Islamic Republic Of Iran
Civil Aviation Organization
Deputy of Flight Standard
Aircraft Accident Investigation Department

Final Report
Basic Information

Type of occurrence:	Accident
Date:	02.Jan.2008
Time of accident:	07:32 local time (04:02 UTC)
Location of accident:	Mehrabad International Airport (OIII)
Aircraft:	Airplane
Model:	Fokker 28 MK-100
Registration:	EP-IDB
Owner:	Iran Air
Operator:	Iran Air

Civil Aviation Organization of I.R. of Iran
Deputy of Flight Standards (Aircraft Accident Investigation Department)
Mehrabad International Airport
Tehran/Iran
PBO: 13445-1795
Fax: + 98 21 6601 8659
Tel.: + 98 21 6604 7965
---
http://www.cao.ir/farsi/Offices/Office03.aspxE-mail: AIG@cao.ir

Contents:

Foreword:

According to Aircraft Accident Investigation Act of Civil Aviation Organization of the Islamic Republic of Iran,

- Accident investigation shall be conducted separately from any judicial, administrative disposition, administrative lawsuit proceedings associated with civil or criminal liability.

Base on Annex 13 to the Convention on International Civil Aviation, Chapter 3, Paragraph 3.1, and Chapter 5, Paragraph 5.4.1; it is stipulated and recommended as follows;

- The sole objective of the investigation of an incident or accident shall be the prevention of incidents and accidents. It is not the purpose of this activity to apportion blame or liability.

- Any judicial or administrative proceedings to apportion blame or liability should be separated from any investigation conducted under the provisions of this Annex.

Abbreviations:

AGL	above Ground Level
A/C	Aircraft
A/D	Airworthiness Directive
AFM	Airplane Flight Manual
AIRMET	Airmen's Meteorological Information
ARP	Aerodrome Reference Point
APP	Mehrabad Approach
ATC	Air Traffic Control
ATIS	Automatic Terminal Information Service
ATPL	Airline Transport Pilot License
BEA	French aircraft accident investigation bureau
BFU	German Federal Bureau of Aircraft Accidents Investigation
C	Celsius
C.S.N	Cycle since new
CVR	Cockpit Voice Recorder
DME	Distance Measuring Equipment
FDR	Flight Data Recorder
FT	Feet
GND	Ground
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
METAR	Meteorological Aerodrome Report
mm	Millimeter
MSL	Mean Sea Level
NDB	Non directional radio beacons
NM	Nautical Mile
OAT	outside Air Temperature
RWY	Runway
RR	Rolls- Royce co.
TAF	Terminal Aerodrome Forecast
T.S.N	Time since new
TWR	Tower
UTC	Universal Coordinated Time
VOR	Very high Frequency Omni directional range

Synopsis:

On Wednesday, 02.01.2008, the Accident Investigation Department of Civil Aviation Organization of I.R of Iran was notified that a Fokker F.100, operated by Iran air with flight No.IRA.235 involved an accident immediately after take off from Tehran Mehrabad International Airport (OIII)/I.R of Iran at time 07:32 local time.

The Aircraft Accident Investigation Department of I.R of Iran Civil Aviation Organization began the accident investigation. According to Annex 13, chapter 5, the Notification was sent to Dutch safety board (state of Design &Manufacture) and German Aircraft Accident Investigation Bureau-BFU (state of engine manufacture). The Accredited Representatives and their Advisers were introduced to I.R of Iran CAO.:

Netherlands Dutch Safety Board:
Mr. Vogelaar Gisbert Accredited representative
Mr. Arthur Reekers Adviser (Fokker Service)

German Federal Bureau of Aircraft Accidents Investigation (BFU)
Mr. Thomas Karge Accredited representative
Mr. Smith Kelvin Adviser (Rolls-Royce co.)

The Cockpit voice Recorder and the Flight Data Recorder have removed from aircraft. The download of the FDR and CVR had performed in BEA laboratory in Paris on 18th Feb 2008. The state of manufacture has been provided the information of FDR and CVR by investigation team and finally this state sent FDR findings and their analysis.

It maybe concluded that on accident time, there was such a snowy condition and the ***aircraft was not de-iced*** according to manual .This accident caused by the unusual aircraft attitude and roll rates in combination with possible wing airflow separation which has encountered just during take off.

1. Factual Information

1.1 History of the flight:

On 02 Jan 2008, at 07:32 local time ,The Aircraft F.100, registered EP-IDB, operated by Iran Air flight No;IRA235 took off from runway 29L of Mehrabad Airport (OIII) /Teheran destination to Shiraz (OISS) city in the Islamic Republic of Iran . It was a regularly scheduled passenger transport flight. The aircraft started to roll to left wing down shortly after lift off. The left wingtip touched the ground. Thereafter the aircraft rolled momentarily back to a more neutral position. A few seconds later, while losing altitude, the second left wing down roll started. The left wing touched the ground and when the aircraft rolled back to a more neutral attitude both main landing gears touched the ground. All gears broke off and the aircraft sled on the area next to the runway.

Reportedly, during the impact or shortly thereafter all electrical powers were lost. When the aircraft came to rest, the fire developed starting from the left wing root towards the fuselage. All passengers and crew were evacuated through the two right over wing emergency exits.

