CIVIL AVIATION ACCIDENT

REPORT NO CIA 156

FEDERAL REPUBLIC OF NIGERIA

MINISTRY OF TRANSPORT AND COMMUNICATIONS
AIR TRANSPORT HEADQUARTERS
14, BROAD STREET-LAGOS

REPORT ON THE ACCIDENT TO THE
CONCORD AIRLINES FAIRCHILD FH 227B AIRCRAFT
REGISTERED 5N-ATL AT MURTALA MOHAMMED AIRPORT RUNWAY 19L, IKEJA .

ON THE 1ST APRIL 1990

FEDERAL MINISTRY OF TRANSPORT AND COMMUNICATIONS
AIR TRANSPORT HEADQUARTERS

ACCIDENT INVESTIGATION BUREAU
.....DEPARTMENT

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LAGOS NIGERIA

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Ref. No.: CIA.156/09/91,
8th June, 19

The Honourable Minister
Federal Ministry of Transport and
Communications,
Air Transport Headquarters,
14, Broad Street
Lagos.

Dear Sir,

CIVIL AIRCRAFT ACCIDENT REPORT NO. CIA 156

I have the honour to submit the report complied by Mr. Remi Faminu of this bureau on the circumstances of the accident involving the Concord Airlines Fairchild Hiller PH-227B registered 5N-ATL at Murtala Muhammed Airport Runway 19L, Ikeja on the 1st April, 1990.

I have the honour to be sir,

Yours faithfully,

K. K. O. SAGOE,
Deputy Director,
Accident Investigation Bureau.

AIRCRAFT DATA

Type	-	Fairchild Hiller
Model	-	F 227
Serial Number	-	534
Registration	-	5N-ATL
Date of Construction	-	February 1967
Manufacturer	-	Fairchild Republic Company Hagerstown, Maryland 21740 U S A
Operator	-	Concord Airlines Nig. Ltd 18 Old Domestic Airport Ikeja - Lagos
Owner	-	The Operator
C of A Validity	-	22 April 1990
Total Airframe Time	-	20925 hours
Engines	-	Two Rolls Royce
Type	-	Dart - 532 - 7
Serial Nos	-	No. 1 - 16072 No. 2 - 16360
Propellers	-	Two Dowty Rotor Aerospace
Serial Nos.	-	No. 1 - DRG/323/65 No. 2 - DRG/191/67
Souls-on-Board	-	45
Place of Accident	-	Murtala Mohammed Airport Ikeja
Date of Accident	-	1st April 1990
Time of Accident	-	1055 hours UTC
Location	-	N.06^0 34.5" E.003^0 19.1"

Personnel Data

Pilot-in-Command	-	Capt. Joseph Gamra
Nationality	-	Nigerian
Age	-	43 years
Licence	-	ATPL No. 1287
Total Flying Experience	-	4926 Hours
Type Experience	-	528 Hours

First Officer	-	Capt Philip C. Amobi
Nationality	-	Nigerian
Age	-	33 years
Licence	-	ATPL No. 3083
Total Flying Experience	-	3200 hours
Type Experience	-	540 hours

Synopsis

The accident was notified to the Deputy Director Accident Investigation Bureau at his official residence and an accident inspector was dispatched to the scene immediately.

The accident occurred on the take-off run on the runway 19L, when the aircraft was accelerated to about 100 knots and it suddenly started to veer off the runway centre line. A maximum left rudder pedal application could not correct the runway side over-run onto the right hand shoulder.

The side over-run continued until the aircraft ran into an undulating terrain surface of the shoulder which sheared off the nose gear and the aircraft fuselage impacted with the ground with an immense momentum which distorted the front section airframe.

The report concludes that what was merely runway side over-run resulted into an accident exacerbated by an improperly maintained runway shoulder.

1. FACTUAL INFORMATION

1.1 History of flight

The flight crew arrived at the airport at about 0900 hours UTC and performed the preflight inspection for the Sunday mid-day flight to Port Harcourt. After the startup clearance, the engines were started and the aircraft was taxied out while the crew performed the 'taxi check' which was found to be normal. The Aerodrome Control directed that the crew enter the runway 19L and back track for the take-off clearance. So, the aircraft made a right hand turn into the runway through Link-2, taxied ahead to the threshold point where a right hand 180 degrees U-turn was completed to align with the runway centre-line. At the take-off clearance, the throttles were advanced by the flying captain, who was the Pilot-in-command, both of them being captains. As the aircraft started to roll, the first officer set the power to 15000 RPM on both engines, and a glance at the engine parameter indicators showed that all were in the GREEN.

The airspeed indicator coming alive, the officer called it out and at the call of 55 knots, the flying captain transferred his left hand from the nose wheel steering wheel to the control column. At the call of 80 knots, the captain cross-checked his airspeed indicator with his First Officer's call-out and he was satisfied with the instrument's accuracy. As the aircraft kept accelerating to V1, which was 102 knots, it started to veer to the right hand side of the runway centre-line, which instigated the captain on the control to comment rather casually, "Ha! this aeroplane is veering to the right" and he applied left rudder input as a corrective measure to nose the aircraft back to the centre of the runway. When maximum rudder application did not help the situation anymore, the captain announced his decision to abort take-off, and the F/O dutifully pulled the emergency fire handles after observing that the captain had retarded the throttles and had selected ground fine pitch on the propellers. By this time, the aircraft had left the paved runway onto the shoulder.

On the shoulder, before the speed could dissipate, the left landing gear had run over an uncovered runway edge light transformer pit and burst number two tire; but the roll continued until the nose gear ran into a small depression on the undulating runway shoulder and fractured the upper torque link, which made the nose gear to retract inward. The sudden retraction of the nose gear while the aircraft was still in some considerable high forward motion made the underside of the forward fuselage to severely impact with the ground and the Cockpit cabin suffered structural distortion and massive skin wrinkles.

The aircraft came to rest on the runway shoulder just before the link 4R which leads to the international terminal apron. Passenger evacuation was normal and there was no injury to passenger as well as to the crew members.

The accident occurred during day light at about 1055 hours UTC., location 06^0 34.5" North and 003^0 19.1" East; airport elevation is 135 feet.

