a misjudgement of the closeness of the fence caused the right side propeller to engage the fence. The high power setting of the power levers and speed levers also indicate an intention of turning the aircraft around immediately after crossing the second barrier. Why else would a pilot, who is experiencing a 'sluggish brakes' response, use flight idle (FI) selection on the power levers and speed levers above 'low', if he was only wanting to park the aircraft in the parking area for getting the brakes repaired. If the aircraft had already drifted to the right after crossing the first barrier, and the right propeller had engaged the fence, the aircraft would swing to the right due to power differential between the two engines. With a higher power setting (power lever at FI and speed levers ahead of 'low'), correction to the left with the rudders would have caused the nose wheel to move through 8° only. This would reduce the angle of approach of the aircraft towards the wall. A more slant angle of impact of the nose is then to be expected and the point of impact of the nose would be further away from the fence compared to an impact point in the first case.

4.1.6.3 **Probability Analysis.** Assuming that the aircraft had stopped 20 feet short of the second barrier, then for the propeller to engage the steel-pipe fence and nose to collide with the wall, it would have to drift to the right by over 18.5 feet and traverse an angle of 26° right for the propeller to engage the steel-pipe fence (Appendix 'N1' & 'N2'). After engagement of the steel fence, the angle of drift reduced to approximately 21°, indicating an effort by the pilot to avoid

collision with the wall. The disengagement of the right propeller drive should have increased the drift angle, however, higher power setting restricted the nose wheel steering command to 8^0. This resulted in the ultimate collision of the aircraft with the wall. These calculations also indicate an intention of turning around immediately after crossing the second barrier because these actions could not have been inadvertent. It can also be said that the aircraft had started drifting to the right of the yellow line for taxi after it crossed the first ASF barrier during its return journey from the apron. The evidence on ground, the statements of the witnesses and the analysis of the events indicate such a possibility. An intention of turning about after crossing the second barrier is evident from this assumption. With either of the above assumptions the aircraft seems to have been drifted to the right intentionally.

4.1.6.4 **Negation of Hypothesis 1.** Hypothesis 1 is negated because the nose impacted the wall at a very shallow angle, which indicates that an effort was made to recover the aircraft to the left but the NWS authority was limited to 8°. The impact of the nose is not very close to the fence, which was engaged by the propeller. The swing rate was not so vicious or else the passengers would have felt the extreme swinging movement and reflected it in their statements.

4.1.7 Did the pilot react correctly to the situation he had encountered?

The PIC did not react correctly to the situation that he encountered on 19 February 2003. His decision making was less than adequate and his knowledge of the aircraft manual left much to be desired. While he wrote in the post flight report that (Appendix 'L'),
"Due sluggish brakes and reduced hydraulic pressure aircraft returned. During return aircraft braking was lost and aircraft hit wall near ASF gate,"
the captain confessed that the hydraulic pressure was 'within green limits' (Appendix 'B3' Answer to Question 3) and he did not use the emergency brakes (Appendix 'V' Answer to Question 62). If the hydraulic pressure is within green limits, the system is to be considered serviceable. If he felt otherwise, he would have used the emergency brakes.

4.2 OPERATIONAL ANALYSIS.

4.2.1 The facts collected indicate that AP-BGF, Dornier-228-200 was detailed on a charter mission by M/s Star Air Aviation on 19 Feb 2003.

4.2.2 The pilots were appropriately qualified but as per CARs 94, Rule 197 (2) (C), Captain Tanvir Afgan was not authorised to be the Pilot-in-command (PIC) of the aircraft as he is not an employee of Star Aviation.

4.2.3 The flight was to emanate from Karachi for Nawabshah and back with four passengers and Mr. Anzar (a Star Air Engineer) on board.

4.2.4 Captain Tanvir Afgan and Captain Nadir Iqbal Mirza piloted the aircraft. Captain Tanvir Afgan was the PIC.

4.2.5 The aircraft was serviceable when it taxied out.

4.2.6 The aircraft taxied out from the parking area of M/s Star Air Aviation in the General Aviation Area without taxi clearance from the ATC.

4.2.7 Abeam the washing bay the aircraft stopped for a longer time than usual as observed by one of the passengers and the Star Air Engineer (Mr. Anzar) on board the aircraft.

