

DEPARTMENT OF CIVIL AVIATION

FOKKER F.27 9M - MCI

REPORT OF THE ACCIDENT AT PENANG INTERNATIONAL AIRPORT

ON 30th. DECEMBER 1981

AIRCRAFT ACCIDENT REPORT NO: /81

1.1.1. AIRCRAFT : VFW Fokker Friendship F27-500
Registration 9M-MCI.

ENGINES : Two Royce Dart 532 - 7.

OWNER AND OPERATOR : Malaysian Airline System.

FLIGHT CREW : 2

OBSERVER : 1

CABIN CREW : 2

PASSENGERS : 30

PLACE OF ACCIDENT : Penang International Airport,
Bayan Lepas, Penang.
Latitude : 0517 N.
Longitude : 10016 E.

DATE : 30 December 1981 at 1039 hours
Local.

TIME : 10:39 LOCAL.

SUMMARY

1.1.2 On the morning of 30th. December 1981 the Fokker F27 aircraft registration 9M-MCI departed Kuala Lumpur for its schedule domestic flight for Ipoh on the first sector. The second was from Ipoh to Kuala Lumpur. The third sector was schedule from Kuala Lumpur to Ipoh and then to Penang Airport. The aircraft then took off from Penang to Ipoh on its second last flight before returning to Kuala Lumpur. Almost immediately after take off at Penang Airport the aircraft was reported as "mushes back on the runway" and crashed on it's fuselage underside with the undercarriage in the up and locked position.

1.1.3. The aircraft started to strike the runway surface with its tailskid at a point 3910 feet from the runway end of 04 and its belly was seen scraping the entire 2300 feet on the runway and came to a complete stop a point 6200 feet from the end of the runway. The crew was seen to be vacating the aircraft together with the 30 passengers, and within minutes the situation was under control without any fire or further damage to the aircraft. There was no injuries reported after the crash.

1.2. INJURIES TO PERSON.

There was no injuries suffered from this accident.

Injuries	Crew	Passengers	others
Fatal	NIL	NIL	NIL
Serious	NIL	NIL	NIL
Minor/None	5	30	NIL

1.3.1. Aircraft Damage.

The damage were concentrated on the belly of the aircraft, where the belly skin and the lower frames were cracked and abraded from station 3100 thru 15235. The lower channels between the crash beams suffered from buckled, cracked and abrasion.

The main frames at Station 7961 - 9440 are buckled with the lower attachment flanges abraded.

The tail skid reinforcing plates were buckled with the metal strip at the tip abraded.

- 1.3.2. Wrinkling of the fuselage skin panels were found between STA 11235 and 12525. There were slight wrinkling of skin panel at STA 11825 below left and right windows. All the avionic antenna fitted on the belly skin were damaged by abrasion. There were no damage to the engines/propellers and wing.

1.4.1.

AIRCRAFT INFORMATION.

1.4.1. The aircraft is a Fokker Friendship 27-500 registration 9M-MCI being registered by the Malaysian Authority and maintained in the Public Transport category. The aircraft is owned and operated by MAS for its domestic scheduled flight in Malaysia.

The engine are Dart 532 - 7 and had done 4181 hours since overhaul. The airframe hours is 22892:05

1.4.2. Since the scheduled check the aircraft has flown for a number of hours before this accident. There was no reported unserviceability since then.

No. 1 propellers has done 1927 hours.

No. 2 propellers has done 500:26 hours.

Last Competency check : Completed Co-Pilot F27 training on the 25 May, 1981. Complete competency check on 30th April, 1981.

Last route check : 23 October, 1981.

FLYING EXPERIENCE

Total Pilot Hours : 105 hours.

Total Co-Pilot in F27 : 220 hours.

Medical Certificate : Valid till 31 May 1980.

Total Flying last 30 days. : 25 hours.

Total Flying hours : 495 hours.

