

INTERSTATE AVIATION COMMITTEE
AIR ACCIDENT INVESTIGATION COMMISSION
FINAL REPORT

Type of occurrence	Accident
Aircraft type	Airplane, Boeing 737-200
Registration	EX-009
Registered owner	"Itek Air" Airline
Operator	"Itek Air" Airline
Regional Aviation Authority	Department for Civil Aviation, Kyrgyz Republic
Place of Occurrence	Manas Aerodrome (distance 9.7 km, bearing 273° M from the ARP)
Date and Time	24.08.08, 14 hours 45 min UTC, (local time 20 hours 45 min)

In accordance with ICAO standards and recommended practices, it is not the purpose of this report to apportion blame or liability.

The sole objective of the investigation and the Final Report is the prevention of accidents.

Criminal aspects of the accident are tackled within the framework of a separate criminal case.

ABBREVIATIONS USED IN THIS REPORT.....	3
SYNOPSIS.....	4
1. FACTUAL INFORMATION	5
1.1. HISTORY OF THE FLIGHT	5
1.2. INJURIES TO PERSONS	5
1.3. DAMAGE TO AIRCRAFT	6
1.4. OTHER DAMAGE.....	6
1.5. PERSONNEL INFORMATION	6
1.5.1. Crew.....	6
1.5.2. Cabin Crew.....	10
1.5.3. Ground personnel.....	11
1.6. AIRCRAFT INFORMATION.....	12
1.7. METEOROLOGICAL INFORMATION	14
1.8. AIDS TO NAVIGATION.....	15
1.9. COMMUNICATION.....	15
1.10. AERODROME INFORMATION	16
1.11. FLIGHT RECORDERS	19
1.11.1. Flight data Recorder, 980-4100 GQUS.....	19
1.11.2. Cockpit Voice Recorder.....	19
1.11.3. ATC recorder	20
1.11.4. Radar Data	20
1.11.5. Aircraft Flight Trajectory Simulation.....	20
1.11.6. Synchronization of the Flight Recorders, ATC Recorder and Radar Data.....	20
1.12. WRECKAGE AND IMPACT INFORMATION	25
1.13. MEDICAL AND PATHOLOGICAL INFORMATION	30
1.14. SURVIVAL ASPECTS.....	30
1.15. FIRE AND RESCUE OPERATIONS	32
1.16. TESTS AND RESEARCH.....	33
1.17. ORGANIZATIONAL AND MANAGEMENT INFORMATION.....	34
1.18. ADDITIONAL INFORMATION	34
1.18.1. Visual Approaches	34
1.18.2. Regulations of Altimeter Settings.....	35
1.19. NEW INVESTIGATION TECHNIQUES.....	36
2. ANALYSIS	37
3. FINDINGS AND CONCLUSION	48
4. SHORTCOMINGS.....	51
5. SAFETY RECOMMENDATIONS.....	54

Abbreviations used in this report

ARP	Aerodrome Reference Point
APLD	Aviation Personnel Licensing Department
CG	Center of gravity
DCA KR	Department for Civil Aviation, Kyrgyz Republic
DH	Decision Height
DME	Distance Measuring Equipment
FCOM	Flight Crew Operations Manual
FOM	Flight Operations Manual
GCU	Generator Control Unit
GPWS	Ground proximity Warning System
IAC	Interstate Aviation Committee
IFR	Instrument Flight Rules
IIC	Investigator-in-Charge
ILS	Instrument Landing System
MAC	Mean Aerodynamic Chord
MDA	Minimum Descent Altitude
MEL	Minimum Equipment List
MMEL	Master Minimum Equipment List
NTSB	National Transportation Safety Board, USA
PAPI	Precision Approach Path Indicator
PF	Pilot Flying
PM	Pilot Monitoring
SOP	Standard Operating Procedures
UTC	Universal Time Coordinated
VASI	Visual Approach Slope Indicator
VOR	Very High Frequency Omnidirectional Range

Synopsis

On August 24, 2008 at 1445 hrs UTC (2045 local time, hereinafter local time will be given) at Manas Aerodrome a Boeing 737-200 aircraft registered EX- 009 operated by Itek Air crashed while conducting a scheduled passenger flight IRC 6895 from Bishkek to Teheran at night in visual meteorological conditions.

The Air Accident Investigation Commission of the Interstate Aviation Committee was notified about the accident on 25 August, 2008.

For the purposes of air accident investigation an investigation team was assigned by Order No. 28/447-P of 26 August, 2008 and No. 28/447-p/2 of 22 December, 2008 by the Chairperson of the Interstate Aviation Committee in coordination with the Ministry of Transport and Communications of Kyrgyz Republic.

In accordance with ICAO Annex 13, the investigation was participated by the representatives of the Kyrgyz CAA, the NTSB (USA) on behalf of the State of Manufacturer and Design, as well as the CAA of Iran (as an Observer).

The judicial inquiry was executed by the General Prosecutor Office of the Kyrgyz Republic.

Start of investigation - 26 August, 2008.

End of investigation – 23 April, 2009.

1. Factual Information

1.1. History of the Flight

On 24 August, 2008 the Boeing 737-200 aircraft registered EX-009 and operated by a crew including a PIC and a Co-pilot of Itek Air was flying a scheduled passenger flight IRC 6895 from Bishkek to Teheran. Also on board there was the cabin crew (3 persons) as well as 85 passengers including two service passengers: a maintenance engineer and a representative of the Iran Aseman Airlines.

Flight IRC 6895 was executed in compliance with the leasing agreement No. 023/05 of 15 July, 2005 for the Boeing 737-200 EX-009 between the Kyrgyz airline, Itek Air, and the Iran Aseman Airlines.

The crew passed a medical examination in the ground medical office of Manas Airport. The crew did not have any complaints of their health. The crew received a complete preflight briefing.

The weather at the departure airport Manas, the destination airport and at alternate aerodromes was favourable for the flight.

Total fuel was 12000 kg, the takeoff weigh was 48371 kg with the CG at 24,8% MAC, which was within the B737-200 AFM limitations.

After the climb to approximately 3000 m the crew informed the ATC about a pressurization system fault and decided to return to the aerodrome of departure. While they were descending for visual approach the aircraft collided with the ground, was damaged on impact and burnt.

1.2. Injuries to persons

Injuries	Crew	Passengers	Others
Fatal	none	64	none
Serious	5	21	none
Minor / None	none	none	none

As a result of the crash and the following ground fire 64 passengers died. The passenger who was transferred on 29 August, 2008 to the burn resuscitation department of the Moscow Sklifasovsky Research Institute died of burn disease complicated by pneumonia on 23 October, 2008, two months after he got burn injuries. Thus, his death is connected with the injuries received due to the accident.

In accordance with ICAO Annex 13 only for the purposes of uniform statistics an injury is classified as fatal if death due to this injury occurred within 30 days after the accident.

1.3. Damage to Aircraft

The aircraft was totally destroyed and burnt.

1.4. Other Damage

There was no damage to other objects.

1.5. Personnel information

1.5.1. Crew

PIC	male
Date of birth	10 January , 1951
Class	Class I ATPL
Education	Higher professional, graduated from Krasny Kut Flight College of Civil Aviation in 1972, and Lenin Academy of Civil Aviation in 1981
Pilot's License	LP 00058
Date of issue, expiration date	Issued on 03 July, 2000 by the DCA KR, valid till 20 November, 2008
Commission as captain of B737-200	Order No. 661/П by DCA KR on 14 October, 2005
Total flying experience/experience as Captain	18250 hours / 11237 hours
Experience on B737-200/as Captain	2337 hours / 2187 hours
Flight time/landings within last month	33 hours / 8 landings
Flight time/landings within last 3 days	8 hours 45 min / 2 landings
Flight time at the day of the accident	0 hours 15 min

Weather minima	ICAO CAT II: landing DH 30 m, visibility 350 m
Breaks in flights	None
Date of last checkride	21 February, 2008, checked by the Flight Director of Itek Air
Simulator training	20 August, 2008, Training Center «Sabena Flight Academy», Brussels
Recurrent training	20 December, 2007, at Kiev International Aviation Training Center
Rest before the accident flight	25 hours
Time at the airport before departure	1 hour 30 min
Place and time of medical examination	Ground medical office at Manas Airport on 24 August, 2008 at 1902 hrs

According to the available information, the PIC undertook initial theoretical training in accordance with transition course program for Boeing 737-200 in September 2005 at Kiev International Aviation Training Center.

Kiev International Aviation Training Center holds Certificate No. 18 issued 13 September, 2005 by the Flight Safety Oversight Agency of Ukraine and valid till 13 September, 2008 that authorizes them to train flight personnel to fly Boeing 737-200 aircraft.

The investigation team was also submitted Certificate No. TO/002 issued to Kiev International Aviation Training Center by the DCA KR the on 22 August, 2006 and valid till 13 September 2008.

The PIC got initial simulator training at the Saudi Arabia Airline Training Center in Jidda under the guidance of a Phoenix Aviation instructor when he was working for the Phoenix Aviation Airline. The simulator training program provides for visual approaches training.

All the simulator sessions marks are satisfactory and are documented in the training tasks.

On the basis of the undertaken training the Kiev International Aviation Training Center issued the PIC a Certificate dated 14 September, 2005 on the completion of the transition training for Boeing 737-200.

After the Phoenix Aviation was restructured in spring 2006 the PIC continued his work at the Max Avia Airline as a Captain of Boeing 737-200.

In accordance with the training task, the PIC on 31 March, 2008 received ground training on visual approaches and on 17 April, 2008 he trained a visual approach at Meshed and Dushanbe aerodromes. The flights were performed at night with a pilot-instructor who is the Flight Director of the Itek Air. The total assessment that the PIC was “ready” was done with the following conclusion: “May be allowed to fly visual approaches on a Boeing 737-200.”

By Order No. 134/П issued on 03 June, 2008 by the Itek Air General Director the PIC was authorized to fly visual approaches on a Boeing 737-200.

There is no record in the “Permit to fly” and “Checkride” sections in the PIC’s Logbook though required by the Flight Crew Training Program. Also there is no record about the permit to fly ICAO CAT II.

The Emergency Training was conducted on 17 September, 2007 in accordance with the requirements of the Itek Air FOM and p. 3.7 of the Civil Aircraft Flight Operations Manual of the Kyrgyz Republic, in effect since 2006.

The PIC had not been involved in any accidents caused by his erroneous actions.

Co-pilot	male
Date of birth	17 September, 1973
Class	Class II ATPL
Education	Higher professional, graduated from Aktyubinsk Higher Flight College in 1995
Pilot’s License	LP 00364
Date of issue, expiration date	Issued by the DCA KR on 22 August, 2006; valid till 16 May, 2009
Commission as Co-pilot of B737-200	Order No. 292/П by the DCA KR of 01 June, 2007
Total flying experience	4531 hours
On B737-200	881 hours
Flight time/landings within last month	29 hours / 8 landings
Flight time/landings within last 3 days	0 hours 15 min / none
Flight time at the day of the accident	0 hours 15min

Weather minima	ICAO CAT II, landing DH 30m, visibility 350 m
Breaks in flights	None
Date of last checkride	17 April, 2008, checked by Flight Director of Itek Air
Simulator training	19 December, 2007, Training Center «Sabena Flight Academy», Brussels
Transition training	Training for B737-200, on 08 April 2007, at Bishkek, pilot-instructor of Max Avia Airline
Rest before the accident flight	25 hours
Time at the airport before departure	1 hour 30 min
Place and time of medical examination	Ground medical office at Manas Airpot, 24 August, 2008 at 19 hours 02 min

According to the available information, the Co-pilot underwent initial theoretical training in accordance with the transition training program for B737-200 in February to April 2007 at Bishkek under the guidance of a Max Avia pilot-instructor authorized by the Kiev International Aviation Training Center.

The Co-pilot underwent simulator training in the Sabena Flight Academy (Brussels) from 01 April, 2007 to 08 April, 2007 under the guidance of a pilot-instructor. The check was carried out by a pilot-instructor of the Kiev International Aviation Training Center. The simulator training program includes training for visual approaches. After the training the Co-pilot was issued a Certificate on 08 April, 2007 on the completion of a transition training course for B737-200.