1.2 Injuries to persons:

When aircraft stopped, all passengers and crew were reportedly evacuated through the two right over wing exits. The latest report about the persons that involved in accident descript as:

injuries	crew	passenger	others
fatal	0	0	0
serious	4	7	0
minor	1	11	0
none	3	87	0
TOTAL	8	105	0

.1.3 Damage to aircraft:

After taking off, the aircraft has reached to 30 feet altitude. The aircraft got wing stall phenomena. The aircraft lost altitude and hit the ground. The wheels of nose landing gear were separated; throw outboard and one of them hit leading edge of left wing, causing fuel leakage. When the aircraft came to rest, the fire developed starting from the left wing root towards the fuselage. The aircraft fuselage has "**destroyed**" due to this accident.

1.4 Other Damage:

None

1.5 Personnel Information:

1.5.1 **Pilot None Flying** :(Right Hand Seat)

_ Pilot in command

_ Male, 46 years old, Iranian Nationality

_ Commercial pilot, ATPL (A) No.1462 Class 1, from Iran CAO

_Type rating: F.100

_ Valid Medical Certification

_Total flight time: 8200H

_Flight time on F.100: 1215 H

-The latest simulator check: 15 Dec, 2007

1.5.2 **Pilot Flying**: (Left Hand Seat)

_ Male, 53 years old, Iranian Nationality

_ Commercial pilot, ATPL (A) No.1482 Class 1, from Iran CAO

_Type rating: F.100

_ Valid Medical Certification

_ Total flight time: 11545 H

_Flight time on F.100: 2750 H

-The latest simulator check: 24 Aug, 2007

1.6 Aircraft Information:

1-6-1 General Information:

_ Type: Fokker 28 Model: MK.100
_ Manufacture: Fokker Co (Stork).
_ Manufacture date: 25.09.1990
_ Serial number: 11299
_ Certificate of Airworthiness: valid until 20.Jan.2008
_Total airframe hours 30732
_ Total cycle 33933
_ Weight in accident time: 90913 lbs

Reference speeds:

Source: AOM performance take-off speeds, for 90913 lbs and flap 8 for R/W 29 L of Mehrabad airport in Tehran(wind 180 Deg . 4 Knot – wet runway)
VR = 136 knots V2 = 137 knots
V2 = 1.2Vstall==========➔V.stall = 137/1.2 = 114 knots
VFR= 145 Knots VFTO = 180 Knots

Stall Warning

Source: report UK-28-364:
Stick shaker flap 8° actives when AOA is >17° (+/- 0.5°).
Stall warning bit FDR set when Stall Protection Computer (SPC) channel A or channel B stick shaker is active.

1-6-2 Engine details:

There were engines model RR Tay 650-15 installed on this aircraft. The detailed information of these engines:

№	Serial Number	Manufacture. Date	T.S.N	C.C.N	Date Of Last Overhaul
1	17332	October 1990	18851	20860	30/11/2006
2	17300	August 1990	22318	24729	17/05/2004

1-6-3 Aircraft anti-ice system:

Normally hot air from engines is used for ice formation protection (Anti-ice) in wing leading edge and tail stabilizers and engine intakes. In such a cold weather situations, the pilots usually put on anti-ice system according to aircraft manual. According to Fokker design this system is not achieved in the ground. This system begins to work as effect of ground flight switch after lift off. However, the limitation of this system, subtracting human errors have caused some accident in the world .we can focus on two accidents of this type of aircraft in Skopje/Macedonia in 1993 and Pau/France in 2007. The conclusion of fore mentioned problems introduced some countries in order to perform airworthiness directive NO; FAA 2002-14-27.
This A/D has recommended installing ***On Ground Wing leading Edge Heating System*** via Fokker service bulletin F100-30-018.This A/D was not achieved on F.100, EP-IDB.

1.7 Meteorological information:

The meteorological information in airport on 01/02 /2008 was as following:

METAR:

	Time		Wind		Visibility	Cloud	TEMP/DEW	Pressure	
	UTC	LMT	DIRECTION (DEG)	SPEED(KT)			RH	HPA	INCH
	02:50	06:20	180	04	1000m	FEW035CB SCT 040 OVC090	01/M01 86.41%	1018	30.09
SPECI*	03:07	06:37	180	04	600m	FEW035CB SCT 040 OVC090	01/M01 86.41%	1018	30.09
	03:20	06:50	180	04	800m	FEW035CB SCT 040 OVC090	00/M02 86.29%	1018	30.09
	03:50	07:20	150	04	1200 m	FEW035CB SCT 040 OVC090	00/M02 86.29%	1018	30.09

TAF:

OIII 012030Z 020018 24004MPS 4000 HZ SCT035 BKN 100 TEMPO 0009 15006MPS 6000 FEW030CB SCT035 BKN100 TEMPO0918 2000 SN RA

AREA FORECAST:

TEHRAN AREA 7000 FEW070 SCT140 TEMPO LOC 2000 SN BR HZ FEW065CB SCT070 BKN120 OVC160

405053 VRB04 410055 26010/15 420073 26025 430095 27060/65 440007 28070

AIRMET 2 VALID 020315 Z 020530 Z OIII
AMD AIRMET 1:

ISOL EMBD CB TOPS ABV FL150 AND SFC VIS LESS THAN 2000 DUE TO SN BR OBS/FCST LOC OVER W, TEHRAN AERA OF IRAN

Correction Version SNOWTAM 0001

A) OIII B) 01020355 C) 11 F) NIL/NIL/NIL G) XX/XX/XX H) 5/5/5 T) BA BY CAR .SN FALLING

Also the cockpit crew received **ATIS INFORMATION (J) as** following:

Mehrabad International Airport, INFORMATION JOLIET TIME 0300 Z. Expect ILS one approach runway 29 L , 29 for departures and arrivals .Transition level 100.Wind 180 Deg 04 Kt .Visibility 800 m . Weather snow, few cloud at 3500 Ft, overcast at 9000 ft .Temperature01, dew-point -1. QNH1018. On first contact with Mehrabad International Airport Tower or Approach notify received of JOLIET.