4.2.8 At this point the ATC pointed out that AP-BGF had not been given taxi clearance by them.

4.2.9 The aircraft replied that it was proceeding back.

4.2.10 No reason was assigned to this return.

4.2.11 The aircraft stopped at the first ASF barrier near the Isphani Hanger. After passing through first barrier, it stopped again for the second ASF barrier.

4.2.12 Once the second gate was opened the aircraft started moving.

4.2.13 The ASF barriers are opened and closed one by one and at no time both the barriers are opened simultaneously for security reasons.

4.2.14 While crossing the second barrier the aircraft was well to the right of the taxi line and its right propeller (# 2 Engine propeller) struck the steel-pipe fence, causing its internal disengagement from the engine. The differential power of the two propellers caused the aircraft to swing right resulting in the collision with the wall on the right side. An attempt by the Co-pilot to pull the left speed lever back made the swing less violent but could not prevent the collision with the wall.

4.2.15 The fact that the propeller struck the right fence first i.e. before the aircraft collided with the wall is ascertained by a careful interpretation of the statements of Witness # 1, 2 and 4.

4.2.16 That the propeller struck the steel pipe fence and its shaft broke loose from the engine is also substantiated by the absence of nick marks of the right propeller on the wall, with which the nose of the aircraft collided.

4.2.17 The post flight report by the Captain (Pilot-in-Command) that the brakes were 'sluggish' could not be substantiated from the evidence. Post accident inspection revealed no malfunction of either the hydraulic system or the brakes including the emergency brake system.

4.2.18 The PIC had mentioned that the hydraulic pressure was low but within green limits. The technical report addresses that argument and requires no further elaboration. If a system pressure is within green limits, the system is serviceable.

4.2.19 It was noted that the PIC was not an employee of the organisation (Appendix 'B5' Answer to Question 1).

4.2.20 Both, the PIC and the Co-pilot, were inexperienced on the type, though experienced on other types of aircraft (Para 3.5 above).

4.2.21 The taxiing procedure of Dornier 228-200 aircraft differs from the taxi procedure of the other multi engine aircraft operating in the General Aviation Companies.

4.2.22 Drifting off the taxi-line to the right caused the accident.

4.2.23 Using engine power higher than those recommended by the manufacturer contributed towards aggravating the situation.

4.2.24 Lack of taxi practice and knowledge of aircraft systems on the type also contributed to the accident.

4.2.25 Had power management been correct the aircraft collision with the wall might have been prevented.

4.2.26 Engine speed levers indicate differential power settings, which was an attempt by the co-pilot to arrest the nose movement to the right. It was an effort but not the correct procedure according to the aircraft manual. The nose wheel deflection to the left supports this contention.

4.2.27 The left deflection of the rudder also lends weight to the argument that an attempt was made to turn the aircraft left.

4.3 **TECHNICAL REPORT**: Technical report is as under:

4.3.1 **Internal / External Inspection**

4.3.1.1 Engine No. 2 Speed Lever was at the low range (5th red graduation on the pedestal) and ahead of Engine No. 1 Speed Lever. This indicated differential power setting.

4.3.1.2. Both the power levers were at flight idle position.

4.3.1.3. EPU switch was left 'ON', with corresponding green light illuminated indicating that crew did not follow proper shutdown checklist.

4.3.1.4. Badly damaged Nose Radome Assembly found lying on ground beneath aircraft nose section.

4.3.1.5. Radar antenna found without cover.

4.3.1.6. Fuselage skin buckled near # 2 L/H side window.

4.3.1.7. Right wing leading edge had deep gash due to the collision with electric pole.

4.3.1.8. Flaps position was just out of detent.

4.3.1.9. Left main wheel tyre found squashed towards inboard side under influence of substantial lateral airframe loading towards (Left) outboard direction.

4.3.1.10. Right hand trailing-edge flap actuator damaged and starboard wing was riding the wall with major part on other side of the wall.

4.3.1.11. Propeller of #2 Engine found bent and curled and spinner resting against wall structure.

4.3.1.12. #2 Engine Propellers free rotations checked and found free. Propeller internal gearing mechanism dislocated at the last stage of the turbine (evidenced from aft side of engine exhaust area).

4.3.1.13. Brake accumulator pressure gauge visible through sight glass just above and aft R/H MLG fairing observed within green band.