All the simulator sessions marks are satisfactory and are documented in the training tasks.

The Emergency Training was conducted on 17 September, 2007 in accordance with the requirements of the Itek Air FOM and p. 3.7 of the Civil Aircraft Flight Operations Manual of the Kyrgyz Republic, in effect since 2006.

The Co-pilot had not been involved in any accidents caused by his erroneous actions.

1.5.2. Cabin Crew

Position	Purser on B737-200, Itek Air Airline
Sex	female
Date of birth	19 January, 1965
Class	1
Flight attendant License	FA 00100, issued by the Kyrgyz DCA on 31 October, 2000, valid until 19 November, 2009
Transition training for B737-200	20 January, 2003, Kyrgyz Aviation College, Certificate No. 152
Total flying experience	7849 hours
Experience on B737-200	3104 hours
Flight time within last month	51 hours
Flight time on the day of the accident	0 hours 15 min
Date of latest check	16.04.2008
Emergency Training	18.12.2007 in Max Avia Airline
Rest before flight	14 hours
Time at the aerodrome before the flight	1 hour 30 min
Medical check before the flight	1902 hrs, at Manas ground medical office
Position	Flight attendant on B737-200, Itek Air Airline
Sex	female
Date of birth	10.01.1968
Class	1
Flight attendant License	FA № 00107, issued by the Kyrgyz DCA on 08 December, 2000, valid until 26 June, 2009
Transition training for B737-200	15.04.2002, Kyrgyz Aviation College, Certificate No. 33
Total flying experience	10016 hours
Experience on B737-200	2383 hours
Flight time within last month	38 hours
Flight time on the day of the accident	0 hours 15 min
Date of latest check	16.04.2008
Emergency Training	18.09.2007, in Itek Air Airline
Rest before flight	14 hours
Time at the aerodrome before the flight	1 hour 30 min
Medical check before the flight	1900 hrs, at Manas ground medical office

Position	Flight attendant on B737-200, Itek Air Airline
Sex	female
Date of birth	02.11.1973
Class	2
Flight attendant License	FA №00048, issued by the Kyrgyz DCA on 13, September, 2000, valid until 09 November, 2008
Transition training for B737-200	20 January, 2003, Kyrgyz Aviation College, Certificate No. 143
Total flying experience	4325 hours
Experience on B737-200	1077 hours
Flight time within last month	66 hours
Flight time on the day of the accident	15 min
Date of latest check	04.11.2007
Emergency Training	18.09.2007, in Itek Air Airline
Rest before flight	14 hours
Time at the aerodrome before the flight	1 hour 30 min
Medical check before the flight	1900 hrs, at Manas ground medical office

The professional level and qualification of the cabin crew were in compliance with the regulations of the Department for Civil Aviation, Ministry of Transport and Communications of Kyrgyz Republic.

1.5.3. Ground personnel

ATC Shift Supervisor	male
	Class I ATC
	AC License No. 00156, valid until 22 November, 2009
	Education – Professional college, graduated from Kirovograd Flight School in 1977.
	Recurrent training at the ATC of St. Petersburg State University of Civil Aviation in 2006.
Approach Controller	female
	Class II ATC
	AC License No. 00237, valid until 23 May, 2010
	Education – professional college, graduated from Bishkek Aviation College in 2004.

Ground Controller Recurrent training at the ATC of Kyrgyzaeronavigatsia in 2007.
male
 Class I ATC
 AC License No. 00118, valid until 22 December, 2009
 Education – Secondary professional, Controller courses at the ATC-25 in 1982, and Riga Higher Aviation Technical College in 1992r.
 Recurrent training at the ATC of Kyrgyzaeronavigatsia in 2006r.

The professional level and qualification of the ATC personnel were in compliance with the regulations of the Department for Civil Aviation, Ministry of Transport and Communications of Kyrgyz Republic.

1.6. Aircraft Information

Registration	EX-009
Certificate of Registration	№ 0340 issued on 14 November, 2007 by Kyrgyz DCA
MSN	№ 22088, variable PK 214, Line 676
Owner	Itek Air Airline
Operator	Itek Air Airline
Manufacturer, Date of delivery	The Boeing Company, Seattle 1 July, 1980
Assigned service life	Not determined
Flight time since in operations	60014 hours, 56196 landings
Date and place of last overhaul (D Check)	19 November, 2000, COOPESA (Panama)
Flight time since last overhaul (after D Check)	12051 hours, 6047 landings
Airworthiness information	Certificate of Airworthiness № 03040, issued on 13 May, 2008 by the Kyrgyz DCA, valid until 15 May, 2009

Last base maintenance

- 3C Check 11 May, 2007 after 58047 flight hours, 55590 landings, ATC (Aircraft Technical Centre), Almaty, Republic of Kazakhstan
- 2B Check 26 January, 2008 after 59030 hours, 55891 landings, Max Avia Airline
- 2A Check 04 August, 2008 after 59824 hours, 56140 landings, Max Avia Airline

Last line maintenance

24 August, 2008, Max Avia Airline

The aircraft had two JT8D15 Pratt & Whitney engines.

Engines	Left	Right
Type	JT8D15	JT8D15
MSN	P702806	P688590B
Date of installation	20 June, 2008	25 April, 2008
Life until next overhaul	12000 hours	12000 hours
Running time since in operation	45013 hours, 32873 cycles	47795 hours, 47961 cycles
Running time since last overhaul	7137 hours, 6256 cycles	783 hours, 239 cycles
Date of last overhaul	05 November, 1999	31 March, 2008

After the last line 2A Check maintenance the aircraft flew 190 hours with 56 landings.

According to provided documents the TAWS/RMI SANDEL ST3400 was installed on the aircraft in April 2008.

1.7. Meteorological Information

On 24 August, 2008 the weather in Kyrgyzstan was determined by a cold front with air waves that was passing over the northern regions of the country and shifting from the west to the east along the main air stream.

According to the surface weather chart for 1200 hrs UTC on 24 August, 2008, at daytime the cold areas of the front showed evidence of cumulonimbus and heavy cumulus clouds with the top at 5-7 km and thunderstorm activity (flight crews noticed radar clutters at the flight level).

On the basis of the weather conditions at 1115 hrs UTC the meteorological officer issued the following forecast for Manas Aerodrome.

UAFM 241115Z 241322 23007MPS 6000 BKN050CB TEMPO 1317 VRB12MPS
TSRA BLDU

Weather forecast for Manas Aerodrome for 24 August, 2008 from 1300 hrs to 2200 hrs UTC: surface wind 230°-7m/sec, visibility 6000 m, clouds broken (5-7 oktas) cumulonimbus, cloud base 1500 m, at times from 1300 hrs to 1700 hrs UTC wind unstable direction 12 m/sec, thunderstorm with rain, blowing dust.

Later thunderstorm activity at the weather front ceased, and at 1415 hrs UTC the weather officer issued the following forecast for Manas Aerodrome:

UAFM 241415Z 241601 14007MPS 6000 BKN050CB

Forecast for Manas Aerodrome for 24 August, 2008 from 1600 hrs to 0100 hrs UTC: surface wind 140°-7 m/sec, visibility 6000 m, clouds broken (5-7 oktas) cumulonimbus, cloud base 1500 m.

After the alert signal at 2045 hrs the meteorologist on duty made a non-scheduled actual weather observation at Manas Aerodrome that was documented by a corresponding record.

According to the non-scheduled weather observation, the actual weather at Manas Aerodrome at 2045 hrs on 24 August, 2008 was as follows: surface wind 130°-3 m/sec, wind at 30 m 110°-3 m/sec, wind at the traffic circuit 100°-5 m/sec, visibility 10 km, clouds broken (5-7 oktas) at 5000 m, temperature 27°C, dew point 7°C, QNH 1012 hPa, QFE 704/938, forecast for landing – NOSIG.

The meteorological support of the flight crew en route Bishkek-Teheran was provided by the shift on duty of the Manas Meteorological Office.

As part of the weather briefing, the crew was provided with a prognostic chart of significant weather en route for 25 August, 2008 from 1200 hrs to 0600 hrs UTC, wind and temperature forecast charts for FL180, FL240 and FL300 for 25 August, 2008 from 1200 hrs to 0600 hrs UTC, sheet No. 13 with forecast and actual weather for Bishkek (airport of departure), Teheran (destination airport) and alternate aerodromes.

According to the significant weather chart, at the beginning of the route cumulonimbus clouds with the top up to FL370 and air stream at FL390 were expected. The weather at Teheran and alternate aerodromes was forecast favorable with simple meteorological conditions.

The meteorological support of the B737-200 flight en route from Bishkek to Teheran was in compliance with the requirements of ICAO regulations and Meteorological Service Standards for Civil Aviation, Republic of Kyrgyzstan.

1.8. Aids to Navigation

At the time of the accident the following navigation aids were operating at Manas Airport:

- Outer and middle markers RWY-08;
- ILS/DME RWY-08;
- VOR-DME;
- En-route Surveillance Radar TRLK-11;
- Automatic Direction Finder ADF-75;
- Precision Approach Path Indicator

The nav aids were supplied with electrical power in a regular way in accordance with the electrical supply standards.

1.9. Communication

At the time of the accident the following aids to communication were operating:

- VHF radio communication aids (main and standby), providing radio communication to North, Approach and Ground Control Centers;
- HF radio communication aids;
- Airport internal communication system;
- Airport internal loud-speaking communication system;
- Interurban loud-speaking communication channels to Almaty, Tashkent, Taras, Osh, Karakol;
- Emergency alerting system “Horn”;
- Magnetic tape recording system that records voice information in accordance with the approved list of track distribution.

The communication aids were supplied with electrical power in a regular way in accordance with the electrical supply standards.

1.10. Aerodrome Information

Bishkek International Airport (Manas) is a Class B aerodrome and a Class 1 airport. It is approved for 24-hour operations in accordance with the established minima. It has only one runway with artificial covering and provides for ICAO CAT II landings. It can serve as an alternate aerodrome for all aircraft types.

Bishkek Aerodrome (Manas) is owned by the JSC Manas International Airport. The air traffic management is provided by the state enterprise Kyrgyzaeronavigatsia.

The airdrome houses aircraft of airlines that are based at the Manas Airport as well as aircraft of the US coalition forces.

Bishkek Airport (Manas) is located 23 km to the north-north-west of Bishkek and 7 km to the north-east of Manas.

The ARP geographical position is as follows:

N43° 03'39.64", E074°28'41.39".

ARP height(HARP) +633,2 m.

Time zone – 5.

Magnetic declination +5°.

The airfield is rectangular. The airfield surface is smooth, with sandy soil and grass.

The airfields dimensions are – 4854 m by 300 m.

The airfield contains one runway with artificial two-layer surface: gravel cushion 26 cm deep and fibercrete 40 cm deep.

Obstacle-free zones:

- landing course 75°M- 400 by 300 m;

- landing course 255° M – 250 by 300 m.

Adjacent to the runway ends there are reinforced trapezoidal areas 50 m long with a base of 60 by 40 m.

Runway dimensions – 4204 by 55 m.

Runway shoulders: 5 m wide, 2,5 m on either side - fibercrete.

Runway PCN is equal to PCN53/R/A/W/T and allows regular operations of all aircraft types.

Runway gradient – 0,26% slope from the west to the east (1/385).

Lateral gradient - 0,12%.

Runway true course - 80°00'02".

Magnetic landing courses:

Landing course =75° M (runway threshold - 08), threshold elevation +637 m;

Landing course =255° M (runway threshold - 26), threshold elevation +626 m.

The visual approach pattern for RWY-08 is shown on Figure 1.