In the Aircraft Operating Manual of FOKKER 100 (FLIGHT TECHNIQUES ADVERSE WEATHER OPERATION - 7-11-1 PAGE 1) had described:

THE KEY TO A SAFE COLD WEATHER OPERATION IS TO ADHERE TO THE CLEAN AIRCRAFT CONCEPT; DO NOT TAKE OFF WITH ANY ICE, FROST, SNOW OR SLEET / ON THE UPPER SURFACE OF WING AND TAIL.

Meanwhile, in another paragraphs in this page, it was pointed that **Ground Icing Conditions** as below:

Ground icing conditions are considered to exit when the Outside Air Temperature (OAT) is below +6 Deg C (42 Deg F) , and either the difference between OAT and "Dew point" temperature is less than 3 Deg C (5 Deg F) , or visible moisture (fog, rain, drizzle sleet , snow or ice –crystals) is present . In addition, ice can form on a "cold – soaked" wing at temperature well above +6 Deg C (42 Deg F) in conditions of high humidity or visible moisture. Be alert to rapidly changing weather conditions, as e.g. sleet or snow may not melt everywhere, or may re-freeze on a "cold – soaked" wing or horizontal tail.

Some uncommon forms of ice accumulation are discussed below:

- Thin layers of ice resulting from frost (overnight under a clear sky and temperature just below freezing) or freezing fog may cause **"sandpaper"** roughness on wings and horizontal tail surface. This roughness may cause deterioration of the aerodynamic properties of wing and tail to such an extent that a safe take off is impossible.
- Relatively warm fuel, uplifted during a stop, may cause dry snow to melt on the wings. This melted snow can re-freeze when the temperature is below freezing, forming an invisible ice layer underneath the snow. Never assume that snow will be blown off during take off roll**.**

Therefore, in according to meteorological reports and ATIS we received , the all of the conditions was shown ICING CONDITIONS because OAT(01 Deg C) was below +6 Deg C and (difference between OAT(01 Deg C) and DEW POINT(-1 Deg C) was less than 3 DEG C and visible moisture(fog , snow) presented .

1.8 Aids to navigation:

The navigation aids in Mehrabad International Airport (OIII) are:

NDB	380 KHZ
DVOR/DME	115.300 MHZ
LLZ	109.900MHZ
ILSGP	333.800MHZ
ILS/DME	CH36X

According to the information of the ATS General Department, all navigation aids available worked normally, and there were not any deficiencies in serviceability prior to the accident.

1.9 Communication:

The communication systems in Mehrabad International Airport (OIII) are:

Section	Frequency	Duration	Index
APP:	119.700 MHZ	H24	
	121.500 MHZ	H24	Emergency frequency
TWR:	118.100 MHZ	H24	
GND	121.700 MHZ	H24	
	121.900MHZ	H24	SMC
ATIS(INFO)	128.000	H24	

The radio communications took place in English / Persian languages and were recorded by the air traffic control. All conversation between the crew and air traffic control were available. There were not any communications problems between the pilots and any of the air traffic controllers who handled the accident flight were reported.

1.10 Aerodrome information:

The Mehrabad International Airport is situated in Tehran capital of I.R. of IRAN country.

_ Name : Mehrabad International Airport

_ ICAO Identifier : OIII

_ ARP Coordination: 354120N 0511853E

_ Landing direction : 11 /29 R&L

_ Runway length 29L: 4030.6 M

_ Runway elevation: 3962 ft

At the time of accident, there was moderate snowing in the airport and according to ***cold weather operation manual*** of airport, all facilities normally had been using and RWY 29L was available.

1.11 Flight Recorders:

This aircraft has been equipped with DFDR and CVR. Both recorders were picked up from relatively undamaged compartment of aircraft in a very good condition. They remained under I.R of Iran CAO control and were presented to BEA laboratory in order to download/analysis and witnessed by aircraft and engine manufacturer representatives and Iranian team on 18 Feb, 2008.

1.11.1 Cockpit Voice Recorder:

Condition of the Recorder: no damaged, serviceable

Made: Sundstrand Type: AV557C

Part Number: 980-6005-070 Serial number: 13002

The type of CVR has a magnetic tape with a recording 30 minutes.

All channels were copied with special equipment into computer. The whole conversations were in Persian/English language. The highlights of the results of CVR and cockpit crew containment voices and interview with coordinator during investigation are:

a) There was moderate snowing in accident time and visibility was poor.
b) The pilot flying realized necessity of aircraft de-icing and has notified to the Pilot in Command.
c) Finally the aircraft has not been de-iced.
d) The Hold Time was so long period due to traffics in the airport.
e) Cockpit Resource Management was recognized weak during taxi and take off.

1.11.2 Flight Data Recorder:

Condition of the Recorder: no damaged, serviceable.
Made: Sundstrand Type: UFDR

Type Number: 980-4100-DXUS Serial number: 8339

This type of FDR has a magnetic tape with a recording time of at least 25 hours. The download of the FDR was successful .The initial evaluation of the flight data revealed known aircraft configuration.