4.3.1.14. No fluid leakage, including fuel/hydraulic, observed on aircraft externally or visible on ground in vicinity.

4.3.1.15. No propeller drag marks were observed as a consequence of prop rotation on wall structure in the vicinity of impact of Engine # 2. This indicated disengagement of the right side propeller from the engine before the aircraft hit the wall i.e. the propeller was stationary before the collision.

4.3.1.16. Hydraulic power unit compartment opened up for inspection of hydraulic quantity level, which was found within serviceable band. The pop out button on hydraulic pressure filter was found normal. No fluid leakage/loss observed.

4.3.2 Aircraft Retrieval

Operator retrieved aircraft from accident location by normal towing. No replacement of tyres was needed for towing operation. No binding of wheels and/or brakes was experienced, which could cause problem with towing operation.

4.3.3 Maintenance History

The aircraft had undergone 300-hour Check Inspection including all lower Checks before this flight. The C of MR was issued following this maintenance activity. This is endorsed in the Airframe, Engine and Propeller Logbooks. Qualified A.M.Es', in respective category, signed off D.I sheet on the day of departure. No notable snag history is evident on the last major maintenance check. Before departure, crew verbally communicated unserviceability of electrical trim adjusts operation of stabiliser. The Avionics Engineer rectified this by recycling CB. Crew accepted serviceability of the system.

Pre Departure Maintenance Clearance and Aircraft Acceptance by crew for subject flight show no recording of any snag as evident by Technical Log (blue) slip S. No. 39 dated 19.02.03 (Appendix 'L').

4.3.4 PIC Post Flight Defect Record

After the accident Captain logged the following snag later in the day on 19.02.03. (Appendix 'L')

"Due sluggish brakes and reduced hyd pressure A/C returned. During return A/C braking was lost and A/C hit wall near ASF gate."

4.3.5 Aircraft Braking System-Description

The wheel brake system consists of a ***main system*** powered by the Aeroplane Hydraulic system and an ***emergency/parking brake system*** powered by a nitrogen accumulator.

4.3.5.1 The **main braking system** is controlled by toe pressure on the upper part of the rudder pedals and also provides differential braking as required. Depending on the toe pressure applied, hydraulic is supplied to the appropriate brake master cylinder and thereon to the brake control valve. The brake control valve is supplied with hydraulic pressure at 206 bars from airplane hydraulic system. This pressure is reduced by the control valve to an output between 0-170 bars and depends on the toe pressure applied to rudder pedals.

4.3.5.2 The **emergency and parking brake system** is powered by two-chamber accumulator, one chamber charged with nitrogen and the other with hydraulic fluid from the airplane hydraulic system. A parking-brake handle in the cockpit operates the brakes. Accumulator pressure is indicated on a pressure gauge mounted just above accumulator. The indicator has a green scale from 80-250 bars indicating satisfactory pressure and a yellow range from 40-80 bars to indicate warning range. The pressure is at maximum when airplane hydraulic pump is running and remains at maximum after the pump is switched off until the parking-brake handle is pulled. When the brake handle is pulled the accumulator pressure is reduced to 65-150 bars range through parking-brakes valve before being applied to brake-assembly. The accumulator pressure is sufficient for several brake applications. Repeated applications cause the pressure to drop until reduced to 40 bars and thereafter further application will have no braking effect. The accumulator pressure will again rise when airplane hydraulic pump is switched on.

Note:
The Emergency brake and parking system is designed to enable the airplane to be braked when parked and provides an emergency braking facility should the airplane hydraulic system fail. (Ref AMM 32-43-00p1)

4.3.6 Airworthiness Inspection/Test

Based on the post accident PIREP (Pilot report), a detailed inspection was performed on 20.02.03 to assess the airworthiness aspects of the aeroplane vis-à-vis subject occurrence. The inspection focused in general on the complete maintenance aspect of the airplane with specific emphasis on the Aircraft Hydraulic and brake system functionality. In view of damage to electrical power receptacle, external power could not be connected neither battery power could be utilized on the Aircraft. As such the electrically driven hydraulic pump could not be operated in such condition until relevant repair is undertaken. However, detailed physical inspection to verify integrity of Hydraulic system including electrically driven hydraulic pump, high pressure filter, hydraulic HP filter pop out indicator position, low pressure filter, hydraulic quantity level, relief valve for evidence of fluid discharge, lines/vents and drains in hydraulic bay was conducted and found normal. It is pertinent to note that in the written statement submitted by pilot in command after the accident he mentions noting the hydraulic pressure to be on the lower edge of normal band on the cockpit indicator. It is inferred from this statement that the hydraulic pressure was in fact normal. Pressure indication fluctuations (spikes) are usually discernible on the hydraulic pressure gauge whenever a shared hydraulically actuated service is suddenly activated. In this case the aircraft steering system input, which is sharing common hydraulic source with the braking system, can induce such effect.