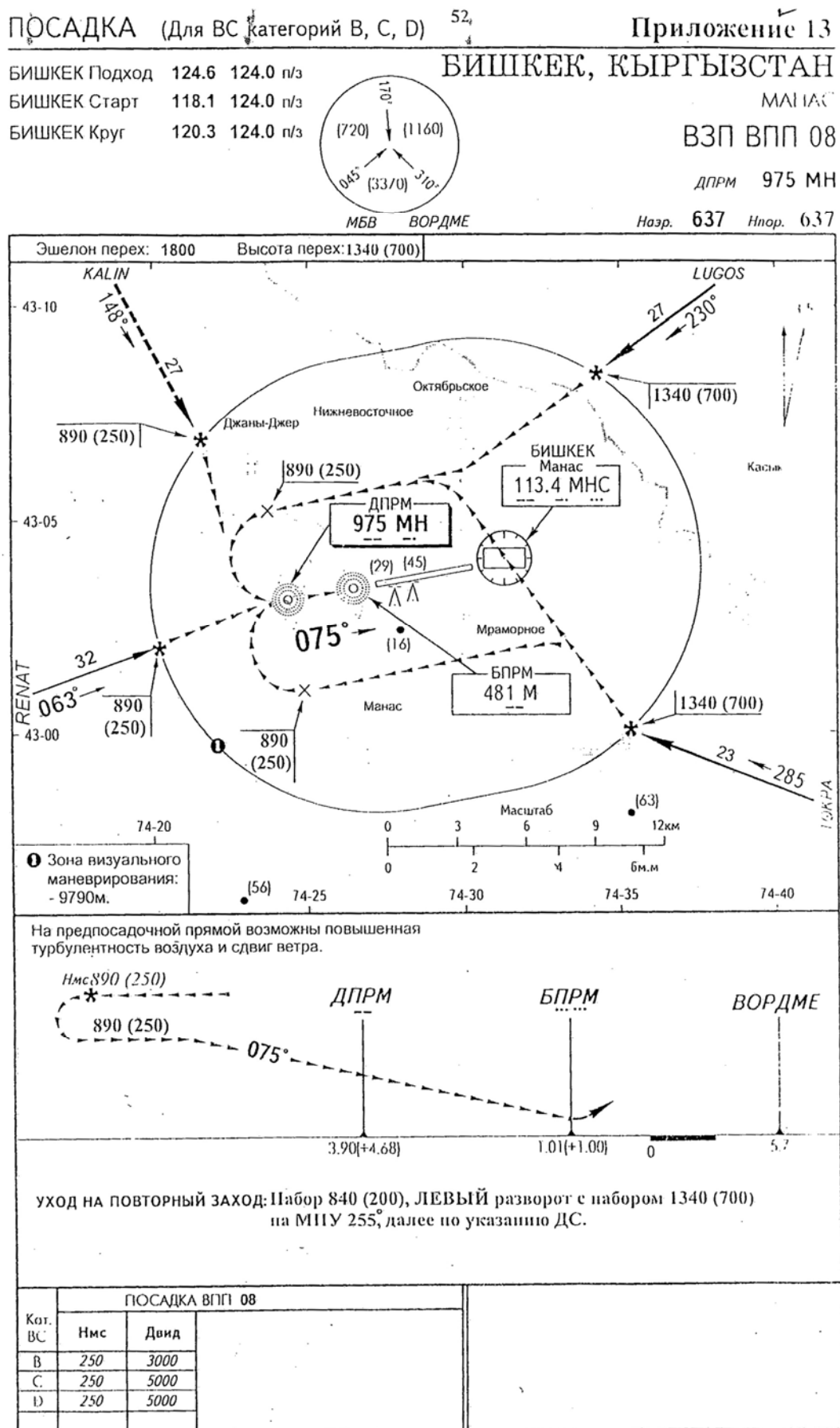


Fig. 1. Visual approach pattern at Manas Airport.

1.11. Flight Recorders

The B737-200 EX-009 aircraft was equipped with the 980-4100 GQUS FDR and the A100 CVR.

The 980-4100 GQUS FDR and the A100 CVR were exposed to high temperature.

1.11.1. Flight data Recorder, 980-4100 GQUS

The 980-4100 GQUS FDR manufactured by Honeywell (USA) is a magnetic tape recorder and it recorded 16 analogue parameters and 3 ON/OFF signals on the B737-200 EX-009.

The flight data readout showed that the FDR 980-4100 GQUS record contains information about the flight of the B737-200 EX-009 on 24 August, 2008.

The FDR investigation revealed that part of the tape 320 mm long was exposed to heat. The data stored on that piece are not recoverable. Based on the assumption that the reeling speed is 12.2 mm/sec and taking into account the position of the magnetic heads, the missing portion of the last flight data is about 13 seconds.

***Note:** Initially in the course of the accident investigation a different reeling speed was erroneously assumed that was why the Preliminary Report of the Calculations and Analysis Group mentioned the impossibility of recovering 4 seconds of the record.*

The recorded parameters are shown on Figure 2.

There were no ON/OFF signals or parameter values recorded on the FDR that could evidence any in-flight failure.

1.11.2. Cockpit Voice Recorder

The investigation of the A100 CVR revealed the following:

- The magnetic tape was suitable for readout;
- The tape contained a record of 1 hour 02 minutes;
- The sound quality was satisfactory.

The recorded voice information refers to Flight IRC 632 from Moscow to Bishkek. It was not possible to determine the date of the flight. There is no record of the B737-200 EX-009 flight on 24 August, 2008. This proves that the CVR was not operative in the flight on 24 August, 2008.

In accordance with ICAO standards (Annex 6, Supplement D, p. 3.1) the CVR is to be checked before the first flight of the day. In accordance with the Boeing 737-200 MMEL and the

Itek Air MEL, the aircraft may be dispatched with the CVR inoperative with the operative FDR within three flying days.

It should be noted that there were no items deferred as per MEL before the last flight on 24 August, 2008.

1.11.3. ATC recorder

The ATC recorder contains information on the flight of the Boeing 737-200 EX-009 on 24 August, 2008. On the basis of the record's readout a transcript of crew-ATC communication was made.

1.11.4. Radar Data

The Boeing 737-200 EX-009 takeoff and flight on 24 August, 2008 was controlled by the en-route radar TRLK-11.

On the basis of the radar data the investigation team reconstructed the flight trajectory of the B737-200 EX-009 on 24 August, 2008. The analysis showed that the last aircraft position blip was recorded at the altitude of 650 m (height approximately 20 m).

1.11.5. Aircraft Flight Trajectory Simulation

The trajectory simulation was done on the basis of the TRLK-11 radar and FDR 980-4100 GQUS data.

The aircraft positions recorded by the radar were used a priori during the simulation.

The results of the simulation are on Fig. 3-5.

1.11.6. Synchronization of the Flight Recorders, ATC Recorder and Radar Data

The synchronization of the radio exchange recorded by the ATC recorder at Manas Airport and the flight data on the FDR was aligned with the VHF keying signal. The synchronization accuracy is within ± 1 sec.

The synchronization of the ATC recorder data and the radar data was done automatically in the multichannel automatic radar data and voice recording system SMAR-T.

The synchronization of FDR 980-4100 GQUS data and the radar data was done using the pressure altitude readings recorded by the FDR and radar. The difference between FDR time and radar time was 9 seconds.

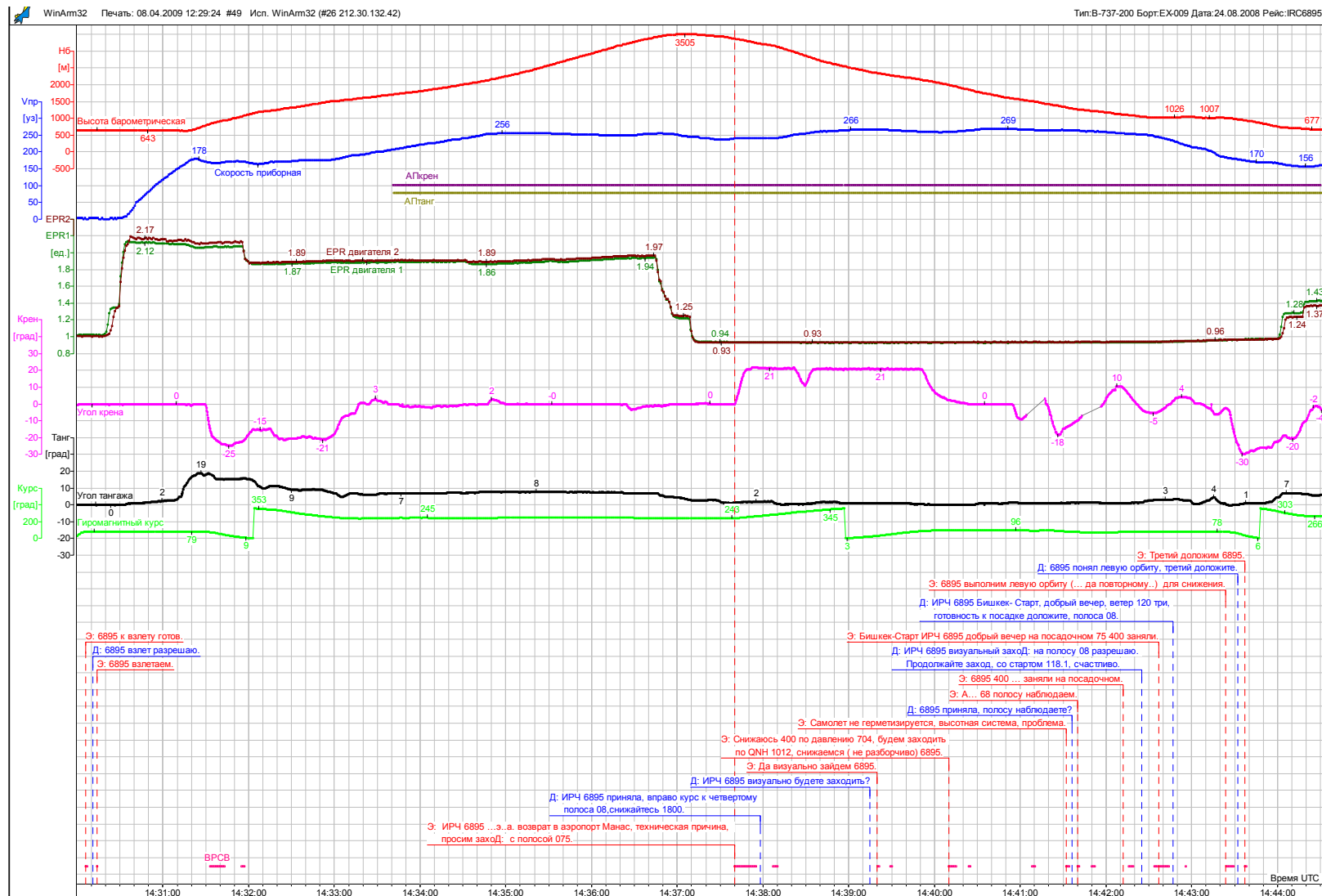


Fig. 2. The B737-200 EX-009 flight data for 24 August, 2008 on the basis of the FDR data.