1.2 Injuries to persons

There was no injury to any of the 40 passengers and 5 members of the crew.

1.3 Damage to aircraft

Substantial damage was done to the cockpit-cabin structure and the forward section of passenger Cabin structure. These primary structures are badly affected though only skin wrinkles were apparent to the eyes.
There was evidence of massive skin wrinkles and distortions at beneath and forward of the cockpit section, also at under the fuselage aft of the nose-wheel-well and at the upper fuselage mid-section.

The nose landing gear was totally destroyed and the nose wheel steering mechanism was totally destroyed.

While the left main landing gear was not damaged, the number two tire on the gear was totally destroyed.

1.4 Other damage.

One runway edge light isolating transformer was damaged and one runway edge light was damaged.

1.5 Personnel Information

1.5.1 The Pilot-in-command is a 43 years old Nigerian male with a Nigerian issued Airline Transport Pilot Licence No. 1287 valid until 7th June 1990. He had his aircraft type training in October 1989 and had accumulated 528 flying hours experience since then till the time of the accident. He had instrument ratings and aircraft type endorsements of DHC-6, BAC 1-11 in addition to the type he was flying at the time of this accident. The captain had a total flying experience of 4,926 hours and his medical certificate would not expire until 7th June 1990. He had rested for about 38 hours before reporting for duty that Sunday morning. He was therefore, well qualified to take the flight that day.

1.5.2 The First Officer is 33 years old, a Nigerian male with a Nigeria issued Airline Transport Pilot Licence number 3083 which was valid until 27th May 1990. His instrument ratings was good until 9th December 1990 and he has PA-31, Citation 501 and Fairchild F-227 aircraft type endorsed into his licence. The First Officer had a total flying experience of 3,200 hours, 540 of which were on the aircraft type. His medical certificate was valid until 27th May 1990. He was also well rested before undertaking the flight that Sunday morning.

1.6 Aircraft Information

1.6.1 The aircraft was predominantly operated in Europe where it was registered and de-registered in many countries. It held a Belgian registration when it was acquired by Concord Airlines Nigeria Limited. The aeroplane came under Nigerian registration on the 22nd of March 1990 and its provisional Certificate of Airworthiness was to expire on the 22nd of April 1990. The explanation given by the FCAA the registering authority for this provisional C of A, was to enable the owner to fly the aircraft to Nigeria before the operators could comply with the Nigerian Aviation Regulations after which full certificate of Airworthiness would be issued.

Incidentally, the aeroplane was flown into the country on the 26th March 1990 and crashed seven days later - Sunday the 1st of April 1990. No defect was registered in the Aircraft Technical Logbook which could indicate any inherent problem. The ferrying crew confirmed there was no technical hitch in the absolute performance of the aeroplane during the 15 hour ferry flight. The aircraft operated in the country for a total flight time of 83 hours and 22 minutes up till Friday 29th March 1990 when it was pulled into the hanger for paint touch-up and other finale to enable it to earn the full period of a certificate of Airworthiness. "Nobody", claimed the operator, "worked on the powerplant section for any reason". On Sunday morning about 0900 hours UTC the aircraft was pushed out of the hanger and put on the flight line for passenger flying operation. But it did not make the flight.

1.6.2 The aircraft is powered by 2 Rolls Royce Dart-532-7 turbo-prop engines. The port-board engine is serial numbered 16072, while the starboard engine is numbered 16360. The former engine ran for 3,767 hours Time Since Overhaul while the latter operated for 3,130 hours Time Since Overhaul. They had, therefore, both operated for more than 50% of their time between overhaul periods before the accident. The engine logbooks did not have any entry to portend inherent engine problems while it was on foreign registration, or during the ferry flight and during the short period in which they had operated in the country.

1.6.3 There was no indication of engine problem right form the start-up to the point when the aircraft was accelerated to "just before V1", which was the critical decision point of a take-off run and it is that point that the pilot makes his final decision whether to continue with the take-off or to abort it. The V1 for this aeroplane is placarded to be 102 knots indicated airspeed. The aeroplane had been accelerated to about 100 knots indicated airspeed when the veering tendency was first apparent. The aeroplane's performance, therefore, started to be in doubt from 100 knots indicated airspeed as per the crew's observations.

The weight of the aircraft on the take-off run was within limit, and the centre-of-gravity wouldn't have matter on this phase of the operation related to the accident.

The type of fuel used was the JETA-1 aviation fuel of which 7000 Ibs was on board the aircraft.

1.7 Meteorological Information.

The last weather trend before the take-off was issued at 1030 hours UTC and was:

Wind	-	from 210 degrees at 11 knots
Visibility	-	10 kilometres
Cloud	-	5 CUSC at 480 metre base
Weather	-	Nil
QFE	-	1009 HectoPascal (29,80 Hg)
QNH	-	1012 HectoPascal (29.88 Hg)

The aeroplane had an head wind of 11 knots and it was made available to the crew.

There was sunlight condition at the time of accident.

1.8 Aids to Navigation.

Navigational aids were not pertinent information to this accident though the visual ground aids were operating fully well.

1.9 Communications.

Communication between Control tower and the aircraft was good.

1.10 Aerodrome Information

Runway 19L is, in itself, a good runway to take-off and land on; but the taxi-way leading to the threshold point through the Link-1 is in a deplorable condition. This is the reason why aircraft from Domestic Aprons are instructed to enter the main runway and then to back-track for the eventual take-off. Again, large aircraft which cannot back track easily are instructed to cross the runway to use the opposite taxi way which leads to the threshold point.

This procedure sometimes creates a long queue of aircraft on a very busy day and also burns unnecessary fuel in taxing the aircraft to the beginning of the runway in use.

Only about 10 percent of the runway edge lights are functioning and there exist on the shoulder, scores of open transformer pits which should have been covered at the ground level. Please see the appendix 2A and B showing few of these open pits. One of them actually burst the number 2 tire on ATL.

1.11 Flight Recorders

1.11.1 Flight Data Recorder

The flight data recorder was still at its installed location in the aircraft after the accident.