Main wheel brake functioning and operation was checked using the emergency and parking brake system while utilizing residual accumulator pressure available after last system shutdown (i.e. without powering up the Hydraulic system). The pressure at time of this test showed 100 bars (normal range is 80-260 bar), which is sufficient for several brake applications. The brakes were applied and released several times using emergency and parking brake system. No abnormality was observed in the operation of brakes. ***No binding or failure of brakes to engage was noticed in this case.***

4.3.7 Technical Analysis

Based on post accident inspection of Aircraft Hydraulic system as discussed above and related maintenance history record of last five months till date, no instance of Hydraulic pressure loss is recorded. Moreover no pilot report is recorded since 03.09.02 till date of an occurrence of this nature, indicating a problem specific to the Aircraft hydraulic system or in general for associated systems such as nose wheel steering system and landing gear extension / retraction system on this account. No problem was reported on any

of these systems and no snag history is recorded on this account. Technical log shows "Nil" snag status for the four-week duration prior to this occurrence.

4.3.7.1 The emergency/parking brake system, which serves as back up for emergency braking in case of hydraulic system failure was checked and the operation verified. No abnormality was noticed. As discussed under the heading 'Post Accident Observations' (Paragraph 3.13.5), the Parking brake/emergency brake lever was found corresponding to off position at the time of inspection after the accident. As such it was not used by the operating crew. (Appendix 'V' Answer to Question 62). Considering a scenario where normal brake system is lost due hydraulic failure, the option of operating emergency braking system was not considered by the operating crew. The SOP in such cases is to shut down engines and call for tow without continuing further movement of aircraft.

4.3.7.2 Aircraft came to complete stop before crossing second barrier. This just preceded the aircraft clearance to taxi forward and the time when the #2 engine propeller struck the security barrier fence. It is concluded from subsequent rotational check of engine and allied gearing mechanism that movement of propeller and #2 engine power to the propeller died down at this point as a consequence of internal damage sustained by the prop upon impact with the steel-pipe fence. This premise is confirmed by the fact that no grazing marks (or other such damage) are visible on the wall structure, which in such eventuality will be inscribed by a rotating prop (under engine power). Propeller and associated pitch mechanism (#2 engine) was consequentially rendered inoperative on impact with fence due to severing of propeller shaft (internally) connection to the compressor/turbine. Impact with fence is visible on #2 propellers, which is curled. Damage to the fixed steel-pipe fence is identifiable by a broken structural member on the fence.

4.3.7.3 An assumption of a locked right main wheel condition is ruled out as the aircraft did not make a single point (yaw) turn to the right but proceeded progressively to the right side until the propeller hit the second steel-pipe fence barrier. Also no tread marks (skid) on tarmac or rotational (uneven) wear on tire is indicated. Additionally post

accident inspection reveals no brake binding and operation of braking mechanism is observed to be satisfactory.

4.3.7.4 Aircraft came to complete stop before crossing second barrier (i.e. heading towards General Aviation Hanger area), which confirms brake serviceability at that point in time. This is the event in sequence immediately after which the aircraft collided first with the fence and then with the wall when it started to move following the release of brakes by the crew. As per pilot snag report logged later, aircraft braking was reportedly lost before the accident. Based on such assumption the natural tendency of the aircraft should have resulted in continuous forward roll in the direction as commanded by steering input (straight-ahead following taxi line). This assumption does not explain the initial right hand drift followed by sudden veering of the airplane towards the wall. Also the extent of damage on the wing, prop, engine and nose antenna inside radome indicate a very quick movement towards the right before impact with the wall after the aircraft crossed the 2nd barrier fence.