1.5.3. The co-pilot is very junior in service, he had been with the company for only 13 months. He had very little experience in flying and during this flight he has been instructed to be the co-pilot for all the flights flown that day. As far as this sector is concerned he is doing his normal co-pilot duties. His flight duty hours was well within limits and his crew rest time was found to be adequate.

C. OBSERVER.

AGE : 30.

LICENCE : Malaysian Commercial Pilot's Licence, Valid until 11 March, 1982.

AIRCRAFT RATING : CC 41G, Bulldog 102, Cessna 402, HS 125.

MEDICAL CERT : Valid until 11th. March, 1982 with no restrictions.

Total HOURS : 2500 hours.

TOTAL ON TYPE: nil.

1.5.4. The observer was on his first observation flight on the Fokker F27 after completing the grounds school training for co-pilot duties. His duties were confine to observation from the 'jump seat' in preparation to become the co-pilot soon after. This observer had vast experience in the Air Force; including instructor training and his knowledge were of service types of flying with a mixture of single engine and twin engine experience. His participation was confine to observation duties only.

METEOROLOGICAL INFORMATION.

- 1.7.1. The weather report at Penang Airport at 0230 hours was fair weather with wind of 050/08 knots. Visibility all around the aerodrome is more than 10 kilometers with 1/8 of low clouds at 1800 feet and 4/8 at 30,000 feet.

The temperature at the time of accident is 28° celcius, with humidity of 72%. The QNH setting is 1011 mbs. There was no significant weather that could effect this accident. Particular attention was examined on the aspect of wind shear which could affect aircraft in the vicinity of this airfield. These factors were finally ruled out.

1.8.1 AIDS TO NAVIGATION.

All the aids to navigation of this airfield at the time of the accident was reported normal and there was no reported unservabilities of equipment.

The aircraft was on a take off roll and the use of navigational aids at this moment was nil and could not effect the consequences that occurred.

1.9. COMMUNICATIONS.

The communications were mainly centered to the use of VHF from the aircraft to Control Tower. There was no unserviceability in this aspect that could have cause their accident. Both control tower and the aircraft were in radio contact with a high degree of clarity. The last transmission was made by the Duty Controller to the Captain at 10:40 Local. There was no reply than due to the fact that the Captain has shut down the aircraft switches and vacated the aircraft.

Other communication to other aircraft was noted as normal and nothing abnormal to be highlighted in this report. However the committee was unable to traced actual timings of communication made before and after the accident due to the absent of the tape facilities in the Control Tower of Penang Airport.

1.10 AERODROME INFORMATION.

- 1.10.1. The airfield is an international aerodrome with a paved (Bituminous Asphalt) runway surface of 3475.6 meters (11,4000 feet).

Actual runway heading is 042/222 magnetic. And is 3.3. meters (11 feet) above the sea level, with actual take off run available as 2353 meters (11000feet). The gradient of the runway from 04 is 0% , until 2073 meters (6800 feet) where the gradient start to rise to 1/2% to the end of the runway. Further details of the runway is available in the Aeronautical Information Publications.

MEDICAL AND PHATOLOGICAL INFORMATION.

- 1.11.1. Medical attention was given to all the crew and passengers at the airport by the airport facilities, and there was no injuries reported by persons involved in this accident.

FIRE AND SURVIVAL ASPECT.

- 1.12.1. There was fire reported in this accident, although the smoke was evidently noted as heavy coming from the underside of the aircraft. The accident was survivable.

FLIGHT DATA RECORDERS.

- 1.11.1. The investigators manage to extract the F.D.R. and on inspections of the conditions revealed that every component was intact, and a reasonably accurate figures could be obtain to assist the findings of this investigation.
- 1.11.2. The BDR is a foil type having 5 parameters recording i.e.: Airspeed, height, gravity force, heading and a time base. The airspeed recorded for this flight was seen and interplated as below 125 knots to 100 knots. The marked decrease of airspeed is clearly seen to established a few seconds before the final drop of speed to be low 100 knots.