The type fitted was a fairchild scratch foil recording model, which was replayed at the Air Accidents Investigation Branch at Farnborough UK. There was no problem encountered with the readout; however, for no adequate explanation, it was noticed that on previous flights, the recorder had been recording and stopping before touchdown. Information retrieved was good and satisfactory, but the calibration factor for the FDR has not been made available to form the base data for the read-out.

1.11.2 Cockpit Voice Recorder.

The CVR too was in a very good condition externally when it was recovered but when opened up, it was found that one of the allen screws bolting the two halves of the crash protection together was loose. This would only have caused a problem if there had been fire.

When the crash protection was removed, it was immediately evident that the tape was jammed and that some tape had become unspooled within the case (see appendix No.7).

The tape, an endless loop of 30 minutes duration, was taken from the centre and collected on the outside of the tape spool. The tape having passed the recording heads had become tightly wound around the tape capstan and the recording head. This tape situation had actually jammed the machine from recording the conversation on this unfortunate flight.

It was therefore, concluded that the recorder would not have been running at the time of the accident, though the recorder had functioned after the aeroplane was registered as 5N-ATL just couple of weeks back.

1.12 **Wreckage and Impact Information**

At the final resting point of the wreckage the aircraft was resting on its under side of the nose section after the nose gear had broken its upper torque-link and the strut had been retracted up into the fuselage. A short distance from the point of the ground impact, the aeroplane came to rest after a total run of 494 metres on the runway shoulder. As it looked to ordinary observer, the aircraft portrayed a minor damage to the under nose section only, but from aerodynamic point of view the airframe had been badly distorted as evident by skin wrinkles and dents under the cockpit cabin (appendices 3A & 3B). The cost of restructuring the whole fuselage both longitudinally and laterally could be astronomical.

1.13 **Medical and Pathological Information**

No injury to anybody was reported.

1.14 **Fire**

No fire outbreak.

1.15 **Survival Aspects**

The impact forces were survivable and the passenger evacuation was well coordinated otherwise panic could make the confused passengers run into coasting propellers.

1.16 **Test and Research**

At the initial stage of this accident the aircraft portrayed an indication of asymmetric thrust. The aircraft veering to the right indicated that the right engine must be defective thereby causing the unbalanced propulsion of the aircraft.

The right engine was therefore removed and shipped to the facilities of Hants and Sussex: Aviation Limited, Dart Engine Division in United Kingdom. Hants and Sussex is the largest independent Dart repair and overhaul facility authorised by Rolls Royce engine - the manufacturer.

The test cell of the No. 2 engine confirmed that the fuel pump overspeed governor had been set too low. The test run also indicated low power output of the engine at high turbine gas temperature and low engine oil pressure was also indicated. (Appendices 4, 5, & 6).

1.17 Additional Information

1.17.1 The power-plant

The fairchild Hiller F27-227 airplane is powered by two Rolls Royce Dart 520 Series turbo-prop engines. The operating cycle of these engines is a continuous process consisting of air compression, fuel injection to the compressed air, then expansion by combustion provide the high velocity gas stream which drives turbine wheel.

The fuel injection is metered by the fuel control unit which maintains a correct fuel/air ratio throughout the engine operating range. The continuous flow of fuel is supplied by an engine-driven fuel pump which has a variable output. The pump is provided with overspeed governor which automatically prevents excessive overspeeding of the engine.

The engine maintenance manual, chapter 73-2 under the "Adjustment/Test" of the fuel-pump - Maintenance practices issues a NOTE on setting the fuel pump governor, "Because of the maximum engine speed limitation, it is not permissible to overspeed the engine to the r.p.m at which the governor normally controls. It is necessary, therefore, to check and set the governor at a lower engine speed. The governor is then adjusted by a predetermined amount to obtain the final governor setting".

A setting Jig AK-969A or GU. 21377 instrument is prescribed for performing this "Adjustment/Test" Operation.

1.17.2 Aircraft Technical Logbook

Technical logbook is a mandatory document which must be carried on each aircraft registered in Nigeria. The commander of such aircraft must enter in the technical logbook particulars of any defect in any part of the aircraft or its equipment, which is known to him and if no such defect is known to him, an entry to that effect.

Upon the rectification of any defect which has been entered in a technical logbook, the work done for the rectification of the defect or any defect shall be entered in the technical log in such a position or manner as to be readily identifiable with the entry of the defect to which it is related.

Any other works in repair of defect or adjustment are also mandatory to be entered in the aircraft technical logbook and the repairing personnel to sign the appropriate section in the logbook for the work done.

2 Analysis

2.1 Preamble

The Accident Investigation Bureau believes that 5N-ATL's number 2 engine had been tampered with by the company's maintenance personnel.

The aircraft was parked in front of the Company's hanger at the end of Friday 30th March 1990 flight, which terminated at 1835 hours UTC. It remained on ground throughout Saturday 31st March 1990 but the company insisted that only minor jobs like paint touch-up and cleaning were performed on the aeroplane that day. On Sunday April 1st 1990, the 1045 hours, Lagos - Ports Harcourt flight would have been the first flight since the aircraft was parked on Friday night.

The bureau also believes that there had been verbal communications, between the flight crew and the maintenance personnel after Friday evening's last flight, about the aircraft's performance in flight but whatever the complaint was, was never entered into the ATL's technical Logbook. So when the same crew arrived on Sunday morning to resume their flight they might have had the assurance that everything was ok.

Investigation also drew out the fact that on other flights, the aircraft had the problem of right hand engine's fuel trimmer and the practice within the company is that when a snag develops initially, the flight crew will

continue to monitor the problem's parameters. If the problem persists the crew will then verbally intimate the ground engineer with the information, who may decide to work on it or decide to fly with the crew to observe the problem in flight. But on this occasion, the crew might have discussed the problem with a foreign nationale engineer who had earlier arrived with the aircraft, He, who did not understand the clandestine practice, would have seized the ensueing free day to adjust the fuel trimmer or the fuel pump overspeed governor. Observations by some airport workers remembered that they saw work being performed on the aircraft's engine while it was in the hangar.

2.2 The take-off roll.

While taxing, the crew stated they performed taxi-checks and they performed pre-take-off check when they were aligned with the runway and ready to go. But none of these checks called for power assurance check because it is not recommended. So there was no means of the crew's knowing that something was amiss.