4.3.7.5 Both the **Power levers** in the cockpit were found in the *flight idle range* (actual position at F1 which is air operation starting range corresponding to blue line on the pedestal). The left **Speed lever** was found placed in the shutoff range (not in the minimum or feathered position). As per manufacturer's callout, the **Power lever range** between *ground idle and flight idle* is used for taxing. This clearly implies that ***taxing should not be done with Power lever in Flight idle range.***

The ***Power lever position*** corresponding to **GI** (ground idle) selection provides *minimum fuel flow for ground operations* and in this selection the propeller pitch angle is controlled by the propeller pitch control unit and set to *zero thrust*. Conversely the Power lever FI (flight idle) range provides minimum fuel flow for flight. In this mode (i.e. FI) the propeller blade angle is controlled by the propeller governor. The power lever range between FI and MAX is used to select the desired power for a given flight condition.

4.3.7.6 As mentioned earlier the position found on both engine **Power levers** was in the FI range and indicates that the aircraft was being taxied at flight idle selection, which would mean that the pilot added too much power causing

the aircraft to move fast. This situation would cause a tendency for the engine to respond very fast to changes in power and the aircraft would become difficult to control as a consequence of high speed aircraft movement experienced as a result of such engine power selection. Complementing the power lever operation, the **Speed levers** control engine speed (RPM) as per pilot selection. During Beta *ground operation* mode the speed lever controls the under speed governor (USG) in the fuel control unit, while during *flight mode* it controls propeller governor (additionally it also controls feather valve and fuel shut off valve). With **Power lever** set in flight mode (as described above) during ground operation the **Speed lever** function would be in conflict with conventional wisdom given the two modes of Speed lever operation discussed here (Appendix 'J2'). This clearly points towards discrepant engine power management procedure adopted by the crew.

The left speed lever placed in shutoff range was positioned by the co- pilot to shutdown the left engine to correct an adverse inadvertent right hand yawing of aircraft. The yawing tendency would be created by sudden loss of engine #2 with engine #1 still operating when both engine power levers were set in Flight idle range.

4.3.7.7 On this aircraft certain conditions are required to be met, which involves operation of NWS switch, NWS button and engine speed levers while taxing and manoeuvring Aircraft. Details are given in AMM (Ref 32-5-00 Pg 2). It is also highlighted in Q.C Alert No. 1 issued by Star Quality Control section. *Taxiing and manoeuvring (45° Authority). The 45° steering authority is in operation when the following conditions are fulfilled:*

- *NWS switch set to ON*
- *Both engine SPEED levers set to LOW*
- *NWS button on the left-hand control wheel pressed.*

The 45° steering authority is applicable when both speed levers are set to the LOW position. The nose wheel steering is reduced to 8° when one or both speed levers are moved out of the LOW position (towards HIGH).

The nose wheel steering can be switched to the 8° authority by releasing the NWS button on the left-hand control wheel, or can be disengaged by setting the NWS switch to BYPASS.

(What makes this significant is that the nose wheel steering authority can be switched between 0-8 and 0-45 degrees at the pilot's (left hand control column) discretion by selecting Speed Lever position to High/Low.) In case Aircraft is moving fast and any one of the Speed Lever is selected at Low setting, any directional correction by engaging nose wheel steering button ***after*** applying full rudder can cause sudden increase to 45 degree steering authority and would make Aircraft difficult to control in such situation. Conversely, if aircraft is moving fast towards an obstruction and any one of the Speed Lever is selected at High setting, any directional correction by engaging nose wheel steering button would prevent maximum deflection of NWS to avoid obstruction. Likelihood of such occurrence is explored by Operations Investigator. (Appendix 'J2 & 'J4').

4.3.7.8 The fixed steel-pipe fence, which was struck by Engine #2 Propellers, is situated at a distance of approx. 30.5 feet from the yellow taxi line. The outer reach of propeller on #2 engine does not exceed 11-12 ft from aircraft BBL 0 by virtue of its construction. The probability of #2 propeller striking fence is only likely if the aircraft is moving at least 18-19 feet (on right hand side) off the centre taxi line (towards the fence).