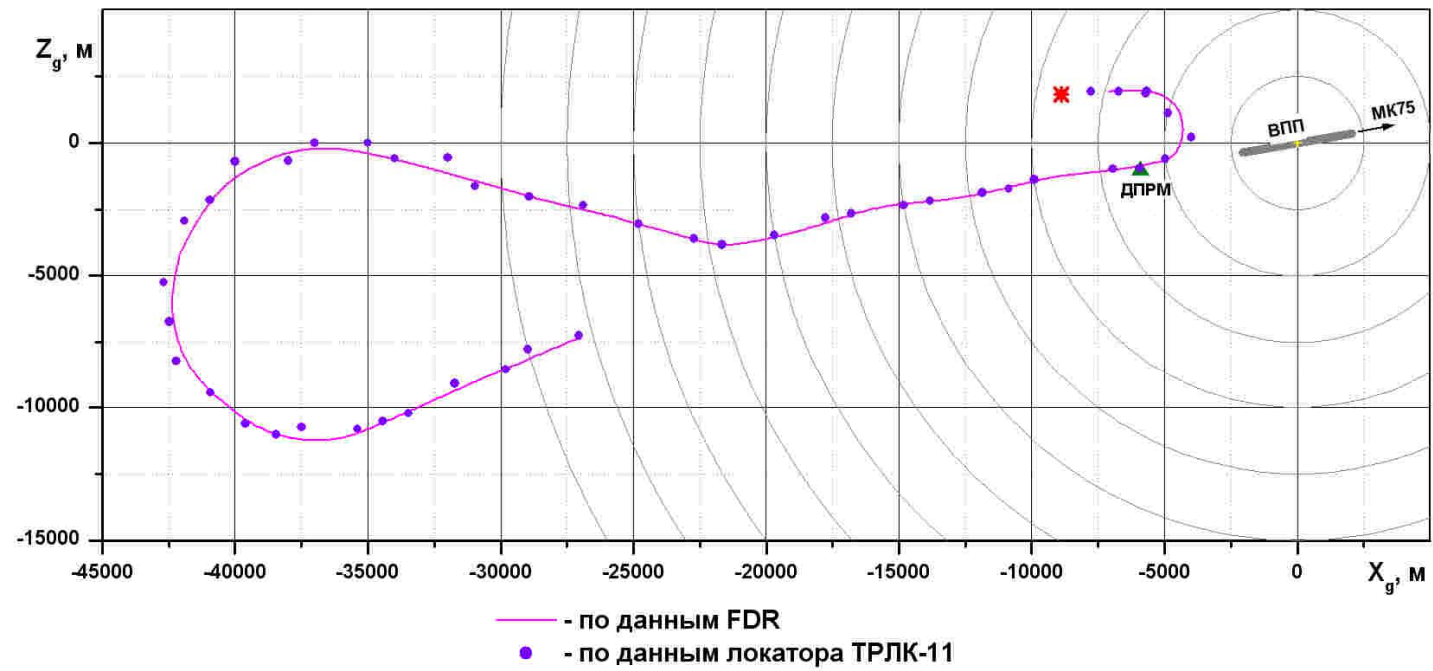


Fig. 3. The B737-200 EX-009 flight trajectory, 24 August, 2008

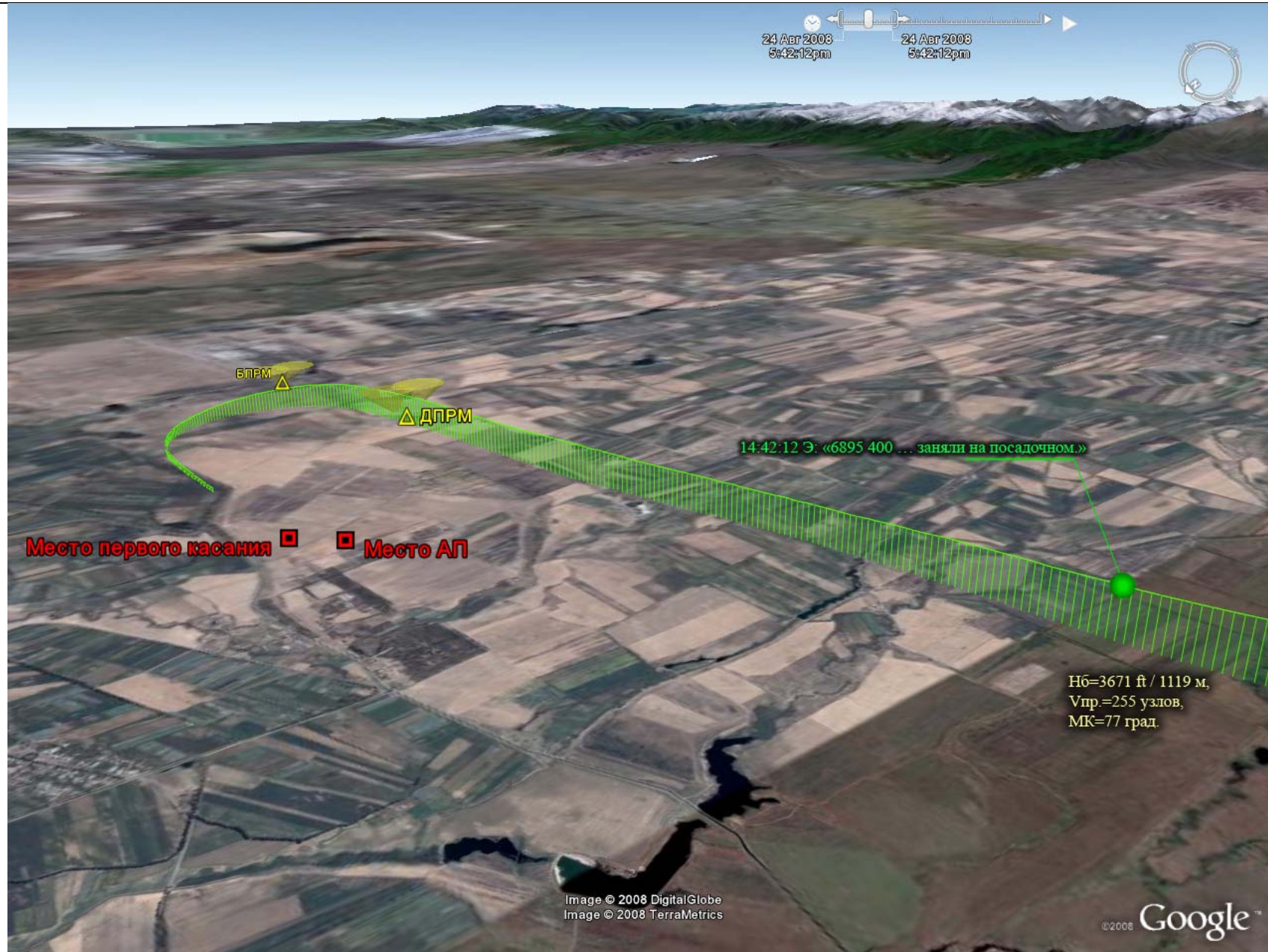


Fig. 4. The B737-200 EX-009 flight trajectory, 24 August, 2008 (FDR data)



Fig. 5. The B737-200 EX-009 flight trajectory, 24 August, 2008 (FDR data)

1.12. Wreckage and Impact Information

The wreckage plot was drawn on 25-26 August, 2008 at daytime, from 1000 hrs to 1500 hrs local time.

The wreckage position and linear distances were measured with the help of the GARMIN-195 satellite positioning system and the retractable pocket rule. The accuracy of GARMIN-195 positioning system is within 15 m.

The accident to the Boeing 737-200 EX-009 occurred at a distance of 9,74 km from the ARP of Manas Aerodrome, bearing 273° M at a field on the territory of Zhany-Zher Settlement Council, Sokuluk District, Chuysk Region.

The geographical position of the accident site (wreckage) are as follows:

- N43° 04' 420, E074° 21' 41,785;
- Accident site elevation is approximately +620 m.

The accident site represents a field with rough surface crossed from the south-east to the north-west by a drainage trench up to 3 m deep, 5 m wide and with a breastwork of up to 1,5 m high on the north-eastern side of the trench. The surface preceding the trench has loose, argillo-arenaceous, ploughed soil. The surface succeeding the trench is not ploughed, hard argillo-arenaceous soil with grass and turf.

The aircraft touched the ground left wing first at a distance of 620 m and bearing of 039° M from the place of its final stop. The left wingtip was partly crushed on the impact. Small fragments of the wing were found at the following distances from the place of the first impact: first fragment – 27 m, second fragment – 42 m, third fragment (a piece of the navigation light glass) – 46 m.

36 m after the first impact there was a trace of the left landing gear impact, 43 m long, 1 m wide and up to 0.8 m deep.

First touch by the left engine was 2 m after the left landing gear impact. Further the trace of the left engine was 26 m long, 0,5÷0,8m wide and 0.7 m deep.

After the first impact the aircraft lifted off and the second impact was on the trench breastwork. The place of the second impact was 320 m bearing 225° M from the place of the first impact.

The grass and field surface at the place of the landing and until the final stop of the aircraft have evidence of ground fire. The landing was 30 m after the trench on the right landing gear. The right wheel then lifted off 13 m after the impact. Further, 4 m after the right landing gear impact there was a trace of the right engine 9 m long, when the engine was separated. 12 m

after the right landing gear impact there was a trace 3 m long and up to 0.8 m deep which is a trace of the nose gear impact and liftoff.

As the aircraft was moving along the ground surface the lower fuselage and other low-lying parts of the aircraft were crushed which is confirmed by the scattered minor fragments of the fuselage, wing and passenger baggage after the drainage trench until the aircraft full stop.

The aircraft was almost totally burned out in the ground fire, excepting the tail part.

The plot on Fig. 6 shows the positions of the largest fragments.

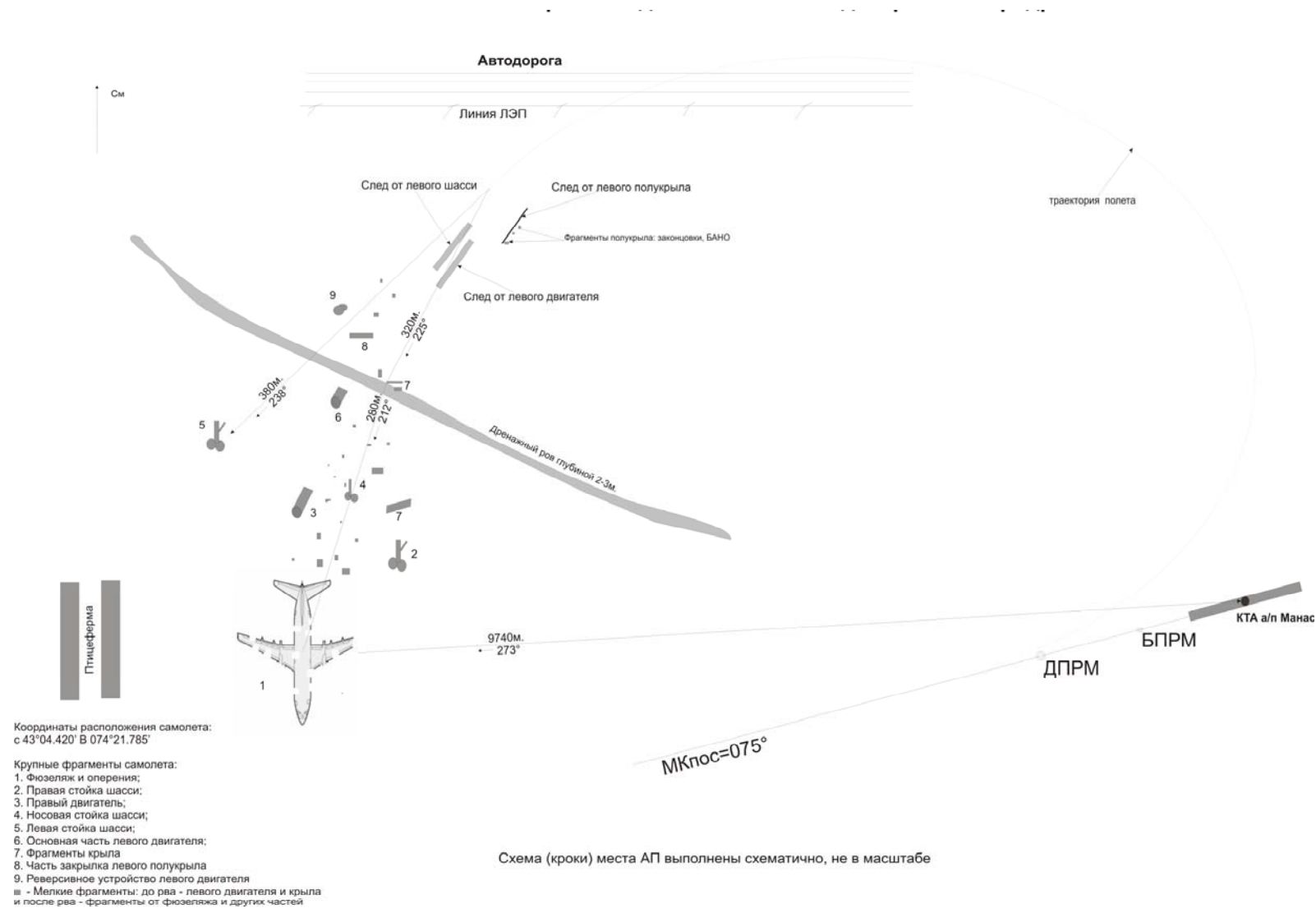


Fig. 6. Wreckage plot (no scale).