Throttles were advanced to max-power and the aircraft started to roll, within 39 seconds the aeroplane had attained a speed close to V1. But for obvious reasons, on the attainment of 100 knots, the aircraft started to veer to the right and the veering became progressively incorrigible by the maximum input of rudder/vertical stabiliser's anti-yawing moment to counter-act the right hand runaway tendency of the aircraft.

The aircraft started to veer off the runway centreline because of the asymmetric thrust which was developed by the dissimilarity between the portboard and the staboard engine speeds - one was running at the maximum allowable speed of 15,000 rpm while the other engine's speed was being inhibited from attaining 15,000 rpm, because the fuel pump overspeed governor had been set erroneously to govern below 15,000 rpm.

2.3 Overspeed Governor

The fuel overspeed governor is set to normally control the maximum engine speed, because it is not permissible to overspeed the engine to the rpm at which the governor normally governs i.e 15,000 rpm. It takes an experience engineer and a special tool - the setting jig, to adjust the governor. (Appendix 4).

Although the air operator denied ever touching or working on the overspeed governor but this Bureau believes that the governor was tampered with after the aircraft arrived in the country as per our probability statement in chapter 2.1 of this report. Again the findings at the overhaul facility, where the engine was put on the test cell as described in chapter 2.4, proved that the governor was disturbed in many ways.

2.4 The test cell run

For detailed analysis, the staboard engine was shipped to the World Wide reknown Rolls Royce Dart engine overhaul and maintenance specialist Hants and Sussex in United Kingdom.

The shipped engine serial numbered 16366 was received in by shipping acceptance Section of the company which Logged the following observations against the conditions of the engine arrival:

1. Incorrect fitment of blanking caps at fuel pump bleed valve. (Appendix 5).

2. Fuel inlet shroud was left off.

3. Combined drain valve union was off.

4. Throttle valve lever split pin fooling casing was disturbed.

When the engine was installed on the test cell and ran as received, the test cell crew and this Accident Inspector observed that the overspeed governor started to govern the engine speed at a low setting of 14,974 rpm, instead of the maximum rpm of 15,000. The engine was then shut down and necessary re-adjustment was performed using the setting jig on the governor; the second run indicated that the governor, started to control the engine speed at 15,000 rpm. At this desired speed, the power output was 1,836 shaft Horse Power (SHP) and the Turbine Gas Temperature (TGT) was 802 degrees Celsius, which was not acceptable to maintenance standard. The maintenance manual calls for 790 degrees Celsius TGT at this speed and power output.

Could this be the reasons why the engineers cut down on the engine speed by reducing the governed speed of the engine ?.

At another run of 15,000 rpm, we obtained the oil inlet temperature of 120 degrees Celsius and the flight fine pitch solenoid energised the oil pressure at 13 pounds per square inch (psi). The minimum acceptable pressure to energise the solenoid is 14 psi.

Other test cell observations and findings were:

1. The oil and air leaks from the compressor feed pipes, which were repaired on the cell.

2. The port side igniter plug was worn-out and was replaced.

3. The hot air gate valve was found not functioning. (Please refer to appendix 6 for the detailed test cell result).

2.5 The runway shoulder

The aircraft has side-run the paved runway onto the shoulder. So what ? But isn't the shoulder specified by ICAO manual to be as equally as serviceable as the runway ? Although it is not the norm for aircraft to run off runway, but it is still acceptable occurrence for a negligible percentage of airplane operations to face some unfortunate incidents like this case on hand. ICAO "Aerodrome Design Manual" Document 9157 - AN/901 part 1 provides for certain categories of runways to have shoulders and stopways. The shoulders or stopways or runway are specified by the document "to be prepared or constructed so as to minimise the hazard to an airplane running off the runway or stopway".

The shoulders to Lagos runway 19L are hazardous to any aeroplane which have problem of keeping the runway heading.

The runway edge light assemblies have been knocked off their posts; the electrical transformers which power these lights have been excavated from their buried positions and their open pits or holes have become deadly traps to any aircraft running onto the shoulder. (Please see appendices 1B, 2A & 2B). One of such holes ripped open the No. 2 tire on ATL.

Despite the fact that the crew had shut down the engines before the onset to the shoulder the acquired speed of the aircraft could not be brought to an instantaneous halt. Unfortunately, it could not achieve this feat because the nose wheels ran into a small ditch

and fractured the upper torque-link which collapsed the nose gear to retraction. The sudden nose-gear retraction made the fuselage forward section to impact with ground with a devastating force which distorted the airframe. (Appendix 3).

This juncture of the runway side over-run exacerbated the incident to an accident of total loss of hull; it is the major factor of cause of accident.

This Bureau believes that if the runway shoulder had been maintained in accordance with ICAO Doc. 9157-AN/901 Part 1, 5N-ATL will still be safe and intact on the runway shoulder at the final stopping point. It could have been taxied or at worst, towed back to the operator's hangar.

3. Conclusions

3.1.1 The aircraft was certified and registered in accordance with aviation regulations of Nigeria.

3.1.2 The flight deck crew was also qualified and certified in accordance with the Nigerian Civil Aviation Regulations.

3.1.3 The two pilots are captains, trained and qualified to fly the aeroplane.

3.1.4 Whereas the aircraft had a technical logbook, but the book was not fully utilised.

3.1.5 At the end of the last flight prior to the one of the accident, the aircraft was parked outside the operator's hangar and no entry was made into the technical logbook indicating, inherent problems.

3.1.6 Investigation reveals that the aircraft had the inherent problem of fuel trimmers on one of its engines, which might have been verbally communicated to the maintenance crew.

3.1.7 Certain jobs were performed on the aircraft on the following day of the parking, but the type of jobs were not entered into logbook and the aircraft did not fly throughout the day.

3.1.8 On the morning of the accident flight, it is believed that the type of the job performed previously had rendered the aircraft unairworthy; but no logbook entry to raise any suspicion within the crew, which also was the same team that flew the aircraft last before the parking.