4.3.7.9 Transcript from CAA ATC was obtained (Appendix 'D') to verify evidence for Aircraft return to Hangar after having entered apron area with focus on reporting/discussion of any technical reasons. It is interesting to note that no reporting of any problem with aircraft is traceable in the communication record between aircraft and ATC and no reason is given by pilot when he informed ATC of "returning back to dispersal area". What is, however, significant is the response of the Controller upon receiving this input when he questions the Pilot on his having entered apron without ATC permission for taxi clearance. As per established procedure, all Aircraft departing General Aviation area before entering apron confirm taxi clearance. Additionally, the pilot did not report the accident to ATC (Appendix 'D'). The accident was first reported officially by CAA (Pak) COO (to ATC) in person who was coincidentally passing by the site of the accident at the time of accident.

4.3.8 **Technical Findings**

4.3.8.1 The aircraft was properly equipped and maintained.

4.3.8.2 The maintenance staff was adequately qualified and certified.

4.3.8.3 The engine, aircraft systems and components including brakes and hydraulic system were operational.

4.3.8.4 Incorrect use of power and speed lever operation during ground taxi operation by pilot.

4.3.8.5 Taxing with Power Lever in flight idle range by pilot.

4.3.8.6 Aircraft Engine No. 2's propellers initially struck second barrier fence while aircraft was returning to the General Aviation dispersal area. The shock impact caused disengagement of Engine internal drive mechanism and resulted in sudden loss of thrust on Engine No. 2.

5. APPLICATION OF RULE 274 – CIVIL AVIATION RULES 1994

5.1 In view of the conclusions drawn from physical evidence and technical checks, the evidence suggests that the Pilot-in-Command (PIC) is responsible for the accident. Accordingly, the PIC, Captain Tanvir Afgan, was issued a notice under Rule 274 of Civil Aviation Rules 1994, and informed that he caused the accident of a serviceable aircraft and he may defend his position by giving a statement, producing any evidence or witnesses. Despite being given three chances to do so the pilot did not cooperate with the investigation team. Instead, he kept issuing a stream of correspondence asking for the provision of relevant records, documents material, statements of witnesses and basis on which he was likely to be held to blame. In response to his demands, Capt Tanvir Afgan was informed that evidence against him was based on his non-compliance with the standard procedures, non-adherence to points of airmanship and not following the Pilots Hand Book. The captain was also informed in clear terms that there was no witness statement directed against him and that the conclusions were based on his own report weighed against the evidence available on ground and on the aircraft.

5.2 On his first appearance he came with a counsel who promptly handed over a 'Wakalat Nama' (Appendix 'U') to the investigator incharge. Captain Tanvir Afgan told the investigator incharge that the counsel would represent him. The proceedings of the day were adjourned to consult the Legal Directorate of CAA on the subject, who confirmed that a counsel could not represent the witness at a present stage of the investigation.

Captain Tanvir was informed accordingly and again requested to reappear as per Rule 274. The witness stuck to his earlier theme of being provided with statements of witnesses, material and evidence collected by the investigating team. Since these could not be provided as already mentioned to him in writing, the PIC maintained a non-cooperative stance. His answers to direct professional questions related to the accident were 'No Comments' (Appendix 'V').

5.3 His case was again referred to the Legal Directorate and a decision of the DG CAA was sought based on the inputs from the Legal Branch. A third chance was provided to the witness pursuant to orders. His attitude during the third appearance again remained non-cooperative. It was noted during this appearance that the witness was not ready to accept even a small spelling mistake he had made in one of his of letters. In his letter he had written that he expected "justice and ***pair*** play". When asked what was meant by 'pair play', he replied that the meanings were self-explanatory. It was suggested to Captain Tanvir Afgan by the investigation team that this word may have been 'fair play' as 'justice and fair play' was in common usage. He, however, insisted that the English was correct. Two dictionaries, namely The Concise Oxford Dictionary (New Edition) and Chambers 20th Century Dictionary, were consulted but this phrase was not found in them. A break in the proceedings was taken and the witness was requested to produce any document, book, dictionary or any form of writing where these words were used. The witness, however, could not produce such a phrase but continued to insist that the English was correct. From such an attitude it is evident that a person who does not accept a simple spelling mistake is unlikely to accept responsibility for errors committed by him as PIC, which led to the accident. This stance of defiance is clearly manifested in his numerous letters and answers to the questions.