UTC	Event	Remark
03:44:04	Engine 1 and 2 parameters started to increase.	Temporary engine parameters increase and ground speed consistent with taxi speed.
03:44:05	Longitudinal acceleration increased.	
03:44:08	Engine 1 and 2 parameters decreased gradually until engines ran idle at sample 110.	
03:44:09	Ground speed started to increase.	
03:44:47	Longitudinal acceleration decreased a little bit.	Parameters consistent with taxi speed. The heading remained approximately 105 degrees.
03:44:48	Ground speed reached approximately 7.5 knots, hereafter the groundspeed started to decay.	
03:45:20	WXR LH EFIS off.	The weather radar picture on the LH EFIS was selected off.
03:45:35	WXR RH EFIS off.	The weather radar picture on the RH EFIS was selected off.
03:45:55	Longitudinal acceleration decreased.	
03:45:58	Ground speed decreased to 2 knots Longitudinal acceleration returned to The same value as before taxiing.	Aircraft stopped.
03:46:38	Longitudinal acceleration increased.	Aircraft started to taxi.
03:46:44	Ground speed started to increase.	
03:46:56	Longitudinal acceleration decreased intermittently.	Parameters consistent with taxiing. Maximum ground speed recorded during this period of taxiing was 7 knots. The heading remained approximately 105 degrees.
03:46:58	Ground speed reached 7 knots.	
03:47:32	Longitudinal acceleration decreased further.	Aircraft stopped
03:47:33	Ground speed reached 1 knot.	
03:58:14	Transmit became active for 1sample.	
03:58:24	Transmit became active for a short time.	
03:58:27	Longitudinal acceleration started to increase.	Aircraft started to taxi.
03:58:30	Ground speed started to increase.	
03:58:43	The heading started to increase from approximately 105 degrees to 195 degrees which was obtained at sample 1012.	The aircraft turned to the right.

03:58:49	Transmit became active for a short time.	
03:58:58	Ground speed became 9 knots. The maximum value recorded during this part of taxiing.	
03:59:49	Ground speed started to decrease.	
04:00:11	The heading started to increase from proximately 195 degrees to 289 which were obtained at sample 1091.	The aircraft turned to the right.
04:00:32	Engine 1 and 2 parameter started to increase.	Temporary engine parameters increase and ground speed consistent with taxi speed.
04:00:37	Maximum EPR obtained (1.07/1.12). Hereafter the EPR started to decrease until sample 1100 when both engines were running idle.	
04:00:40	The heading started to decrease from approximately 289 degrees to 286 which was obtained at sample 1100.	The aircraft turned slightly left to align with the runway.
04:00:50	Ground speed reached 1 knot.	Parameters are consistent with initial take-off.
04:01:12.	Engine 1 and 2 parameter increase	
04:01:19	The ground speed started to increase.	
04:01:21	Longitudinal acceleration increased.	
04:01:25	Both engine stabilized momentarily at 1.24/1.27 EPR. Rudder position started to change to maintain runway heading (until lift-off).	
04:01:27	Active lateral mode changed from 0 to 1. Active thrust mode changed from 5 to 7. Auto throttle engaged.	FMA: TO TO --- HDG
04:01:29	Elevator pushed forward (aircraft nose down).	
04:01:35	The airspeed became valid (30 knots).	
04:01:40	Take-off EPR obtained (1.735).	
04:01:47	Airspeed became 80 knots. Auto throttle clutches opened.	
04:02:03	The elevator deflection indicates that the crew pulled back the control column to rotate the aircraft. At the same moment the rudder deflection was stopped. The airspeed was at that moment approximately 137 knots.	Parameters consistent with rotation
04:02:04	The aircraft pitch started to increase.	
04:02:07	The lift dumper system disarmed.	Aircraft became airborne.
04:02:08	Ground flight switch indicated flight. The airspeed was almost 148 knots.	
04:02:10.	Both EPR indications showed a momentary dip (minimum values 1.73/1.71). The engine rpm's remained stable	
04:02:11	The aircraft started to roll left wing down. Aileron started to deflect left wing up The elevator moved in the aircraft nose up direction until the elevator reached the mechanical stop –27 degrees at sample 1185. Pitch momentarily stabilized at 12 degrees aircraft pitch up. Hereafter the pitch angle started to increase again. The angle of attack shows the same trend as the pitch. The angle of attack stabilized momentarily at 11 degrees after which it increased. The maximum airspeed during the flight reached was 150 knots. Hereafter the airspeed started to reduce. Heading changed in the left direction. The heading change continued until impact.	The roll rate was approximately 10 degrees per second
04:02:12	Just before sample 1184 the crew gave 20 degrees (maximum) left wing up aileron. The aircraft roll stopped at	