3.1.9 The flight crew unsuspectingly accepted the aircraft, started up the engines and taxied to the take-off position.

3.1.10 No pre-take-off check would have, at this point, revealed the inherent problem of the engines.

3.1.11 Within 39 seconds the aircraft had acquired the speed close to V1 before the asymmetric thrust became apparent and the take-off was aborted.

3.1.12 Records reveal that since the aircraft arrived in the country a few days prior to the accident, 18 take-offs had been executed and most of them by the same crew.

3.1.13 It is more than probable that the aeroplane became unsafe to fly after it was parked and an unrecorded jobs were performed on it.

3.1.14 On the very first attempt to take-off after the job, the attempt resulted into an incident.

3.1.15 The aircraft left the paved runway onto the badly maintained shoulder which exacerbated the incident into an accident.

3.1.16 Post mishap investigation revealed that the cockpit voice Recorder was not functioning after the aircraft had operated here in the country.

3.1.17 Investigation also revealed that the fuel pump overspeed governor foolproof casing had been disturbed before the engine was accepted for test cell run at the H & S overhaul facility.

3.1.18 The test cell run confirmed that the fuel pump overspeed governor had been set too low to achieve the maximum engine speed of 15,000 rpm.

3.1.19 The dissimilarity in the engines' speed led to the asymmetric thrust which made the aircraft veered off the runway onto the shoulder.

3.1.20 The undulating runway shoulder condition inflicted substantial damage to the aeroplane, which could have, hitherto, been brought to an accident - free halt.

A

Picture showing number 2 tire was ripped out by the opened electrical transformer pit on the shoulder.

B

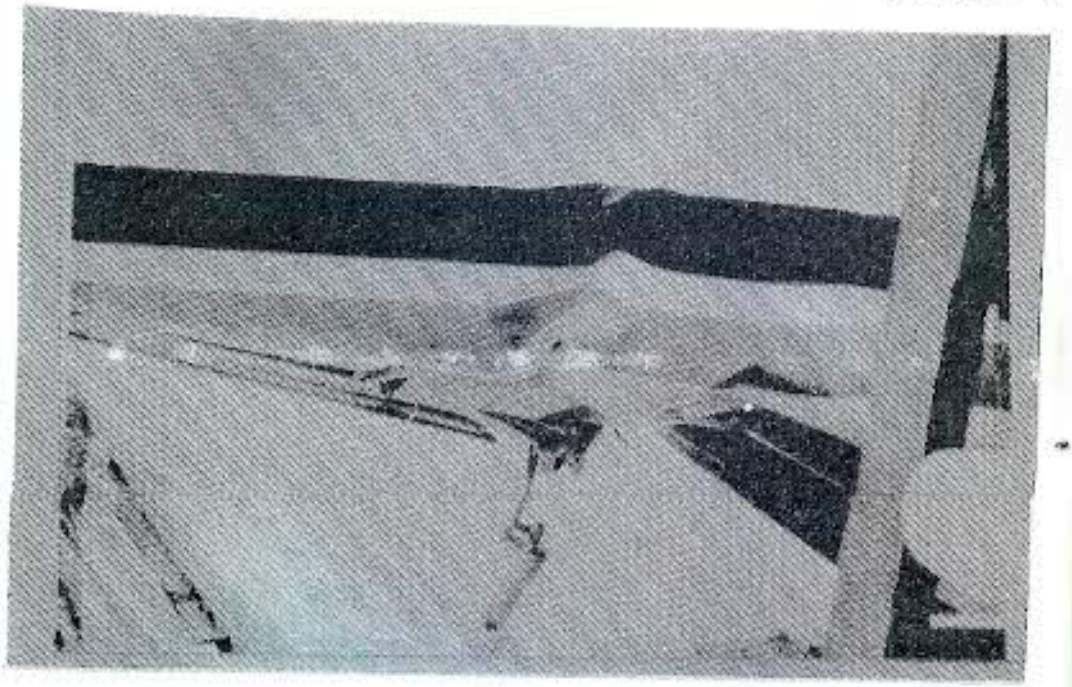
Picture showing the uncovered runway edge lights electrical transformer pit which through the tire.

A

Another uncovered electrical transformer pit which dotted the length of the runway shoulder.

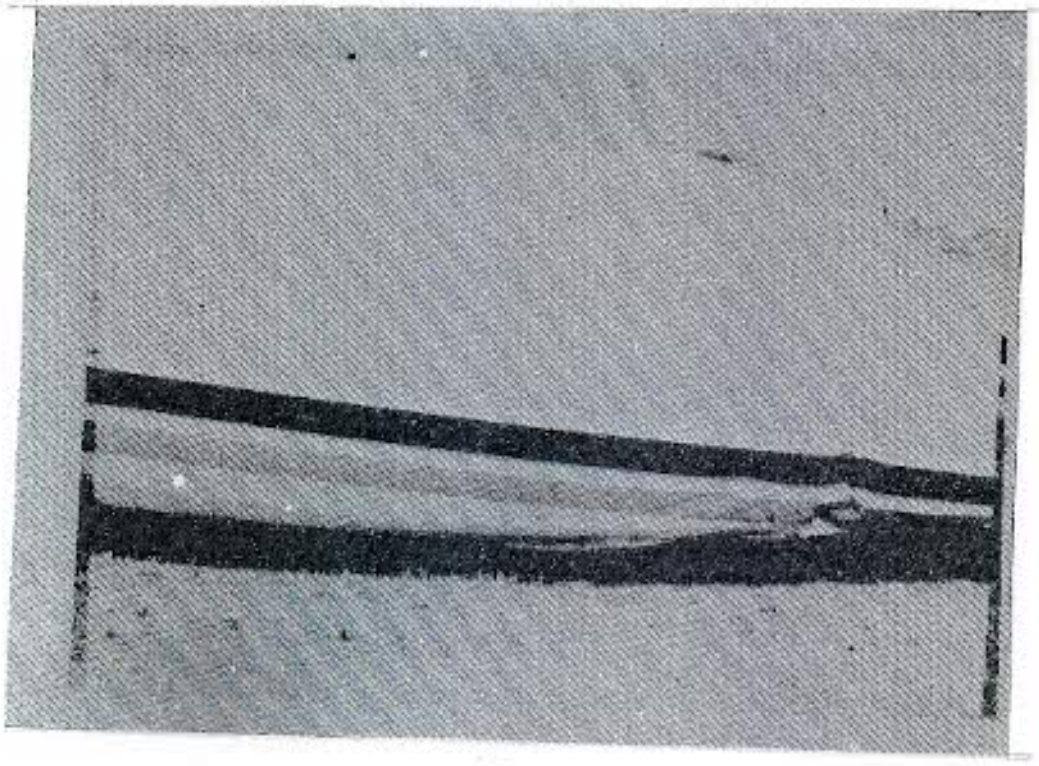
B

Another poorly maintained transformer pit.