5.4 During his stream of letters (Appendix 'C1' to 'C10') addressed to the investigator incharge he leveled a number of allegations against the technical member and the investigation incharge without authenticating how he had arrived at concluding such allegations. Clearly, the aim of the Captain was to lead the investigators into areas not related to finding the cause of the accident but rather to digress from the main issue to small talk, the purpose of which seemed two fold:

- To turn the investigation into a court case.
- To show that he responded to the call under Rule 274 but to ensure that the proceedings do not become meaningful towards achieving the purpose for which they were held.

It is clear that the PIC remained non-cooperative in facilitating the investigation and kept blaming the investigation team of 'threatening' him. Yet, the evidence is so conclusive and compelling against him that Capt

Tanvir Afgan cannot absolve himself of the responsibility of causing the accident except by digressing from the main issues. Such a person, who is not even ready to accept a simple typing error can hardly be a 'fit person' (in terms of Rule 36 of CARs-94) to hold a flying license. For the present, his license has been suspended till finalization of the investigation; however, it may be necessary to cancel his license through the normal legal process. It may be dangerous to accept a person with such a strong ego, flying as PIC. His display of confidence without the requisite knowledge is a serious flight safety hazard.

6. CONCLUSION

6.1 FINDINGS:

6.1.1. The aircraft was on an approved-chartered flight.

6.1.2. The pilots were qualified but had low experience level on the type.

6.1.3. The Pilot-in-Command was not an employee of Star Air Aviation and had 11:30 hours on the type.

6.1.4. Captain Tanvir Afgan was flying as a PIC on the basis of a "To Whom It May Concern" letter from his employer OMV Pakistan to the operator (Star Air), which is in contravention to Rule 197 (2) (C) of CARs 94.

6.1.5. The contention of Captain Tanvir Afgan that he was 'Captain under supervision' of Captain Nadir Iqbal Mirza (Co-Pilot on this flight) is not supported by documentary evidence (Entry in the Authorization Book Appendix 'O') and by the CAA Rules as he is endorsed as Captain on Dornier-228-200 in his licence.

6.1.6. The pilot asked for start up permission but did not take taxi permission before proceeding out of the general aviation parking area.

6.1.7. The pilot did not report any problem with the brakes at any time before the accident.

6.1.8. While taxiing out, the aircraft stopped at least twice before it entered the apron and again twice during its return journey from the apron to the general aviation area. In addition, at least two 90 degrees turns and a turnabout were made before the accident. Brakes and the steering system were, therefore, serviceable before the accident.

6.1.9. The aircraft returned from the apron without announcing any reason (by the pilot) to the ATC.

6.1.10. While crossing the second barrier the aircraft drifted 18.5 feet to the right, and its right engine propeller hit the fence, causing the engine to disengage from the propeller internally.

6.1.11. Post accident inspection of the wall showed no nicks of the propeller on it. A rotating propeller would leave nicks on a wall when it collides with it.

6.1.12. Though the left engine was still generating power, yet the aircraft did not swung further to the right before collision with the wall.

6.1.13. Documents of the aircraft indicate that there was no reported snag involving either the brakes or the hydraulic system during the recent past.

6.1.14. Post accident inspection of the brakes and hydraulic system indicated no malfunction of the brakes or the hydraulic system.

6.1.15. The emergency brakes were not applied as revealed by the post accident inspection and also confessed by the PIC.

6.1.16. Even if the Flight Data Recorder (FDR) is down loaded, the parameters it is designed to record would not assist the investigators in arriving at any conclusion because these parameters are not related to the present accident. CVR readout facility is not available in the country.

6.1.17. Post accident inspection of the aircraft also revealed that the pilot was taxiing the aircraft at power setting higher than recommended.

6.1.18. Mismanagement of power was evident during taxi.

6.1.19. The evidence available on ground and through the aircraft documents could not substantiate the post flight write-up by the pilot.

6.1.20. After the collision the pilot did not inform the ATC about the accident.

6.2 **Cause**

Pilot not observing correct taxi procedure.

6.3 **Contributory Cause**

Low on-type experience and inadequate aircraft system knowledge.