There was no indications of height on the FDR, as the scales is too minute to pick off any height changes below 100 Feet. The 'G' forces was recorded as 1.5 indicating that there was a relatively low impact forces with the aircraft and the runway surface.

The heading and the time base was not used to assist any of the calculations involved in establishing the cause of this accident.

Although the FDR reading of speed was taken for calculation the necessary of speeds above 110 knots to 125 knots was doubtful and the scales used to established this figure require a more accurate method to assist the investigation.

ANALYSIS.

- 2.1.1. The initial investigation revealed that the aircraft struck the runway at (3910 feet) 1192 meters from the end of the tarmac available for runway 04 with the first impact taken from the tailskid of this aircraft. The scraping marks (two feet) .61 to the right of the centre line) was seen continuous until a point (3960 feet) 1207.3 meters where the marks were not visible indicating that the aircraft was airborne again for another (70 feet) 21.3 meters and the marks continued to show from this point (4030 feet) 1228.6 meters to the end of the crash site at(6200 feet.) 1890.2 meters.
- 2.1.2. Further investigations were continued to establish the start of the take off, and finally it was concluded that the distances were taken (based on a rolling take off point) at (400 feet) 121.9 meters from the end of the runway surface. Thus the initial impact point was selected as (3510 feet) 1070.12 meters.
- 2.1.3. The investigation committee were then able to obtain the initial fuselage crash angle from the tailskid which indicate an angle of 19 degrees, and the FOR recording was valued as 1.59 positive 'G' with some (loss of airspeed).
- 2.1.4. Interviews with witness from the ground and from the aircraft reached that the aircraft did not get off the ground to any distinct height. However, the cockpit crew confirm that the aircraft was airborne achieved the required speed of 104 knots before rotation was initiated. The cockpit crew concerned that the last speed they could positively remember is 109 knots, which is the (VR) of this aircraft with the condition of the day of the accident.
- 2.1.5. Although the FOR recorded speed of 100 to 125 knots were seen on the magnified data sheet attached the accuracy of the interpolation were suspected. However speed above 100 knots and 109 knots were accepted for the calculation of the analysis.

- 2.1.6. From the various graphs and figures obtained to base all the calculations, it was verified that the distance at which the VR could be reached is (3029 feet) 923 meters from start of the take off roll. These figures indicate that the aircraft could have rotated at this point where (VR) is also equals (VI).

UNDERCARRIAGE

- 2.1.7. The investigators were unable to establish any witness marks that could indicate any malfunctions or damages that could be done by the aircraft sinking on the runway, nor could they find any damages prior to this flight.
- 2.1.8. The undercarriage system were tested two hours after the accident without altering any essential and related switches, and the results showed that the undercarriage was working in perfect order, with a retraction time of 6.5 seconds (see damage report).

The conclusion was that the undercarriage has been selected up with the handle bar properly secured in the correct position, and the time taken to properly secure in its bay is 6.5 seconds. Aerodynamic forces at this juncture would be too minimal to cause any significant time increase.

Thus, the time taken from the gear handle being down and selected to the up position to the system being locked in the bay, as 6.5 seconds.

- 2.1.9. It is clearly seen here that from the time the aircraft lifted off the ground to the point of initial impact, the aircraft would take 2.28 seconds (using one average speed of 107 knots) to travel a distance of (3080 to 3510 (Research) 939 meters to 1070.12 meters 430 feet (131.09 meters)).

This also shows that the undercarriage system were retracted almost immediately after rotation and the aircraft impacted the ground without the landing gear as it is in the process of retracting but has passed the lower belly position, going rearward into its bay. The nose wheel system travels forward. With the aircraft level on its belly the nose gear door system is too high to cause any scraping damage, which proves correct on this accident.

PROCEDURES.