A

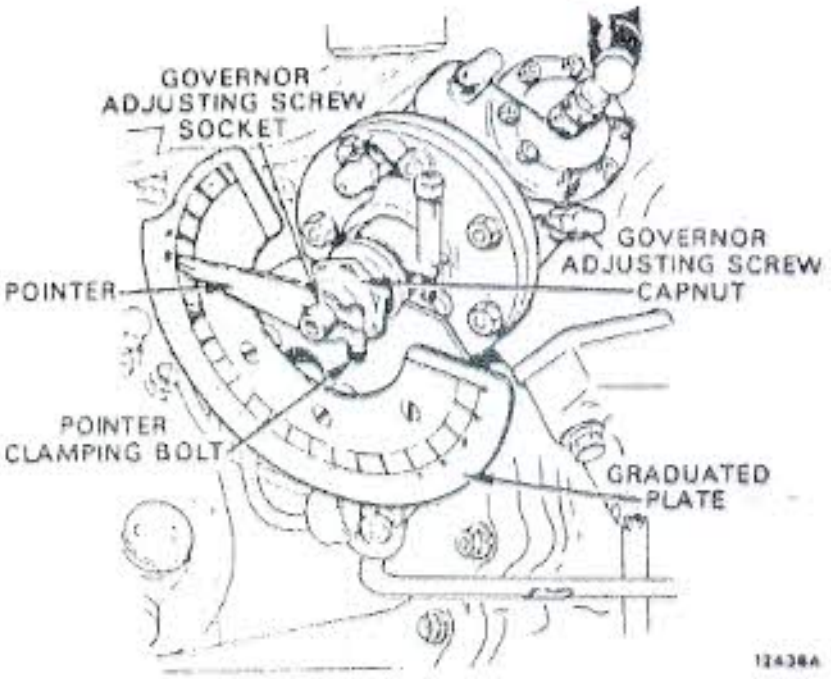
The damage to the underside nose section of 5N-ATL.



B

The nose section on the ground after the impact.

Fuel pump - Maintain practices (cont'd)



Fuel pump governor setting jig
Fig.202

(6) When the governor is set to control at 14,700 r.p.m., plus 0, minus 100 r.p.m. close the throttle and stop the engine. Reposition the pointer to coincide with the 0 degree mark.

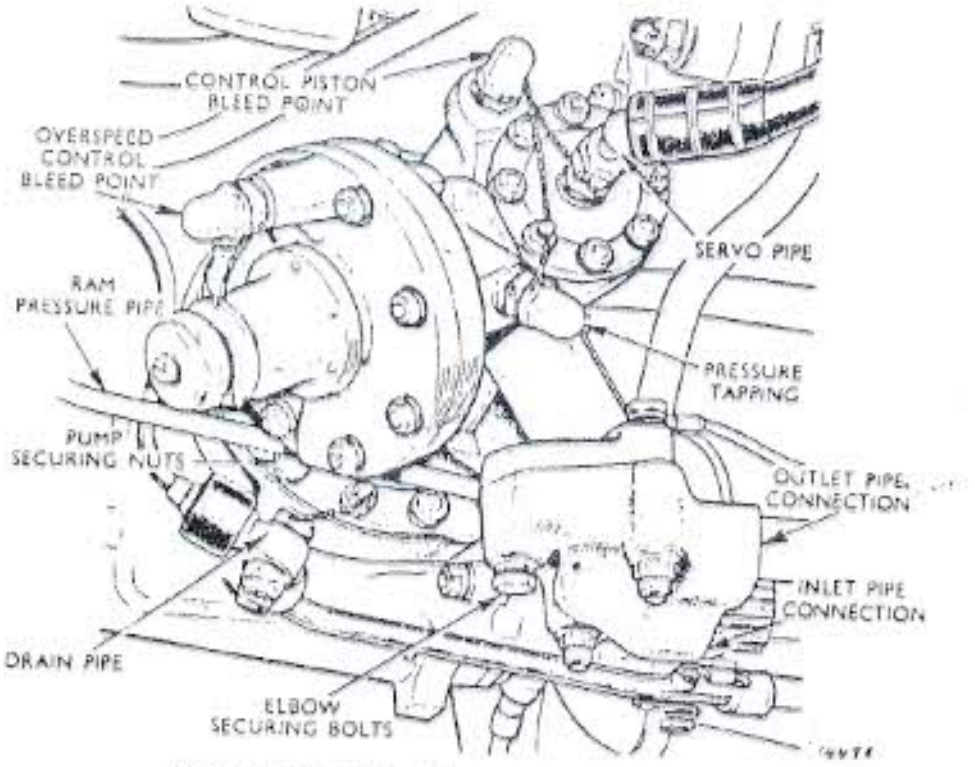
(7) Loosen the capnut and carefully move the pointer in a clockwise direction to the 180 degree mark. This adjustment will set the governor to control the actual governed speed. No attempt must be made to check this setting. Tighten the capnut and lock it with 0.028 in stainless steel wire. Ensure that the pointer setting is not displaced, then remove the setting jig.

(8) Reset the automatic feathering circuit breaker and restore the electrical supply to the automatic feathering circuit.

(9) Carry out an engine serviceability ground run.

Fuel pump - Maintenance practices (cont.)