Fig.7 Wreckage of the aircraft structures. Backward view.



Fig. 8. Wreckage of the aircraft structures. Forward view.

1.13. Medical and Pathological Information

In order to determine the causes and circumstances of the B737-200 EX-009 passengers' deaths, 64 conclusions of the forensic experts of Kyrgyz Republican Bureau of Forensic Medical Expertise (No. 1038-1103) and the record of forensic examination of body (No. 647) in Moscow Forensic expertise Bureau (mortuary No. 3) were analyzed.

According to the forensic expertise (No. 1038-1103) the passengers who died in the accident did not suffer any traumatic impact that could have caused death or serious injury. The chemical blood analysis of the dead passengers' bodies did not reveal any carboxyhemoglobin that could have caused sudden unconsciousness and death by carbon monoxide poisoning.

Most passengers deaths (except passenger who died after the accident) was caused by the burn shock when they were in the smokeless closed atmosphere of the passenger cabin heated up to very high temperatures due to the outside ground fire caused by the fuel spillage and ignition. After death the bodies' skin, tissues and limbs were burnt and carbonized.

The analysis revealed 28% of carboxyhemoglobin in the blood of the passenger who died after the accident, which in addition to the burns confirms that at the time of the thermal traumas he was in the middle of open fire in smoked atmosphere.

1.14. Survival Aspects¹

The description and analysis of the emergency evacuation from the aircraft was based on the available explanations, reports and enquiries of the crew members and passengers.

When the aircraft was taking off, two flight attendants were seated at the aft row of passenger seats, but not at their working stations, and the third flight attendant - at her working station in the forward part of the plane. The flight attendants in the rear part of the plane were not at their working places as the Iran Aseman Airlines representative was praying.

The impact (almost without any vertical load factor and with a left bank of approximately 15 degrees) and the aircraft further movement led to conditions that severely impeded emergency evacuation of the crew and passengers.

- Jamming of the door to the passenger cabin and Co-pilot's window in the cockpit;
- Fire in the area of the left forward entry door;
- Open fire in the middle of the passenger cabin with heavy smoke;
- Jamming of the right aft passenger cabin entry door.

The crew left the cockpit through the left window in the following order: PIC, Co-pilot, Engineer.

¹ For the reasons of confidentiality the references to the particular statements of the crew members and passengers that were used to analyse the evacuation sequence were deleted from that chapter.

The passengers started evacuation after the aircraft had stopped through the left aft entry door of the passenger cabin and later through the right forward exit.

The flight attendants in the aft part of the plane opened the left aft door but closed it at once when they saw fire outside. One flight attendant tried to open the right aft entry door but failed as it was jammed. Then the other flight attendant with the help of the passengers opened the left aft entry door again.

The evacuation from the passenger cabin through the open left aft entry door was chaotic and occurred in the following order:

- One flight attendant was pushed out by the passengers;
- Two passengers;
- One passenger;
- The second flight attendant was pushed out by another passenger;
- One passenger;
- Two passengers;
- One passenger;
- One passenger;
- One passenger;
- One passenger;
- One passenger;
- One passenger covered by a shirt returned to the passenger cabin and dragged out his two unconscious sisters.

The right forward entry door was opened by flight attendant with the help of the PIC who was helping her from the outside.

The following persons left the passenger cabin through the right forward entry door:

- Flight attendant was pushed out by the passengers;
- One passenger.

There is no information about the other passengers.

Nobody tried to open the emergency hatches in the middle of the passenger cabin as they were in the area with high temperature.

Thus,

- After the aircraft stopped only those passengers who were in the forward and aft parts of the passenger cabin could evacuate unassisted.
- The passengers who were in the middle of the passenger cabin most probably could not be saved due to:

- the emerging open fire in the middle of the passenger cabin when the aircraft was still moving, which was rapidly spreading to the forward and aft parts of the aircraft;
- burn injuries of throat and lungs;
- lack of technical and physical opportunities for the flight attendants to arrange the evacuation of passengers in the given situation.

Most passengers deaths (except the passenger who died after the accident) was caused by the burn shock when they were in the smokeless closed atmosphere of the passenger cabin heated up to very high temperatures due to the outside ground fire caused by the fuel spillage and ignition. After death the bodies' skin, tissues and limbs were burnt and carbonized².

The passenger who died after the accident was taken after the accident to the burns department of the Bishkek Research Center of Injuries and Burns with III-IV degree body burns and a I-II degree upper airways burns. His blood contained 28% of carboxihemoglobin, which in combination with the burns confirms his presence in the open fire area in smoked atmosphere at the time these burns were suffered.

1.15. Fire and Rescue Operations

At 2045 hrs the shift supervisor of Kyrqyzaeronavigatsia alerted all rescue services of the airport informing them on the accident site position and the absence of communication with the aircraft.

At 2051 hrs an emergency signal from the emergency location transmitter ARTEX C406-1 on the Itek Air B737-200 EX-009 was received and processed, which means that the ELT was triggered and the alert signal passed through the COSPAS-SARSAT system.

The search and rescue units of the airport gathered in the TWY D grid within 5 minutes. Three units of the aerodrome fire rescue service arrived at the meeting point in the MAZ-27, MAZ-36 and ASM 48-03 trucks. The fire and rescue team was supervised by the airport shift supervisor.

At 2050 hrs the fire and rescue teams set off for search and rescue.

At 2120 hrs the airport ambulance, the official delegations service minivan and the airport search and rescue vehicle Niva arrived at the accident site. The arrived personnel started evacuating the passengers to a safer distance and rendering first aid to the injured passengers and crew members. Five injured were delivered to the airport medical emergency room for further

² The seeming inconsistency of the conclusions about the passenger death causes and the statements of some surviving passengers and flight attendants concerning heavy smoke and open fire in the middle of the passenger cabin can be most probably explained by the fact that the passengers actually died before the fire penetrated the the passenger cabin, as the bodies were carbonized after the death. .

medical aid in accordance with the severity of their injuries. The other 16 passengers and 4 crew members were taken to the 4th city hospital in ambulance cars.

At 2130 hrs the accident site was cordoned off by the aviation security service (16 people) and line air transport police department (12 people).

At 2138 hrs the following set off to the accident site:

- a task force of the Central Office of the Kyrgyz Ministry of Emergency– 4 persons, 1 vehicle;
- a task force of the Northern Interregional Office of the Kyrgyz Ministry of Emergency – 5 persons, 2 vehicles;
- search and rescue teams of the military base No.86123 – 57 persons, 2 search and rescue vehicles;
- Bishkek Rescue Service teams – 13 persons, 1 search and rescue vehicle;
- Tokmak Rescue Service teams – 7 persons, 1 search and rescue vehicle;
- Fire Rescue Units of the military base No.4 of the Bishkek City Fire Rescue Service, and fire rescue unit No.7 of Zhany-Zher Village – 10 persons, 2 fire vehicles;
- Northern Emergency Center of the Kyrgyz Ministry of Emergency – 4 persons, 4 vehicles

At 2211 hrs the fire units started to extinguish the fire on the aircraft. This was anticipated by 2 units of Manas Airport, 1 fire rescue unit of Zhary-Zher Village and 1 fire unit of the Bishkek military base No.4.

At 2220 the fire was localized and at 2308 hrs it was totally extinguished.

The bodies of the dead passengers were brought to the central mortuary of Bishkek.

At 0657 hrs on 25 August, 2008 the search and rescue operations were completed.

1.16. Tests and Research

The Air Accident Investigation Scientific and Technical Support Commission calculated and reconstructed the aircraft trajectory after the takeoff until the impact. They analyzed the FDR data and the crew's actions.

The findings of their investigations can be found in the Report on the Circumstances of the Itek Air Boeing 737-200 EX-009 accident near Manas Airport approved on 13 January by the Chairman of the Air Accident investigation Scientific and Technical Support Commission.

Upon request of the Interstate Aviation committee, the NTSB USA in cooperation with the Boeing Company made a mathematic simulation of the aircraft movement during the last portion of the flight. The simulation was made to assess the aircraft configuration, its aerodynamics and possible external disturbances affecting the aircraft (windshear, etc.)

The simulation was made for the last 70 seconds of the flight, immediately before the left turn with descent. The simulation revealed the following:

- During the last portion of the flight the landing gears were down, Flaps 15;
- The aerodynamics of the B737-200 EX-009 in its last flight corresponded to the aircraft type; the aircraft movement was governed by the flight controls and engines modes, there were no significant external disturbances affecting the aircraft.

1.17. Organizational and Management Information

Itek Air Ltd. was established as a passenger, mail and cargo carrier and registered in Kyrgyz Republic in June 1999 at 128/10 Chuy Avenue, Bishkek.

In March 2006 it started operating B-737-200 aircraft.

The airline holds an Aircraft operator Certificate No. 04 issued by the DCA of the Ministry of Transport and Communications, Kyrgyz Republic, valid until 11 September, 2009. At the time of the accident the airline was operating 3 Boeings 737-200.

The Flight Operations Service of the airline is staffed with specialists trained in accordance with the programs of the Kiev International Aviation Training Center. The airline has 7 flight crews authorized for international flights and ICAO CAT II landings.

The airline's flight routes include: Bishkek – Domodedovo - Bishkek, Bishkek – Urumchi (China) – Bishkek, Osh – Domodedovo – Osh, Osh – Novosibirsk – Osh, Bishkek – Teheran – Bishkek.

The airlines pilots undergo B737-200 simulator training at the Sabena Academy, Brussels, Belgium and at the Kiev International Aviation Training Center (the latter holds Certificate No. 18 of 13 September, 2005 issued by the Ukrainian CAA and valid until 13 September, 2008, which authorizes them to train flight crews for the Boeing 737-200 aircraft).

A Flight Dispatch Group has been established and is operating for prompter and higher quality support for flight crews at the base airport of Manas.

The airline undergoes inspections and audits by the Kyrgyz DCA. The latest audit was on 23 June, 2008.

1.18. Additional Information

1.18.1. Visual Approaches

Doc 4444 ATM/501«Air Traffic Management», Chapter 1. Definitions (Fifteenth editions – 2007).

Visual approach. An approach by an IFR flight when either part or all of an instrument approach procedure is not completed and the approach is executed in visual reference to terrain.

Doc 8168 OPS/611 Procedures for Air Navigation Services - Aircraft Operations, Volume 1, Volume 2 (Fifth edition – 2006) does not contain any definition of the visual approach. The document defines «Arc in Orbit» and «visual manoeuvring (circling) area».

Civil Flight Rules of the Kyrgyz Republic approved by Order No. 220 of the Ministry of Transport and Communications dated 03 August, 1999 give the following definition:

Visual approach is an approach maneuvered using the visual approach pattern approved for the given aerodrome or in compliance with visual approach rules at aerodromes that do not have any established visual approach patterns.

Misinterpretation of visual approach definitions can lead to mistakes in assessments and decisions made by the Captain when making a visual approach, in the air traffic management in the aerodrome area and in ATM regulations (erroneous handoff points, lack of control over the aircraft movement in the visual maneuvering area on final and go-around).

1.18.2. Regulations of Altimeter Settings

The following regulatory documents were analyzed:

- Civil Flight Rules for Kyrgyz Republic, edition - 1999 (PPGA KR-1999);
- Flight Operations Instruction at Manas Aerodrome, approved on 01 December, 2004;
- AIP for Kyrgyz Republic;
- Flight Operations Manual for "Itek Air" Airline approved on 20 July, 2007 by the Kyrgyz DCA.

The following has been revealed:

1. Para 5.1.5.1. of the Civil aviation Rules (PPGA KR-1999) prescribes that at the aerodrome area within the aerodrome flight circle QFE shall be set, while Para 5.1.5.3. prescribes setting either QFE or QNH at the transition level.