2.1.10. The Company procedures for this type of take off which is "Dry, flapless" is to select a climb angle of 10 degrees using the artificial horizon as a guide. For a "wet Flap" take off an angle of 6 degrees would be used to initiate the initial climb angle. The normal positive rate of climb would be identified by indication of instruments and visual cues before selection of the wheels would be commanded by the captain of the aircraft .

2.1.11 The vast difference in initial rotate angle from (Dry flapless) and (wet with flap) is noted as "reason" to be the concern of this investigation committee. The outcome of the finding of this accident would be highlighted at the end of this report.

The aircraft were flown in the following sequence.

First take of Rotate angle is 10 degrees.

Second " " " " " 6 "

Thrid " " " " " 10 "

Fourth " " " " " 6 "

Fifth " " " " " 10 "

As can be seen in this procedure that changes in rotation angle can contribute to difficulties in aircraft handling and increases a chance of making an error of which angle for which take off.

CENTRE OF GRAVITY.

2.1.12. From the load sheet the aircraft loading were found to be well within the limits specified by company and manufacturers figures. However on the day of the accident the trim position where the crew claimed to have last set was at 0 setting were found to be at (3/8 of the division, with nose up trim).

2.1.13. Individual seating and loading were accounted for and it is noted that all the passengers were occupying the rear seats leaving 10 rows of empty seat in front of the aircraft. Although this conditions were a major initial focal point. On further analysis, this has been confirmed as correct and the discrepancy of aircraft C.G. limits could not be found.

WEATHER AND TURBULANCE.

2.1.14. On the day of the accident the weather was given as wind of 050/07 knots, visibility more than 30 kilometer temperature 28°C and the runway was dry. There was a short skyvan 220 aircraft which took off 3 minutes before this F27 aircraft, there was no apparent wind shear reported anywhere within the vicinity of the airport.

Turbulent around the surrounding hills were carefully studied for any possible eddies that could cause any significant effect on the aircraft taking off from runway 04. Even the possibility of the turbulent from the proceeding Skyvan were accounted, but the results indicate that these possibilities were way beyond logical mathematic calculation to effect the aerodynamic of this F27 aircraft. Wind of 050/07 knots would be away from the runway after 3 minutes. In addition the wing vortex of this Skyvan aircraft was too small to effect F27 aircraft.

RUNWAY SURFACES.

2.1.15. This particular runway has undergone an extensive repair previously and the authorities has been keeping a watchful eye on any complaints from all operating aircraft and most of the complaints were mainly confined to rough surfaces effecting take off roll and landing run, but the runway surfaces has just been redone two weeks before the accident and no further complaints were received to the day of the accident.

2.1.16. On the day of the accident this aspect has been inspected thoroughly and no significant irregularities could be traced to effect this take off roll.

The runway slope from beginning 04 to (6000 feet) 1829.2 meters were noted as having 0° gradient and (6000 feet) 1829.2 meters to 11900 feet (3628 meters) as 1% downslope gradient.

Any retardation effect on exseleration of aircraft was estimated and factorized as normal.

CONTROLS.

- 2.1.17. From the interviews, the flight controls engineering report, and actual functional test done by the investigators there were no defects found. The cockpit crew stated that there was no significant difference in control feel up to the time of accident. Different sets of crew were interviewed to determine control feel before and after the accident were investigated. The results were noted as normal. The possibility of controls malfunction were ruled out.

INSTRUMENTS.

- 2.1.18. The crew reported that the airspeed were positively identified as 104 knots before rotate was commence and there was no way that the airspeed could have been missed read and all possible errors on the airspeed indicator system were thoroughly checked. Both the instruments especially the airspeed indicator and associated systems were tested for any defect, but the results indicated that normal errors were minutes to contribute to the cause of this accident. This possibility is thus ruled out.

WITNESSES.