	an angle of approximately 27 degrees left wing down. The stall warning system became active. Both EPR's started to drop again. Engine 1 rpm's started to reduce while the same parameters of engine 2 showed an increase.	
04:02:13	The aircraft rolled back towards wings level. The aileron deflection decreased toward neutral. The aircraft reached its maximum radio altitude of 30 feet. After this moment the aircraft descended.	
04:02:14	Aileron position became around neutral. The roll angle became less than 9 degrees leftwing down.	
04:02:15	The aircraft started to roll to the left again. The aileron started to deflect in the left wing up direction. Maximum pitch angle reached (approximately 25 degrees pitch up). Aircraft started to roll again (left wing down).	
04:02:16	The airspeed dropped to 80 knots. The aircraft rolled 28 degrees left wing down and continued to roll. The aileron was deflected 15 degrees left wing up.	
04:02:17	Maximum angle of attack reached (approximately 27 degrees). The roll reached 38 degrees left wing down (20 degrees per second). After this moment the aircraft rolled back to a more or less level attitude at sample 1191. The aileron was deflected 29 degrees left wing up.	
04:02:18	Impact with ground. This can be concluded by the change in many parameters. The ground flight switch also indicated ground for 1 sample after which it started to show in air again. This is probably due to main landing gear failure. Analysis of the parameters from this point onward is considered not effective since the parameters clearly show that they are affected by system failure. It is however remarkable that both engines started to spool down to a value below which electrical power can be generated. For this reason the recorders also stopped at that moment. From the FDR it can not be concluded whether the engine spool down was the result of impact forces or a crew action.	

1.11.3 Flight Data Recorder findings:

Remark: Most parameters are sampled once every second. The lines in the plots suggest continuous change of the parameters. However in reality only the sample points contain genuine information and it can not be established what the value of the parameters was between the measured samples.

Condition at start of recording (sample 0):
Tail anti-icing on*, wing anti-icing on*, engine anti-icing both engines on
Airco on (econ off) FD on [FMA: TO MAN --- ---]
Lift dumper armed (lift dumpers in)
LH and RH EFIS QNH selected /Flap 8 degrees
Stabilizer position –3.3 degrees/Heading 105 degrees
Landing gear down and locked
Speed brake retracted

TAT 1 degrees Celsius (varied between 0.2 and 1.4 degrees Celsius during taxi and take-off)
Stab trim 1 and 2 valid
Weather radar on
Engines ran at idle power
CAS No Computed Data (NCD), this is normal when the airspeed is below 30 knots
Uncorrected altitude 3677 feet
Flight controls near neutral
Aircraft was standing still at heading 105 degrees.

Note *: The FDR shows that the wing and tail anti-icing are on when the aircraft is on the ground. This however is caused by the ground flight switch in the wing and tail anti-icing systems.
The effect of the ground flight switch is that the FDR always will show that wing and tail anti-icing are on when the aircraft is on the ground. After liftoff (Flight) the wing and tail anti-icing information is recorded correctly.

1.12 Wreckage and Impact information:

The airplane wreckage was located in military apron on left side of runway 29L, near TWY 37 at an elevation of about 3962 feet. The debris field was about 660 feet long and extended along a 203°magnetic heading. The major structures of the airplane including the cockpit, wings, fuselage, and empennage were found at the accident site. The outside of L/H fuselage was consumed by fire. The nose landing gear and the right main landing gear were found separated from the fuselage. The position of the left main landing gear was consistent with the landing gear being in up position at impact point, therefore lower section of fuselage gridded on the ground.

1.13 Medical and pathological information:

Investigation of the crew member's medical history confirmed that they met ICAO annex 1 medical standards for licensing. Both pilot had glass limitation during exercising the license privileges. There were no indications of any disorder that could have had a bearing on this accident.

1.14 Fire:

After taking off, the aircraft has reached to 30 feet altitude. The aircraft got wing stall phenomena. The aircraft lost altitude and hit the ground. The wheels of nose landing gear were separated; throw outboard and one of them hit leading edge of left wing causing fuel leakage. When the aircraft came to rest, the fire developed starting from the left wing root towards the fuselage as result of friction.

1.15 Survival aspects:
NIL.

1.16 Test and Research:
The engines were removed from the wreckage and some bore-scope tests were done on it according to manufacturer introduced manual. No abnormalities were found on both engines.

1.17 Organizational and management information:
NIL

1.19 Useful or effective investigation Techniques:

The standard and normal techniques were applied.

2. Analysis:

2- 1 Scenario of events before taking off:

At 06:30 local mean time (LMT) both pilots came to Iran Air dispatch section and were briefed purposed flight to Shiraz (OISS) then Lengeh (OIBL). They were notified about SNOTAM but clean &dry runway!! They came to the aircraft and the pilot flying performed pre-flight checking and consider on wing contamination. He realized de-icing necessity and notified the Pilot in command (PNF). Boarding of

passengers finished and the pilot requested de-icing for aircraft. Due to accumulation of aircrafts for de-icing, the pilot ignored de-icing then requested engine start.

At 07:09 LMT engine start completed, and the aircraft taxied and continued to hold short RWY 29L at 07:28 LMT.

At 07:31 LMT, the aircraft was cleared for take off. The flap and throttle setting of crew was correct.

It was described Ground Icing conditions, meteorological reports and ATIS information. The Aircraft Operating Manual of F.100 **(Flight Techniques Adverse Weather Operation 7-11-01 Page 5 (Prior Take Off)** describes: the take off shall not attempt unless the pilot in command has ensured that the wings, tail , control surfaces , engine intakes and other critical surfaces of the airplane are free of ice ,frost and snow , as required in chapter Limitations subsection 2.05.01 .

Warning:

Small Quantities Of Ice Or Other Contamination (Equivalent To Medium Grid Sandpaper On The Upper Part Of The Leading Edges Of The Wing Can Cause Significant Losses In Maximum Lift And Can Cause The Airplane To Stall At A Lower Than Expected Angle Of Attack . Stall Speeds Can Be Increased By Up To 30 Knots And Drag Can Be Increased Considerably, Resulting In Control Problems, Wing Drop Or Even A Complete Stall Shortly After Lift – Off.