2. According to the Flight Operations Instruction for Manas Aerodrome approved on 01 December, 2004 by the Kyrgyz DCA, flights at the aerodrome area (45 km) are to be performed with either QFE or QNH.

Para 5.4.3. of the Instruction is in accordance with the PPGA KR-1999 in terms of QFE or QNH setting, while Para 4.13.5. states that category A airplanes and helicopters perform flights in the takeoff and landing areas until the distance of up to 20 km using QFE, but after 20 km using the QNH, which does not comply with Para 5.1.5.4. of the PPGA KR-1999, which prescribes changing the altimeter setting from QFE to QNH only on leaving the takeoff and landing area of the aerodrome (aerodrome flight circle).

Thus, Section 4 «Flight Operations» of the Flight Operations Instruction for Manas Aerodrome does not comply with the PPGA KR-1999.

3. According to the Kyrgyz AIP, flights are to be conducted only using the QFE, excluding aerodromes in mountainous regions where flights shall be conducted using the QNH.

Section 1.7. «Altimeter Settings»:

According to the Introduction, “altitudes lower than transition level are assigned by the ATC using the QFE”;

According to Para 2.1.2.: «Determining and Maintaining the Flight Altitude»:

a) using the QFE – when flying within the takeoff and landing area up to the transition altitude or from transition level until landing”, which does not comply with Para 5.1.5.3 of the PPGA-1999.

4. Itek Air Flight Operations Manual approved on 20 July, 2007 by the Kyrgyz DCA mandates flights only using the QNH or QNE (standard atmosphere, 760 mm of Hg) during cruise.

Para 8.2.3. «Climb, level flight and descent»:

b) Altimeter setting: «...on civil aircraft usually QNH or standard pressure of 1013,2 is set», and further: «...QNH is used during takeoff, landing and when measuring the flight height. It is also used to set and maintain vertical distance.”;

c) “...Detailed instructions concerning conversion of the QNH are specified in the Jeppesen... Before landing the PIC should receive the QNH value for each specific aerodrome”:

“All flights at or below the transition altitude shall be performed using the QNH for the given airport or established area” (Ch. 8, p. 22).

Taking into account all the abovementioned, the Itek Air Flight Operations Manual does not prescribe using the QFE, which does not comply with the PPGA KR-1999 requirements.

Thus, the regulations and operating procedures concerning the altimeter settings in terms of flight operations and air traffic management are inconsistent and contain ambiguous requirements.

1.19. New Investigation Techniques

The investigation was executed in accordance with the standard procedures, no new techniques were used in the course of the investigation.

2. Analysis

The investigation team analyzed the FDR readout data, the transcript of the ATC-crew radio exchange, recorded by the ATC recorder, the records of enquiries of the flight crew and cabin crew, the wreckage plot, the findings of the engines, airframe, aircraft systems, powerplants and navigation equipment examination at the accident site, the operational and maintenance documentation, the current civil aviation regulations of the Kyrgyz Republic as well as the Report on the circumstances of the Itek Air Boeing 737-200 EX-009 aircraft accident on 24 August, 2008 near Manas Airport, made by the Air accident investigation Scientific and technical Support Commission of the Interstate aviation Committee.

The crew's professional level was analyzed on the basis of the documents submitted by the Kyrgyz DCA, the Ukrainian State Air Safety Oversight Agency and the Itek Air Airline.

On the basis of the abovementioned the following was found out:

The Boeing 737-200 EX-009 was owned and operated by Itek air Airline. The aircraft had a valid Certificate of Airworthiness and Certificate of Registry issued by the Kyrgyz DCA.

The aircraft maintenance was performed in accordance with an agreement with the Max Avia Airline. There were no deviations in the maintenance that could have contributed to the accident.

On 24 August, 2008 the Itek Air Boeing 737-200 EX-009 was flying a scheduled passenger flight IRC 6895 from Bishkek (Manas) to Teheran (Imam Khomeini International Airport).

The estimated time of departure was 2030 hrs.

The flight was executed in accordance with the leasing agreement No. 023/05 of 15 July, 2005 for the Boeing 737-200 EX-009 with the crew between the Kyrgyz Airline Itek Air and the Iran Aseman Airlines.

At 1902 hrs the crew passed medical examination at the ground medical office of Manas Airport. There were no complaints on the part of the crew concerning their health. The preflight briefing was received in full under the PIC's supervision, there were no claims as to the aircraft operation.

***Note:** The original flight documents were burned during the ground fire at the accident site. The duplicates of the flight documents were restored by the flight operation service of the Itek Air Airline. The load and weather documentation was submitted by the relative services of Bishkek Airport.*

The weather forecast for the aerodrome of departure, flight route, aerodrome of destination and alternate aerodromes as well as the actual weather at the aerodrome of departure did not impede the flight. The crew's go-decision was justified.

According to the explanations and reports of the crew's enquiry, before the flight the duties were distributed in such a way that the PIC was the Pilot Flying and the Co-pilot was the Pilot monitoring. The investigation concluded that one more person – the maintenance engineer was present in the cockpit during the whole flight.

After the passenger and baggage embarkation the crew started the departure procedures.

On board the aircraft there were 2 flight crew members, 3 cabin crew members, 2 service passengers and 83 passengers. The actual takeoff weight was 48371 kg, with the center of gravity of 24,8% MAC, which was within the B737-200 AFM limitations.

At 20:16:47 the crew reported ready for towing and startup: *"Bishkek Ground India Romeo Charlie 6995 good evening... for Lima 5, Teheran 9600, have information, ready for towing and startup."*

At 20:18:45 the crew received clearance for startup from the Ground Control.

At 20:26:24 the crew requested taxiing to the holding position, the Ground Control cleared them for taxiing and informed them on the taxi pattern for takeoff from RWY 08.

At 20:26:46 the Ground controller informed the crew on the departure pattern, their initial cleared flight level, squawk and next contact: *«Cleared flight plan, standard instrument departure Delta Whiskey One, initial climb 1800, squawk 0215, when airborne contact Approach 124.6.»* The crew read back the information and the Controller confirmed it.

At 20:27:32 the crew requested lining up and after the clearance they continued taxiing.

At 20:30:11, after lining up at RWY 08 (heading 75° M), after being cleared for takeoff, the crew at 20:30:14 started the takeoff procedures.

At 20:31:34 the crew reported the Approach control about the takeoff and on the Controller's advice continued climbing to FL 4500 m bearing 240° M. The vertical speed of climb did not exceed 12 m/sec.

During the climb at 20:33:41 at 1700 meters the crew engaged the roll and pitch channels of the autopilot, which is confirmed by the relevant ON/OFF signals recorded by the FDR. The autopilot remained engaged until the end of the record. The FDR does not record the activated autopilot modes, but the recorded control actions may suggest that control wheel steering mode was used to control the aircraft during the descent and approach.

According to the crew's enquiry, during the checklist at 10000 ft (approximately 3500 m) they found out that the Pressurization System indicators did not show the change in cabin pressure which should have increased with the climb. The AIR STAIR light on the Overhead

panel was on (meaning that the air stair was not locked). The purser informed the crew on heavy noise in the left forward entry door area.

In that situation the PIC made the right decision to make an air-turn back to the airport of their departure. According to the FDR data, on reaching 11500 ft (about 3500) with reference to 760 mm of Hg, the crew started descent. The distance from the Manas ARP was about 35 km, the IAS was 245 knots.

At 20:37:16 the crew retarded both engines to idle which was maintained until 20:44:07 and the engines power was increased only while performing the left orbit.

At 20:37:40 the crew reported to the Approach Control: *“IRC 6895... eh...ah... return to airport Manas technical reason, request approach heading 075”*. At 20:37:58 they received the relative clearance: *“IRC 6895 roger, turn right heading final turn runway 08, descent 1800”*.

The crew started a right turn with about 20° roll to align with the RWY 08 centerline. The vertical speed of descent did not exceed 13 m/sec.

At 20:38:07 the crew reported: *“Descending 1800 to final turn, RWY 08, 6895”*.

At 20:39:15 the Approach Control requested: *“IRC 6895, are you going to make visual approach?”* Here is an extract from the enquiry of the Approach Controller V.V.Bagnyuk on 18 October, 2008: *“I think, in the developing situation this approach was the most suitable for the crew. I evaluated the situation as urgency or emergency that demanded prompt landing”*.

Note: *In accordance with the recommendations of Doc 4444 «Air Traffic Management», Para 12.3.3.2.n, if the pilot does not request a visual approach the ATC should request if the pilot is able to accept a visual approach using the following phraseology: “ADVISE ABLE TO ACCEPT VISUAL APPROACH RUNWAY (number)”*.

The PIC, erroneously evaluating the aircraft attitude in terms of speed, altitude, distance from RWY 08, and descent rate for visual approach, made an unjustified decision to make a visual straight-in approach.

At 20:39:20, immediately after the approach controller’s request, the crew reported their decision: *“Affirm, will make visual approach, 6895”*..

The Civil Flight Rules for the Kyrgyz Republic allow visual approaches both at daytime and at nighttime.

Note: *Para. 5.1.9.3. of the Civil Flight Rules:*

«... Visual approach can be performed:

- at aerodromes not equipped with landing navigation aids or in case these

navaids fail;

- in order to increase the aerodromes' capacity, fuel and flight time economy regardless if the aerodrome is equipped with navaids;*
- to provide prompt landing in case of emergency;*
- in order to train flight crews to perform visual approaches”.*

It should be noted that cabin non-pressurization up to 4000 m did not require additional safety measures and expedite landing. There were no advantages of the visual approach over the instrument flight rules approach in terms of provision of prompt landing.

The PIC enquiry record of 20 October, 2008 runs as follows: “ I did not have time for the instrument approach, I had visual contact with the runway and thought that visual approach will be quicker.” Question: “...how did you estimate your chances for visual approach?”; Response: “I saw the runway and made a decision.”

Note: *Extract from the PIC's enquiry of 20 October, 2008:*

«I had authorization for visual approaches on Tu-154 and trained visual approaches at the B737-200 flight simulator. I don't remember if there was any checkride on line, but we constantly made visual approaches.”

According to the submitted documents, the PIC in compliance with the training task on 31 March, 2008 underwent ground briefing on the visual approach rules and on 17 April, 2008 he had on-the-job training for visual approach at Meshed and Dushanbe aerodromes. The flights were at nighttime with a pilot-instructor. The total assessment was “Ready” with the following conclusion: “Can be allowed to perform visual approaches on Boeing 737-200.”

By the Order No. 134/п of the Itsek Air General Director dated 03 June, 2008 the PIC was authorized for visual approaches on the B737-200 aircraft.

There was no record in the section “Permit to fly” or “Checkride” in the PIC's logbook.

The analysis of the actual crew actions when selecting the method of approach and their further actions during the orbiting, as well as of their explanations and enquiry details, concludes that the crew was not properly trained for visual approaches.

At 20:39:56 the crew were instructed by the Approach Control on the approach details: “IRC 6895, transition level 1800, QFE 704, descend 400, report visual contact with runway”.. The crew requested QNH approach and were responded with: “6895 roger, QNH 1012 hPa, descend 1100 meters.” The flight level was about 6600ft (approximately 2000 m), with the IAS of about 260 knots (about 480 km/h), and distance from the ARP about 36 km. The crew confirmed receiving the information on the assigned altitude of descent.

***Note:** Having informed the controller that they will use the QNH, the crew on further contact with the Controller reported the level using the QFE values.*

At 20:41:40 the crew informed the Controller that they were observing the runway. The distance from the ARP was about 20 km. The Approach Controller cleared them for visual approach to RWY 08.

At 20:42:12 the crew informed the Approach Control: “6895 at 400 on final”. At that time the distance from the ARP was about 15 km with the IAS of 255 knots (470 km/h).

***Note:** Flight Operations Instruction for Manas Aerodrome, Bishkek, Para. 5.4.3.:*

«Flight levels below the transition level are assigned by the ATC in meters, QFE or QNH.”.

«Flight levels after setting QFE or QNH at the altimeter are maintained and reported in meters only.”