7. SAFETY RECOMMENDATIONS

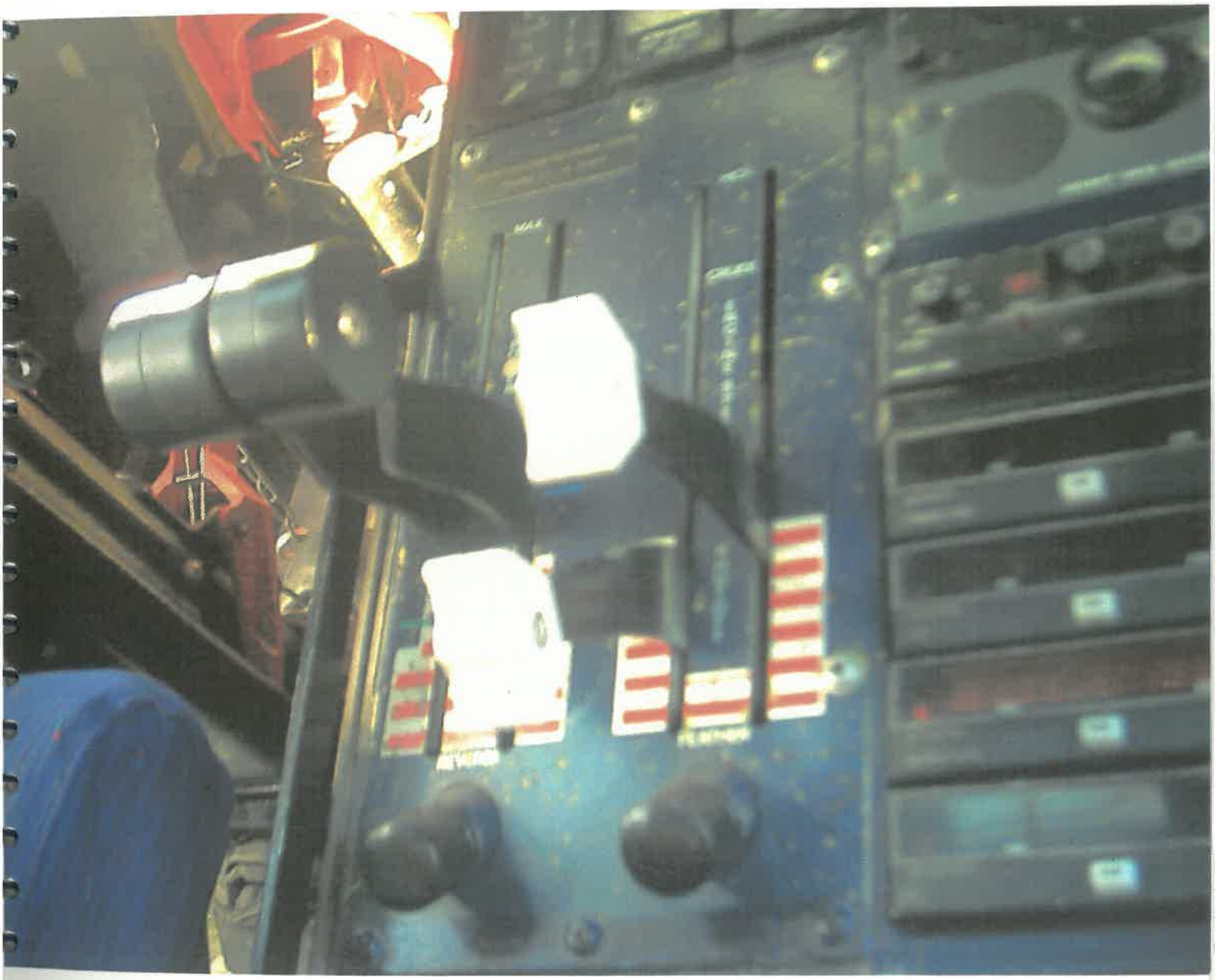
7.1 Captain Tanvir Afgan's rating on Dornier 228-200 be withdrawn.

7.2 Disciplinary action be initiated against Captain Tanvir Afgan for levelling unfounded allegations against the investigation team.

7.3 Observance of Rule 197 (2) (C) of CARs 94 be re-emphasized to all operators.

7.4 OMV Pakistan be advised to refrain from issuing letters, which are in contravention to CAA rules.

Appendix 'P2'



CLOSER VIEW OF POWER LEVERS (LEFT BLACK KNOBS) AND SPEED LEVERS (RIGHT WHITE KNOBS) POSITION

Appendix 'P3'

NOSE IMPACTED AT A SLANT ANGLE