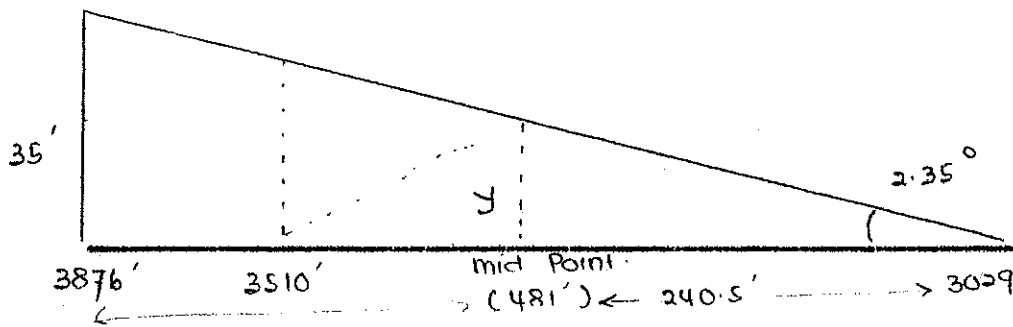
- 2.1.19. Two ground witnesses who were at the sence before and after the accident , were able to give clear indications that the aircraft was hardly a few feet above the ground. at the point of rotation and to the time the aircraft settled on the runway. Although their evident were not taken as a whole meal clues, the outcome of other witnesses which include the duty crash crew and the Air Traffic Controller of the airport indicated that the aircraft did not established any significant height. Other witnesses in the aircraft itself also indicated that the aircraft was airborne for a period of not more than 4 seconds.

CALCULATION OF HEIGHT ABOVE GROUND.

- 2.1.20. As can be seen from the various figures above, the distant from the take off point or from the initial rolling point of this aircraft to the initiation of the rotation by the captain is taken as (3029 feet) 923 meters. From this point the aircraft started a climb to achieve 35 feet (10.6 meters) by 3876 feet (1181.7 meters) making a climb angle of 12.36 degrees.

(Tangent $2.36 = 35 \div 847$).

With the final contact point at (in this case would be at 3910 feet - 400 feet = 3510 feet, or (1070.12 meters). The height above the ground is calculated to be "y" = see diagrams.



To Obtain y from the diagram.

$$\begin{aligned} \text{Tangent } 2.35^\circ &= \frac{y}{240.5} \\ &= 9.9 \text{ feet.} \end{aligned}$$

2.1.21. From calculation it is possible to conclude that the aircraft could not exceed more than 9.9 feet above the runway and the eye witnesses confirmed that this figure is very close. This height is more than sufficient to initiate the landing gear retraction sequence.

2.1.22. The figures used in this calculations were based on the flight manual and figures obtain from the manufacturers' data which were calculated and factorized as the actual figures (see appendix.....)

- a. The VR for the condition specified is 2694 FEET.
- b. The lift off point is 3029 FEET.
- c. The distance to 35 FEET POINT is 3876 FEET.
- d. The stall angle of this aircraft is 12°.

2.1.23. Although the figures are based on estimate, this performances distances could be improve due to the rolling take off done by the aircraft on this particular accident. If it is so, the only significant different is that the airborne time which will be longer than the estimated 2.65 seconds. Should this be so than the theory is even stronger than what it is. The height above ground would be higher and the landing gear would have more time to be able to settle its bay. The calculations is illustrated in the diagram below:

2.1.25. Further to this, it must be remembered that as mentioned earlier in 2.1.6 VR was used together with V1 at 2694 feet. Therefore using speed of 104 knots average from the time VR (V1) was called to the time the aircraft impacted the ground was: (3510 - 2694) add 125 feet for rolling take off the distance would be 941 feet \div 175.6 = 5.35 seconds.

It proves that the undercarriage has been selected within this time and it is far too early and the aircraft could not possibly reach V2 (109 knots).

HUMAN FACTORS.