At 20:42:25 the Approach Control handed the crew off to the Ground Control (Bishkek Ground): “IRC 6895, cleared for visual approach runway 08. Continue approach, contact Tower 118.1, good luck”.. The distance from the ARP was 12,5 km (10.4 km from RWY-08 threshold), flight altitude based on QFE was 400 meters.

***Note:** The aircraft was handed off from the Approach Control to the Ground Control at the boundary of visual maneuvering area at 400 m by QFE. According to the visual approach pattern for RWY-08 the minimum descent altitude in visual maneuvering area is 890 (250) meters by QNH (QFE).*

According to Para 5.1.9.8. of the Civil Flight rules for the Kyrgyz Republic, the ATC is responsible for controlling the crew maintaining the instrument approach pattern until the visual maneuvering area (for Boeing 737 this area is an arc of 9.79 km from RWY-08 threshold).

According to the SOP and the duties description of the Approach Controller of Bishkek ATC Center at Manas Airport, the handoff area to the Ground Control “during the visual approach after the crew’s report... on establishing visual contact with the runway ... as a rule is not further than 20 km from the aerodrome but not later than the final turn.”

Thus, the SOP and duties description of the Approach Controller at Bishkek ATC Center of Manas Airport does not comply with Para 5.1.9.8. of the Civil Flight Rules for the Kyrgyz Republic.

At 20:42:37 the crew established contact with the Ground Control: *“Bishkek Tower, IRC 6895 good evening, on final 75, at 400”*. The distance from the ARP was about 11 km with the IAS of 233 knots (430 km/h). Ground Control: *“IRC 6895 Bishkek Tower good evening wind 120 three report when ready RWY 08”*.

Note: *The Ground Controller does not have radar to track the aircraft flights and controls aircraft visually and through radio exchange.*

As follows from the PIC's explanations given on 09 September, 2008, the crew estimated their distance from the runway and attitude towards the glideslope in the following way: *“First on the basis of the VOR/DME, and later, from the distance of 13 – 15 km we switched to the ILS and realized that we were not following the glideslope. After reaching 260 knots I extended the landing gears and continued decelerating”. ... “When I started decreasing speed to extend the high-lift devices, I understood that I will probably not be able to perform a straight-in approach. That is why I extended the landing gears and high-lift devices to 1°, 5° and 15° at maximum allowable speeds. ... But after flaps 15 finally realized that I will not be able to make a straight-in approach in accordance with the standards.”*

At a distance of about 7-6 km from the ARP (about 5-4 km from the runway threshold) the aircraft was at 3300 ft/1000 m (height about 1250 ft/380 m). In accordance with the guidance provided in the Boeing 737-200 Flight Crew Training Manual the aircraft should be in the landing configuration (gears down, Flaps 30) and stabilized at 500ft (152 m) with the IAS of 140-130 knots.

According to the PIC's explanations, the landing gears were down at 260 knots and later Flaps 15 was set on the basis of the maximum speeds. This is confirmed by the math simulation of the last portion of the flight, which shows at Flaps 15 the best matching with the FDR data. As the FDR does not record the flaps position, it seems impossible to determine the exact time of their extension. However, it can be stated that when the aircraft was 5-4 km from the runway threshold they were already set to 15°. The examination of the jackscrews on the accident site also confirms that the flaps were extended.

According to the record of the PIC's enquiry on 24 August, 2008, making a visual approach at nighttime the crew did not use the PAPI lights: *“I did not look at the PAPI, I was maintaining contact with the runway.”* However, according to Para 5.1.9.4. of the Civil Flight Rules for the

Kyrgyz Republic, «...Category B, C, D, E aircraft are allowed to make visual approaches to aerodromes equipped with VASI, PAPI, etc.)”.

According to the PIC's explanations, at the altitude of 400 m the aircraft started banking left with the increasing thrust, which could have been caused by the engine asymmetry in the PIC's opinion.

The maximum engines asymmetry while performing left orbit (see below) was $0.04 \div 0.06$ EPR (power of the left engine was higher than the right one) which did not impede significantly the aircraft control. It should also be mentioned that at 400 m the engine thrust was not increasing and the bank was caused by the pilot's control inputs.

At 20:43:24 the crew requested the Ground Control: *“6895, we'll make left orbit (illegible) for descent.”* The distance from the ARP was about 6 km.

At 20:43:26 the FDR recorded the left roll control inputs for turn and descent (the IAS was 180 knots). From 20:43:26 to 20:44:01 the roll angle did not exceed 30°, the vertical speed of descent was 7.5 m/sec and the engines were on idle.

At 20:43:32 the Ground Control informed the crew: *“6895 roger left orbit, report base turn”*. The crew confirmed receiving the information: *“Report base turn 6895”*. The distance from the ARP was 5 km.

The PIC made an erroneous decision when choosing the second approach maneuver starting point which further led to loss of visual contact with the runway.

In his turn, when clearing the crew for the left orbit the Ground Controller did not foresee that making this maneuver the crew would lose visual contact with the runway and ground references.

The flight trajectory analysis showed that when the aircraft was turning left the crew actually lost visual contact with the runway and ground references. The crew did not report this to the Ground Control nor made the decision to continue the flight using the Instrument Flight Rules.

At 20:43: 44 during the turn for down wind accompanied with uncontrolled descent the crew descended below the minimum visual maneuvering altitude of 890 m (250 m).

Note: *According to para 5.1.9.7 of the Civil Flight Rules for the Kyrgyz Republic the PIC is responsible for maintaining established minimum descent altitude until the final turn when flying in the visual maneuvering area.*

From the PIC's enquiry of 24 August, 2008: *«Question: How did you control the vertical speed? Response: I did not pay attention, I was monitoring the EADI and the altitude, the aircraft was balanced and I did not feel the descent.»*

The Ground Control that was responsible for the flight at that moment was not able to monitor the flight visually and, as was mentioned before, did not have instrumental means to monitor the flight. On the contrary the Approach Control had the information on the radar screen that the aircraft was descending below the established minimum descent altitude during the turn and while flying downwind but this information was not communicated to the Ground Control. According to the Para 6.12.16 of the Manual for aeronavigation service in Kyrgyz Republic "...during visual approach ... the crew is responsible for maintaining flight path and altitude".

When the aircraft started the turn for down wind the Co-pilot was calling out the Landing Checklist items and monitoring the aircraft position on the GPS. According the Co-pilot's explanation he "...totally relied on the PIC, ... did not have any doubts concerning his actions." The crew lost the altitude control.

Below is the evaluation of crew compliance with the Visual Approach Rules in Para 5.1.9.1. of the Civil Flight Rules for the Kyrgyz Republic which provide for the following:

- Visual maneuvers in the aerodrome area are to be done within the established visual maneuvering area before intercepting the final.

For Category C aircraft, to which the B737-200 belongs, the visual maneuvering area is limited by a curve at the distance of 9.79 km from RWY 08 threshold. The accident site is on the boundary of that area.

- Maintaining the established minimum descent altitude until turning to the landing course.

Being on final and entering the visual maneuvering area the crew did not reach the established visual approach minimum descent altitude of 890 m (250 m) according to the visual approach pattern. Further, while making the left orbit, the crew descended below the established visual approach minimum descent altitude without monitoring altitude properly.

- Continuous visual contact with the runway and ground references should be established and maintained.

- A go-around should be made from any point of the visual approach if the visual contact with the runway and/or ground references is lost and the crew should join the established missed approach pattern in accordance with the Instrument Flight Rules;

When making the turn for the down wind track the crew did not inform the Ground control about losing visual contact with the ground neither performed a go-around maneuver.

As follows from the explanations and enquiries of the crew members, the altitude alert was set at 4400ft (1340 m) for the missed approach pattern, two radio altimeters altitude alerts were set at 200ft (60) m.

At 20:44:07 during the turn when the IAS reached 160 knots the engines RPM was increased.

The aircraft had a Terrain alert warning proximity Ground Proximity Warning Ssystem (TAWS) which alerts the crew of the ground proximity.

***Note:** Record of the Co-pilot's enquiry on 18 October, 2008: «before joining the back course the alert was constantly triggered.... The crew did not react to these signals as this alert can be also triggered in case of descent in non-landing configuration.»*

In his explanations and enquiries the crew mentioned cases of false triggering of the TAWS. However, these faults were not recorded in the tech log nor analyzed by the maintenance personnel, nor discussed at the technological meeting. No recommendations were given to the crews as to the reaction in case they trigger again.

It should be mentioned that according to the crew's explanations, the turn back was performed in level flight (withou descending). In this case there would be no triggering of the TAWS warning. The system activates if the aircraft descends with a certain vertical speed or if the level flight is over an elevating terrain. The elevation of the accident site is 10 m lower than the elevation of Manas Aerodrome.

The continuous descent of the aircraft is confirmed by the FDR data.

At 20:44:27 the aircraft was recovered from the bank, the heading was 267° M and the altitude was continuously decreasing below the minimum safe altitude, down to 2185 ft (666 m) (height 46 m) with a vertical speed of about 3 m/sec. The engines were operating with EPR1=1,43; EPR2=1,37.

At 20:44:32 at 2170ft / 662 m (height 35 m) the PIC applied left control wheel which led to a left roll of 10°.

About 9 seconds later the aircraft hit the ground with its left wing tip and 4 seconds later (at 20:44:45) it started crashing which is confirmed by the consistent noise on the ATC recorder.

According to the radar data, the last aircraft position blip was recorded at 640 m (height 20 m).

A simulation match of the last portion of the accident flight as well as the control inputs and aircraft motion analysis conducted by the Boeing Company "... suggest the aircraft was reacting as expected to control inputs."

After the crash the cockpit door was deformed and could not be opened. The crew left the cockpit through the left cockpit window. More details on passenger evacuation can be found in section 1.15

The investigation team analyzed the aircraft technical condition before the flight and the pressurization system failure in the last flight.

On 23 August, 2008 the crew made a record in the logbook about the in-flight left engine generator failure. The troubleshooting was done by replacing the GCU , after which the aircraft made 4 flights without any claims. If any of the two generators fail all the vital aircraft systems are powered by the operative generator without hindering the operability of the power supply system. In accordance with the MEL, it is allowed to fly with one generator inoperative for 3 days. In the last flight there were no claims on power supply, according to the crew's explanations.

The team also analyzed the records in the flight log defect sheets for August 15, 16 and 23, 2008 (after the last base maintenance) and the explanations of the maintenance staff concerning the troubleshooting. The recorded defects did not have any bearing on the accident.

On the flight of 24 August, 2008, after takeoff and climb to 3000 m the amber AIR STAIR LIGHT activated on the P5-20 Door Warning Module on Forward Overhead Panel, indicating that the air stair door was not locked. The crew noticed that the change in the cabin altitude was lower than the established one for the actual flight level. A flight attendant informed the crew on the developing noise in the area of the left forward door. The crew decided to make an air-turn back to the departure airport and reported this to the ATC.

According to the PIC's explanations, there were cases of AIR STAIR LIGHT activation in previous flights.

The investigation team studied and analyzed the maintenance releases and other technical documentation concerning the aircraft over its entire time in operation by Itek Air. There was no evidence of AIR STAIR LIGHT activation in the previous flights.

As there was no evidence of such defects in the aircraft maintenance documentation within the complete period of the aircraft in operation by Itek Air, it can be suggested that either this information was not reported to the airline's engineering service, or this information was false.

It seems impossible to determine the exact cause of the warning light activation and cabin not pressurizing on the basis of the air stair drive system condition after exposure to high temperature, as the drive system, limit switches and wiring were damaged and burned out.

The investigation team analyzed the air stair extension and retraction principle. It was found out that it is impossible to extend the air stair in flight due to the following locks:

- an electrical lock activated when the left forward door closes;

- and a lock pin activated by the door handle. To extend the air stair one had to open the entry door first.

Self-actuation of the air stair is almost impossible as the air stair drive is a jackscrew with a high gear ratio and the drive motors have brakes. Besides, the air stair door is plugged in by the pressure difference. In four previous flights, including the last flight, the air stair was not used and the cabin was pressurizing properly.