Because A Contaminated Wing Can Stall Below The Angle Of Attack For Stick Shaker Onset, It Is Not Ensured That The Stick Shaker Will Be Activated Before The Stall.

All of the information and below mentions show us that this airplane had left wing and tail stall

2.2 Rolling:

The aircraft started to roll left wing down without apparent reason. All systems that could cause a rolling moment like aileron lift dumper, flap, rudder and thrust reverser, were according to the FDR information operating normally during the accident and previous flights. Furthermore, no reports were received about separation of Aircraft parts prior to impact with the ground. ***This gives reason to believe that the rolling was caused by the wing contamination.***

The first roll reached a maximum recorded value of 26.72 degrees left wing down. During the roll the aircraft did not seem to react to the given aileron input in the opposite direction. The angle of attack continued to increase during the rolling, so there seems to have been no aerodynamic reason why at a certain moment the aircraft has rolled back to a more neutral roll attitude.

When calculating the wing tip height roughly (radio altitude–cos *(roll angle)*× length of wing), the height of the left wing tip was approximately 3.5 feet above the ground. In view of the high roll rate of 17 degrees per second, it can not be excluded that the aircraft rolled to a larger angle and that the rolling moment reversed due to impact of the left hand wing with the ground although this can not be proven by means of the FDR data itself.

The second roll occurred only a few seconds later. This time the roll rate was 21 degrees per second and the maximum recorded roll was 39 degrees left wing down. The wing tip height became negative. Impact of the wing with the ground could be confirmed by listening to the CVR. Hereafter the aircraft rolled back and both main

landing gears touched the ground (as indicated by one ground position sample of the ground flight switch).

Thereafter a lot of parameters started to show erratic data. Most likely both main landing gears separated from the aircraft immediately after the gears touched the ground. Well before standstill all generated electrical power was lost.

The sample rate is just too low to exactly determine the (excessive) roll rate. It can be that the actual roll rate was significantly higher than the calculated roll rate based on the FDR information.

2.3 Elevator and stall warning:

The rotation rate (pitch rate at take-off) was 2.6 degrees per second, which is a normal rotation rate. When the aircraft started to roll the crew gave aileron input to counteract the roll. At the same moment the crew increased the elevator deflection possibly in an attempt to gain (more) altitude. The increase in elevator deflection continued even after the stick shaker became active. The maximum recorded angle of attack was approximately 27 degrees.

2.4 Engines:

The FDR shows that the engine parameters were affected by the rolling. Especially the EPR's were affected by this phenomenon. EPR is the ratio between the fan duct pressure and the total pressure as measured by the Air Data Computer (ADC) and is the main parameter to indicate engine thrust. When comparing the trend of the ground speed with the airspeed (CAS) it can be seen that a difference started to appear when the aircraft started rolling. At the same moment both EPR's started to reduce, this gives reason to believe that the Pitot static systems were affected by the rolling of the aircraft. The rpm's of both engines were not fluctuating significantly. This means that both engines operated normally until the rolling began. Two engine related anomalies could be identified on the FDR.

The witness report showed that in accident time, there was back firing from Engine#1. Due to wing contamination, the airflow separated form left wing and the aircraft has tended to roll. It caused to receive un-laminar airflow in intake section of engine #1.

Engine #1 showed a short roll back in rpm and fuel flow while the TGT was rising. This might be caused by a surge of engine #1. This is supported by the witness report about backfiring of engine #1. The aircraft attitude and roll rates in combination with possible wing airflow separation as encountered during the accident flight are far outside the normal operating envelope of the aircraft/engines. It can therefore not be excluded that engines start to surge under these circumstances. The second anomaly is that at the end of the recording both engines started to spool down. From the FDR information it can not be established whether the spool down was caused by a crew action or by impact forces.

2.5 Emergency power:

According to the pilot report all electrical power was lost during impact. The FDR is connected to the AC essential bus. When generated power is available the FDR

(and also the CVR) are powered. The FDR and CVR stopped just after impact. This is consistent with a loss of all generated power.

However after the loss of generated power the emergency AC and DC buses should remain available. It is however possible that the emergency AC power requires some time to become available and that during this time the LH EFIS displays may momentarily blank. The FDR and CVR information contain no information that can explain the loss of emergency power.

2.6 Ground track:

Appendix 2 provides a picture of the ground track as recorded by the FDR. The position information comes from the Flight Management System (FMS). After TOGA selection the FMS synchronizes to the runway position as provided by the FMS navigation database. For this reason the ground track starts just after TOGA selection.

The accuracy of the position information depends on the navigation mode of the FMS (IRS only, IRS/DME/DME or IRS/VOR/DME) which is not recorded.

The blue dots represent the recorded position. The circular points with the label sample are used to project the ground track over the airport image. The squares symbols with the labels a) through e) are provided by the operator and note the following positions:

a) Exit from the runway centerline.
b) Aircraft entered the grass field.
c) Aircraft exited the grass field.
d) Aircraft exited a ditch.
e) Final position of aircraft (standstill).

It is clear that the FDR track is not completely accurate. It does however give a good idea about the aircraft path on the ground and in the air.