- 2.1.22. The captain has been flying for this company for the last one year and had obtained a considerable amount of hours with just enough time to settle in this F27 fleet operations.
- 2.1.23. On the day of the accident the pilot flew all the sectors due to the fact that this had to be shown to the observer on the complete sequence of the co-pilot duties. On other days the co-pilot would fly half the sectors. (Depending on experience).
- 2.1.24. Although the duties of the Captain were somewhat increased with extra emxiery, the conditions of the pilot is assessed as fit and does not show any significant effect on his ability. His rest and duty time were recorded as ~~satisfactory~~ satisfactory. Medical report indicate that the pilot was fit and in able condition to take the flight .
- 2.1.25. The anxiousness of the captain to proceed with this second last flight is shown in the beginning of this sector at the dispersal area where he requested for "start up clearance" and the control tower had to refused his request because passengers were still boarding the aircraft . The flight was also 15 minutes late.
- 2.1.26 The situation were further agreviated by the controller offering the aircraft for an immediate take off due to an in coming aircraft. The captain accepted this offer and proceeded briskly for a rolling take off.
- 2.1.27. As the runway is a long one, with 11200 feet available take off run, the element of complacency is this existed to contribute to a aleittness of the pilot is somewhat reduce.

THE FINDINGS.

- 3.1. The findings of the committee is that the aircraft did a normal rolling take off from runway 04 and started to lift off at a point 923 meters from the threshold of the runway belly of the aircraft started to strike the runway at 1070.1 meters. This shows that the aircraft was airborne for 146.6 meters. It is noted here that the left point is a calculative estimate, based on the performance graph of the aircraft with all the criteria available being computed. The possibility of the aircraft being airborne earlier could also be applied to support the theory but at this juncture this would not be necessary to effect much on the findings of this accident.
- 3.2. The stalling angle of this aircraft is computed as 12 degrees. The normal pitch angle for rotation with this configuration is 10° , the impact angle is 19° , therefore the most probable cause is that the aircraft was put to an angle which exceeded the critical angle of attack thus causing the aircraft to stall and push towards the ground. When the aircraft stalled the captain slowly increase the pitch angle thus aggravating the critical condition to where the accident was beyond retrievable point and aborting the take off was the only solution to remedy this situation.
- 3.3. Since the aircraft was airborne for about 2.65 seconds (using the average speed of 107 knots), this amount of time is sufficient for the landing gear to be retracted to almost halfway point. As seen from the evidence gathered the aircraft stalled soon after rotation and crash on the runway with the undercarriage in the up position.
- 3.4. In conclusion the aircraft was over rotated to an angle of attack above the stalling angle and it stalled just after lift off.
- 3.5. The early retraction of landing gear is a contributory cause of the accident.

RECOMMENDATIONS

The following are the recommendations made by the accident committee regarding the accident involving 9M-MCI on 30th December, 1981.

- a) Malaysian Airline System (MAS) is to adopt a procedure that all take off in this particular type of aircraft are executed utilising 16½ degrees flap. The usage of water methanol for any take off is still at the discretion of MAS provided it does not jeopardise the safety of the aircraft.
- b) MAS is to review and amend all existing procedures pertaining to undercarriage retraction. Sufficient instrument and visual indications to indicate a positive rate of climb are to be incorporated in the procedure.
- c) The adoption of stalling exercises in the flying training and test syllabus are of paramount importance. On this track, MAS is to include these exercises in all 'check rides'.
- d) In accordance with the existing Air Navigation Order 1953 under investigation of Accidents para. 8 sub para (1)(a) 6 - (f), the Inspector of Accidents by whom the investigation is made ^{is} given certain powers. For smooth running of the investigation, MAS is to provide better assistance and cooperation in the implementation of these regulations.
- e) The Captain of the aircraft is to cease exercising the previlages of his ATPL license No: 536 for a period of one year with effect from 30th December, 1981.
- f) The Department of Civil Aviation is to acquire the necessary laboratory equipment for accurate testing and interpretation of flight data recorder.
- g) The Department of Civil Aviation is to install a radio communication taping facility at Bayan Lepas International Airport in order to assist future aircraft investigation.