(4) Fit the plain washers and pump securing locknuts.
(5) Fit:
  (a) Transfer pipes to the inlet/Outlet elbow.
  (b) L.P. fuel pipe (to differential pressure switch) to the inlet/outlet elbow.
  (c) Servo and drain pipes to the pump.
  (d) Ram pressure pipe clip to the pump mounting.
(6) Insert the transfer pipes into the F.C.U. connection.
(7) Fit the bonding lead at the elbow connection.
(8) Secure the elbow to the pump with the setscrew and two nuts.
(9) Split (cotter) pin the nuts.
(10) Bleed the fuel system, see chap. 73-0.
(11) Set the fuel pump governor, '3. Adjustment/Test'.



Fuel pump connection and bleed points
Fig.201

APPENDIX 6

W/O: 56783
S/No: 6360
Mk: 532-7

R+S AVIATION LIMITED
TEST REJECT REPORT

CARD No: RST8
ISSUE: 2
SHEET: 1 of 1

CUSTOMER: SET 7 EXECUTIVE

DATE: 5.3.91

1. REPORTED DEFECT: Fuel pump overspeed governor set too low at 15,650 RPM

2. Low power, high TGT

At 15,000 RPM engine produces 1325 SHP at 806 TGT
Maximum acceptance figures IAW 0-DAT-AC section 72-0 are 15,000 RPM producing 1325 SHP at 799 TGT.

3. Low oil pressure

At 15,000 RPM with an oil inlet temperature of 120°C
INVESTIGATION REPORT: and flight fine pitch ambient average oil pressure is 15.0 PSI
Minimum acceptance pressure IAW 0-DAT-AC section 72-
is (14.0 PSI)

4. Oil and air leaks from compressor fuel pipes replaced during test.

5. Fuel injector replaced during test.

6. Hot air gate valve not working.

* This section must be completed and copied to IQM/TSM

DEFECT CONFIRMED	YES/NO	ORIGINALLY BUILT AND CLEARED BY:
ASSEMBLY DEFECT	YES/NO	APPROVED TRADESMAN:
INSPECTION FAILURE	YES/NO	SUPERVISOR:
UNREPORTED DEFECT	YES/NO	

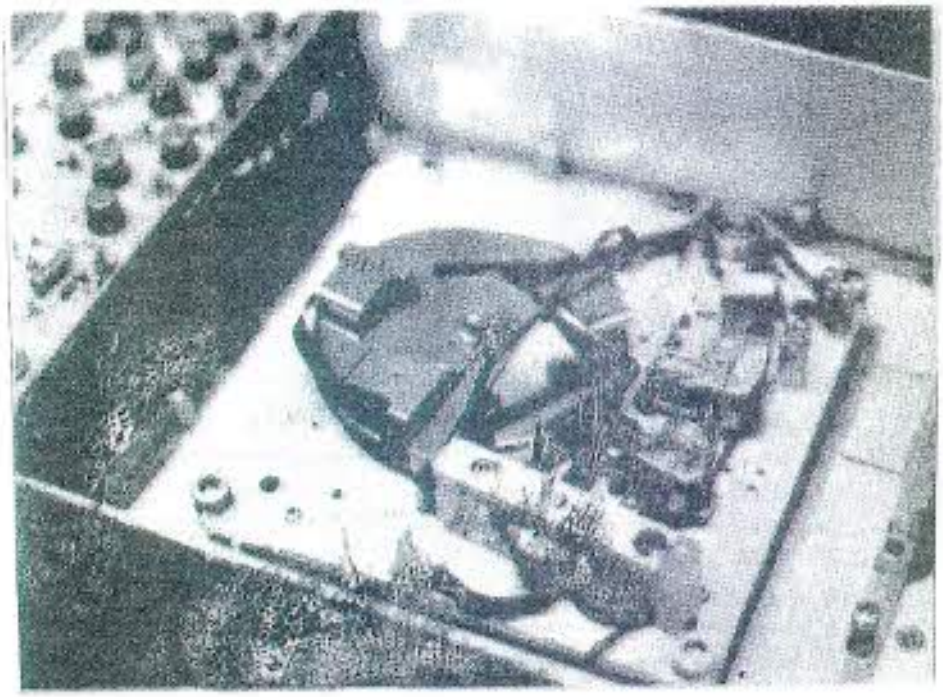
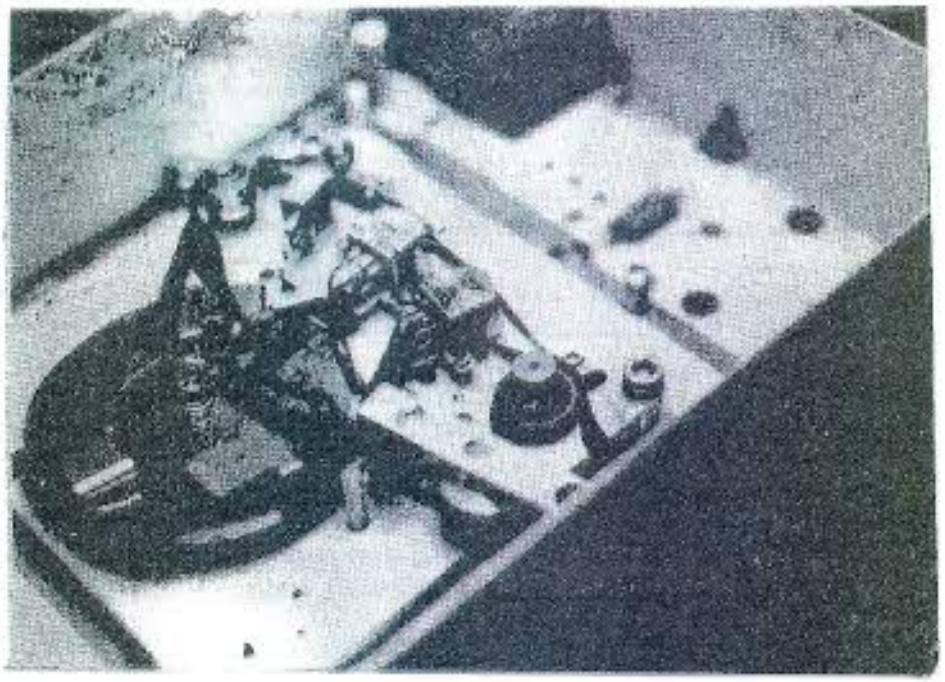
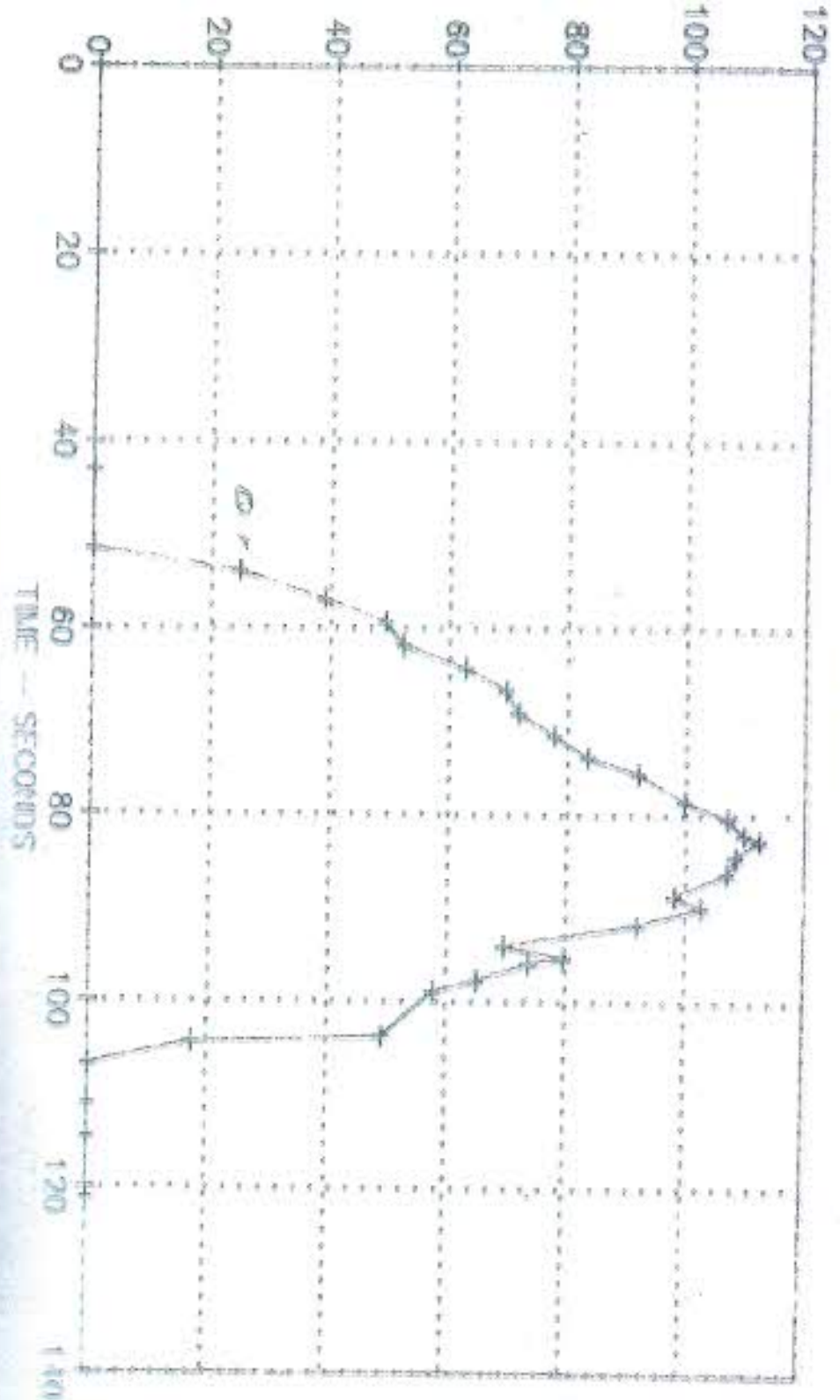