3. Conclusions:

3.1. Findings:

• The flight crew was licensed and qualified for the flight.
• Both aircraft engines worked normally.
• The aircraft was maintained in accordance with regulations issued by aircraft manufacturer.
• Decision making of crew about aircraft de-icing was not correct.
• Task sharing during take off was in accordance with aircraft manuals.
• The engine fire warning was come out during the flight.
• Emergency evacuation good handled by the crew.
• The cockpit resource management of this aircraft was so weak..

3.2 Cause:

It is believed that the accident was caused by the crew fault that has not decided to de-ice aircraft, which led to wing contamination and finally aircraft has stalled during take off.

.

3-2 contributing causes:

a) Weak cockpit resource management
b) Weak management for cold Weather operation of Iran Air.

4. Safety Recommendations:

As a result of investigation of accident involving Fokker 28 MK.100 with registration EP-IDB at January 02, 2008, It had been recommended that the Fokker services Co. and Rolls-Royce, introduce interim measures for the Fokker F.28 MK.100 powered by Tay 650-15 engines, to reduce the risk of wing contamination (ice formation) causing a stall for aircraft . Finally as a result EASA issued AD No; 2009-0008 in subject to Ice & Rain Protection, On-Ground Wing-Leading-Edge Heating System – Installation.

In order to prevent the same incidents or accidents in future, the following safety recommendations were issued:

To European Aviation Safety Agency:

1. It is recommended that the European Aviation Safety Agency should take immediate action to consider the implications of the findings of this investigation on the other certificated Fokker fleets.

To I.R of Iran Civil Aviation Organization:

1. It is recommended that the Airworthiness Directives FAA 2002-12-27 or EASA 2009-0008 shall apply on F.100 fleets with Iranian Registration Prefixes.

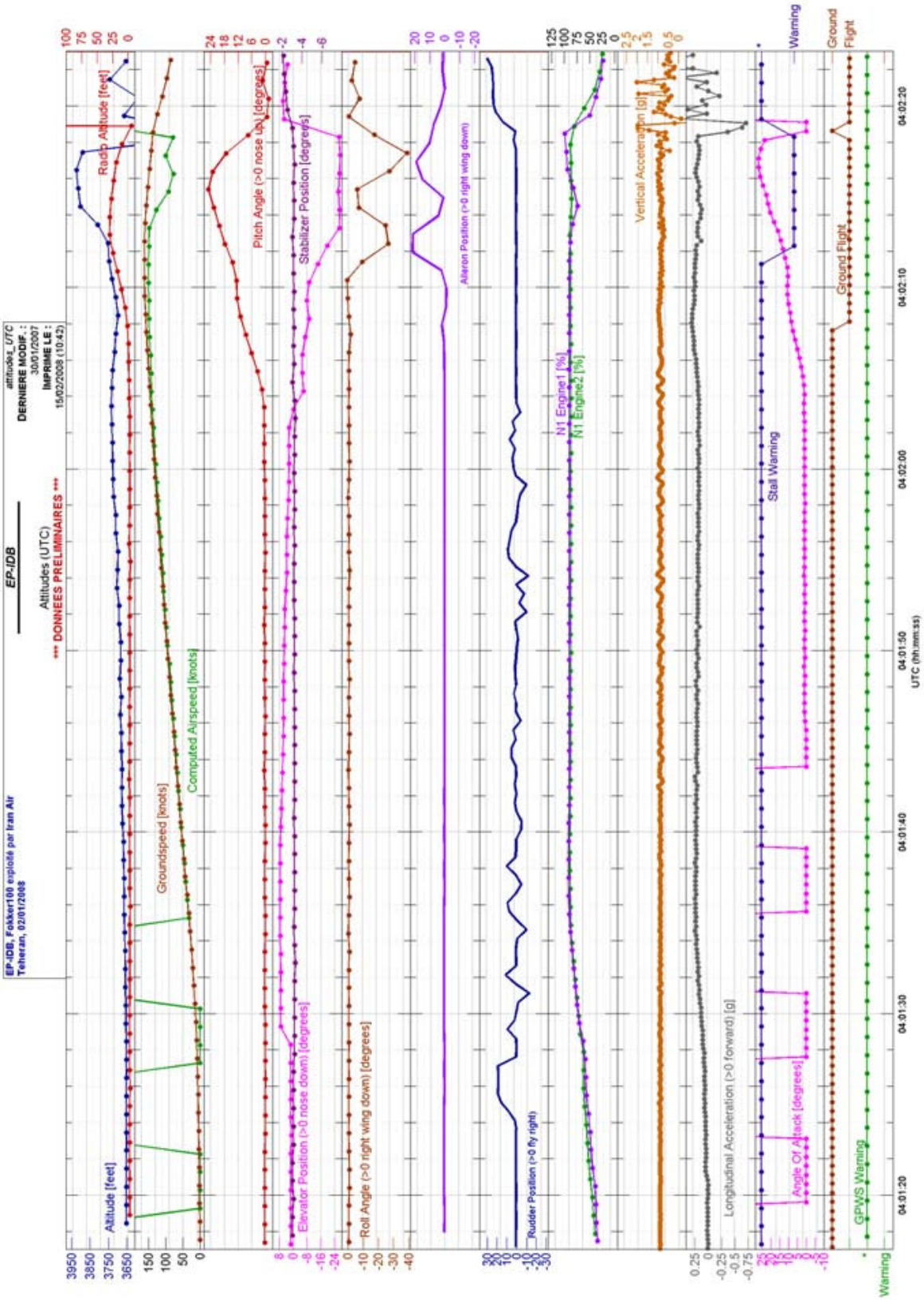
To Iran Air:

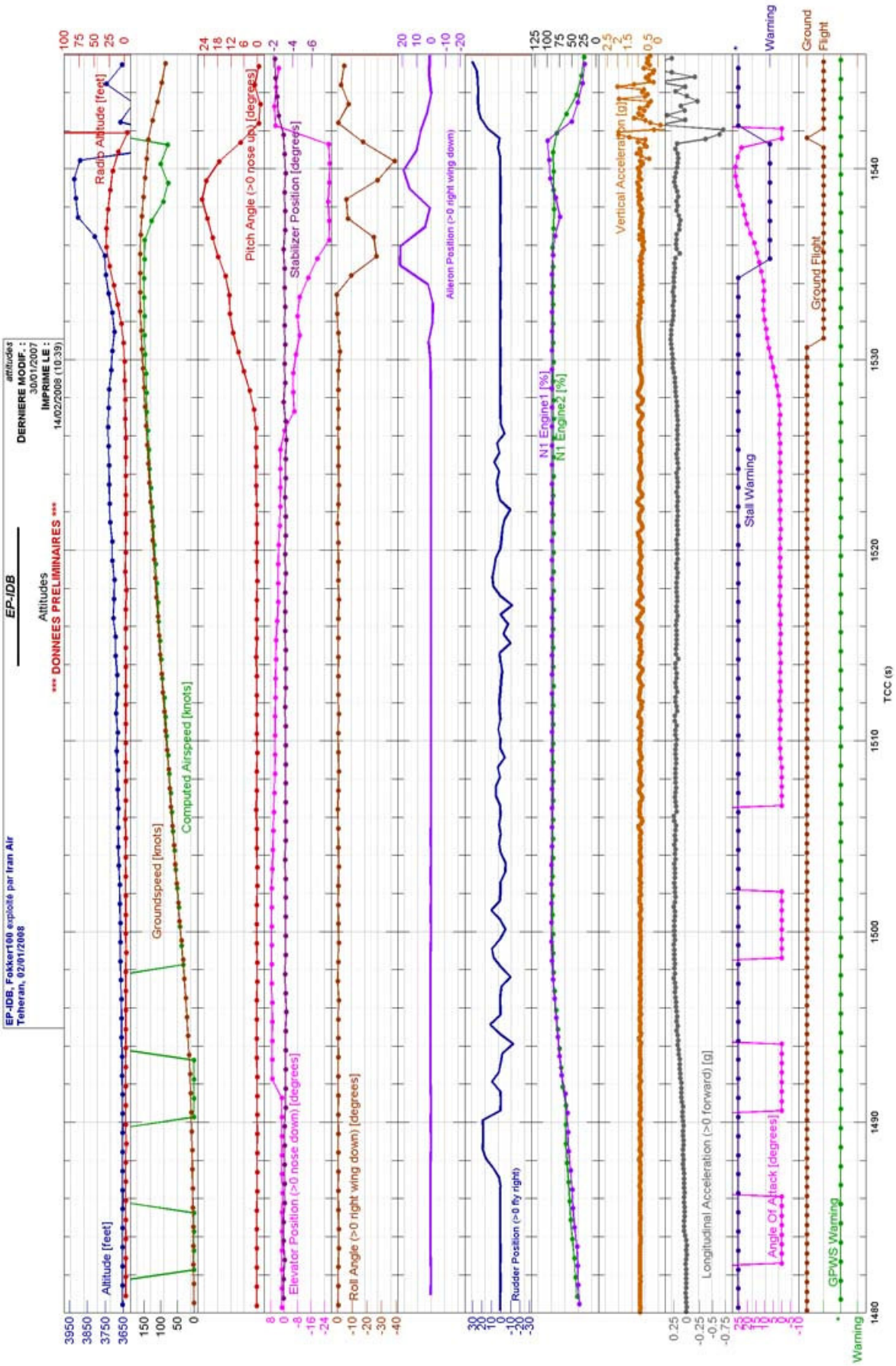
1. Establish and Implement the "Action Plan for Prevention of the Similar Accident" including the followings :
   - Reinforce the education on the cold weather operation, avoidance flight procedure and careful use of the weather reports.
   - Review of flight crews' flight procedure for efficient and immediate reaction against the similar emergency situation.

5-Appendices:

- Plots of FDR
-Ground tracks

Appendices1




EP-IDB, Fokker100 exploité par Iran Air
Teheran, 02/01/2008
EP-IDB
Attitudes
*** DONNEES PRELIMINAIRES ***
attitudes
DERNIERE MODIF. :
30/01/2007
IMPRIME LE :
14/02/2008 (10:39)
Altitude [feet]
Radio Altitude [feet]
Groundspeed [knots]
Computed Airspeed [knots]
Pitch Angle (>0 nose up) [degrees]
Elevator Position (>0 nose down) [degrees]
Stabilizer Position [degrees]
Roll Angle (>0 right wing down) [degrees]
Aileron Position (>0 right wing down)
Rudder Position (>0 fly right)
N1 Engine1 [%]
N1 Engine2 [%]
Vertical Acceleration [g]
Longitudinal Acceleration (>0 forward) [g]
Stall Warning
Angle Of Attack [degrees]
Warning
Ground Flight
GPWS Warning
TCC (s)

Appendices 2