FIG. 10 CVR AFTER REMOVAL OF CRASH PROTECTION.



B

FIG. 11 TAPE WOUND ROUND TAPE GUIDE.



ACCIDENT TO 5N–ATL
FDR DATA

Eng No: 532-7 ESN: 14360 W/O: 53128 OVERHAUL/REPAIR TSO: 3097 DATE: 4-3-91

BAR: 29.53 FUEL SG & TEMP: 0.804 12.0 FUEL INLET TEMP: 11.0 FUEL CV: 10330 WET BULB TEMP 9.5. DRY BULB TEMP 11.5.

TIME	AIT °C	RPM Act	RPM Corr	BRAKE LOAD lb/ft	SHP corr	FUEL FLOW obs gall/hr	FUEL FLOW corr lb/sec	TGT/JPT obs °C	TGT/JPT corr °C	'K' FACTOR	TORQUE PRESS psi	OIT °C	OIL PRESS psi	REMARKS
10.12	S/D	TTL	4	SECS	730 (MAX) STARBOARD IGNITER ONLY									
	14.0	14,974	15,000	6670	1872	171.1	0.391	807	810	0.1180	400	70		P2 64 PSI
				6130	1726	163.2	0.373	775	778	0.1084	365	70	17.0	T2 15.6°C
				5600	1583	156.5	0.355	744	747	0.0991	330	70		WIND 210°
				4650				806		0.1176	420	100		SUNNY
				6085				773		0.1076	385	100	15.0	
				5435				734		0.0961	339	100		
10.39	S/D	RDT	78	SECS	OIL CONSUMPTION @ 1 PT/HR.									
11.03	S/D	TTL	4	SECS	618 (MAX)									
		WATER METH LEAK CHECKS SATISFACTORY												
11.19	S/D	RDT	81 SECS											
			STATIC	PROP CHECKS COARSE 520 PSI										
						FINE 540 PSI								
								TRT 1 HR 11 MINS						

MINIMUM OIL PRESSURE AT 15,000 RPM AND .120..°C, OIT.....13.0..... psi.

MAXIMUM THIRD LINE PRESSURE AT 14,000 RPM AND .120..°C, OIT....540..... psi.

OVERSPEED GOVERNOR SET AT 14,650 RPM AND SET ON 120... DEGREES ON SHUT DOWN.

STAMP

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