The investigation team investigated the principles of the forward entry light and air stair light activation:

The warning system includes the following:

- FORWARD ENTRY DOOR SENSOR;
- AIRSTAIR DOOR PIN LOCK SENSOR;
- STANDBY DOOR CLOSE LIMIT SWITCH;
- MISC.SOLID STATE SWITCHING MODULE;
- FORWARD AIRSTAIRS CONTROL PANEL;
- FORWARD ENTRY LIGHT;
- AIRSTAIR LIGHT.

The principle of the warning system operation is as follows.

When the left forward entry door is open if the air stair is retracted (or being retracted), the AIRSTAIR LIGHT light is on until the forward entry door is starting to close and the STANDBY DOOR CLOSE LIMIT SWITCH is triggered. The close limit switch is compressed, ground is released and the AIRSTAIR LIGHT gets off. The door is closed further until it reaches the CLOSE position, activating the FORWARD ENTRY DOOR SENSOR and forcing the FORWARD ENTRY LIGHT off. When the door is closed the K3 relay in the MISC.SOLID STATE SWITCHING MODULE is actuated getting LOCKED and the forward airstairs control panel is unpowered (so if the forward entry door is closed it is impossible to control the airstair from the cockpit).

When the forward entry door is opened first the forward entry door sensor is activated and the forward entry light switches on. As the door is opened further, the standby door close limit switch is released and the airstair light is activated.

The ground equipment and vehicles of Manas Airport were inspected to find evidence of any impact on the passenger and service doors, baggage and other doors which could have damaged doors during the ground servicing of the IRC 6895 flight on 24 August, 2008 before its departure. There was no evidence found.

On the basis of the technical assessment of the remaining left forward entry door and its respective bay elements, as well as the explanations and records of flight and cabin crew

members' enquiries, and the results of the conducted test, the most probable reason for the cabin non-pressurization was the jamming of the left forward door seal.

In case when the seal is jammed near the Interior Control Lever (that actuates the lock pin in the entry door bay), the lock pin can protrude only partly, which triggers the Air Stair Light activation. However, the entry door and the air stair door are closed which is confirmed by non-activation of the forward entry door sensor.

It should be noted that according to the explanations by the cabin crew and a maintenance engineer, the left forward door was closed by a maintenance engineer, which does not comply with the Cabin Attendant Manual.

3. Findings and Conclusion

3.1. The Boeing 737-200 EX-009 aircraft was owned and operated by Itel Air Airline. The aircraft had a valid Certificate of registry and Certificate of Airworthiness, issued by the Kyrgyz DCA.

3.2 The crew held valid pilot and medical licenses. Their qualifications and health were in compliance with the assigned flight task and did not hinder safe operations. According to the submitted documents, the professional level of the crew was in compliance with the current requirements of the Kyrgyz DCA.

However, the analysis of the crew's actual actions during the approach, their explanations and enquiries suggests that the crew was not properly trained for visual approaches.

3.3. According to the submitted information, the crew's rest before the flight to Teheran was over 24 hours at home.

3.4. The aircraft maintenance was done in compliance with the agreement by the Max Avia Airline. There were no defects in maintenance that could have contributed to the accident.

3.5. The airframe, aircraft systems and engines as well as the avionics of the Boeing 737-200 EX-009 were operative until the impact, except the cabin not pressurizing and the CVR.

There was no in-flight aircraft destruction. All the identified damage of the airframe and aircraft systems, engines and avionics was caused by the high load factors on impact exceeding the operational limits of the aircraft structures and by the ground fire. The cabin not pressurizing and the inoperative CVR did not contribute to the accident.

The most probable cause of the air stair alert and cabin not pressurizing was jamming of the left forward door seal.

3.6. The aircraft had enough good-quality fuel, oil and liquids on board for safe flight operations. The takeoff weight and center of gravity were within the Boeing 737-200 AFM limitations.

3.7. The weather conditions at the time of the accident did not impede flight operations. The meteorological service of the flight was in compliance with the current regulations.

3.8. The ATC Officers professional training level is in compliance with the current regulations and standards of ATC specialists training for Civil Aviation, the Kyrgyz Republic.

The ATC service was certified in compliance with the Rules of Certification of Civil Aerodromes in the Kyrgyz Republic approved by Order No. 862 of the Kyrgyz Government on 26 November, 2004. Certificate No. 07 35 87 of 20 April, 2004.

The ATC personnel at Bishkek Airport held valid ATC licenses with the required qualifications records.

3.9. The nav aids for RWY 075 of Bishkek Airport were operative.

3.10. The PIC decided to make a visual straight-in approach, without taking into account the aircraft position with reference to the runway in terms of altitude, distance and descent profile.

3.11. Making a visual approach at night the crew did not use the PAPI lights.

3.12. The crew did not follow the Visual Approach Rules in Para 5.1.9.1. of the Civil Flight Rules for the Kyrgyz Republic:

- Performing flight in the visual maneuvering area the crew did not maintain the established minimum descent altitude of 890 m (250 m) required by the visual approach pattern;
- The crew did not maintain the established minimum descent altitude before the final turn for the landing course;
- The crew lost visual contact with the runway and/ or its ground references.
- The crew did not inform the Ground Control about losing visual contact with the runway.

- The crew did not exercise a missed approach from any point of the visual approach when they lost visual contact with the runway and/or ground references in accordance with the established IFR missed approach pattern.

3.13. The flight crew training program for visual approaches on Boeing 737-200 aircraft in the airline's FOM suggest ambiguous interpretation of the need for on-the-job visual approach training which can be substituted by flight simulator sessions. The actual flight training does not suggest checking the pilot's visual approach skills both at daytime and at night.

3.14. The crew did not follow the required procedures when the decision height warning and the TAWS warning were triggered.

3.15. The crew did not follow the Boeing 737-200 SOP in terms of complete monitoring of the flight profile during the descent, which led to loss of altitude control.

3.16. The aircraft was handed off from the Approach Control to the Ground Control at the boundary of visual maneuvering area at 400 m by QFE. According to the visual approach pattern for RWY-08 the minimum descent altitude in visual maneuvering area is 890 (250) meters by QNH (QFE).

When the Ground Control was requested by the crew he cleared them for left orbiting not anticipating that when orbiting the crew would lose RWY and visual references.

The Ground Control that was responsible for the flight at that moment was not able to monitor the flight visually and, as was mentioned before, did not have instrumental means to monitor the flight. On the contrary the Approach Control had the information on the radar screen that the aircraft was descending below the established minimum descent altitude during the turn and while flying downwind but this information was not communicated to the Ground Control. According to the Para 6.12.16 of the Manual for aeronavigation service in Kyrgyz Republic "...during visual approach ... the crew is responsible for maintaining flight path and altitude".

3.17. The SOP and duties description of the Approach Controller at Bishkek ATC Center of Manas Airport does not comply with Para 5.1.9.8. of the Civil Flight Rules for the Kyrgyz Republic.

According to the SOP and the duties description of the Approach Controller of Bishkek ATC Center at Manas Airport, the handoff zone to the Ground Control "during the visual

approach after the crew's report... on establishing visual contact with the runway ... as a rule is not further than 20 km from the aerodrome but not later than the final turn." But according to Para 5.1.9.8. of the Civil Flight rules for the Kyrgyz Republic, the ATC is responsible for controlling the crew maintaining the instrument approach pattern until the visual maneuvering area.

3.18. The unexpected character and the rapid development of the emergency situation and the developing panic among the passengers did not allow the flight and cabin crew to complete all the required evacuation procedures.

Conclusion

The cause of the Itek Air B737-200 EX-009 accident during the air-turn back due to the cabin not pressurizing (probably caused by the jamming of the left forward door seal) was that the crew allowed the aircraft to descend at night to a lower than the minimum descent altitude for visual approach which resulted in the crash with damage to the aircraft followed by the fire and fatalities.

The combination of the following factors contributed to the accident:

- Deviations from the Boeing 737-200 SOP and PF/PM task sharing principles;
- Non-adherence to visual approach rules, as the crew did not keep visual contact with the runway and/or ground references and did not follow the prescribed procedures after they lost visual contact;
- Loss of altitude control during the missed approach (which was performed because the PIC incorrectly evaluated the aircraft position in comparison with the required descent flight path when he decided to perform visual straight-in approach);
- Non-adherence to the prescribed procedures after the TAWS warning was triggered.

4. Shortcomings

4.1. Itek Air Airline does not provide systematic compliance with ICAO Annex 6, Part 1, Chapter 3 with regard to continuous flight data monitoring for aircraft with the maximum takeoff weight of over 27 000 kg.

4.2. In Itek Air Airline there are cases of cabin crew closing the entry doors with the help of ground personnel on board, which does not comply with the current regulations.

4.3. The basic regulatory documents (the Civil Flight Rules for the Kyrgyz Republic issued 1999, the Flight Operations Instruction for Manas Aerodrome approved on 01 December, 2004, the Kyrgyz AIP, the Itek Air FOM approved on 20 July, 2007) are inconsistent and allow misinterpretation with regard to altimeter settings in flight operations and air traffic control.

4.4. The Civil Flight Rules for the Kyrgyz Republic approved by Order No. 220 by the Minister of Transport and Communications dated 03 August, 2003 (Para 5.1.9.5) contain minimal distances from the runway threshold for visual maneuvering area without taking into account the aerodrome elevations, which is inconsistent with ICAO PANS-OPS provisions. The values in Para 5.1.9.5 are taken from the PANS-OPS calculations for an elevation of 300 m. The understated distances are used for Tamchi Aerodrome which has the elevation of 1653,8 m but is not equipped with the nav aids.

4.5. The SOP and duties description of the Approach Controller at Bishkek ATC Center of Manas Airport does not comply with Para 5.1.9.8. of the Civil Flight Rules for the Kyrgyz Republic.

4.6. The flight crew training program for visual approaches on Boeing 737-200 aircraft in the airline's FOM suggest ambiguous interpretation of the need for on-the-job visual approach training which can be substituted by flight simulator sessions. The actual flight training does not suggest checking the pilot's visual approach skills both at daytime and at night.

4.7. At the time of the accident investigation the aircraft maintenance documentation was not held by the Operator, but by the Max Avia Airline at Sharjah Airport, UAE.

4.8. The security arrangements did not provide required custody of the damaged aircraft structures and elements.

4.9. In the course of the investigation the following shortcomings were identified in the search and rescue organization of Manas Airport:

- Lack of coordination between the fire guards and medical service;
- Lack of time record by the search and rescue supervisor during the fire and rescue operations;

- Lack of responsible person on behalf of the search and rescue service to be in charge of the communication and coordination with the medical examiner at the accident site when the fatalities were dealt with.

5. Safety Recommendations

5.1. It is recommended to the Kyrgyz DCA:³

5.1.1. To carry out specific briefings for the flight, maintenance and air traffic control personnel on the circumstances and contributing factors to the accident.

5.1.2. To analyze how the recommendations of the Kyrgyz registered aircraft accident investigations are implemented and correct the identified inconsistencies.

5.1.3. To take extra measures to improve visual approach training for flight crews including:

- amending the Flight Crew Training Program for the Boeing 737-200 aircraft with regard to Section 3 “The PIC training for visual approaches” providing for visual approach training both at daytime and at night;
- preparation and conducting with the flight and ATC personnel a meeting about the features of visual approach procedures.

5.1.4. To consider arranging conferences and workshops to share flight operations experience of various aircraft types.

5.1.5. To conduct non-scheduled inspections of Boeing 737 operators to assess the timeliness and quality of compliance with the established maintenance program paying special attention to conditions of doors sealing elements.

5.1.6. To provide compliance with the requirements of ICAO Annex 6, Part 1, Chapter 3 in terms of mandatory flight data monitoring for aircraft with the maximum certified takeoff weight over 27 000 kg.

5.1.7. To draw flight crews’ attention to the necessity of prompt reaction when the TAWS warning is triggered. To include the relative training into the flight simulator sessions.

³ It is recommended to the Civil Aviation Authorities of other Contracting States of the Agreement on Civil Aviation and Use of Airspace to consider the applicability these recommendations on the basis of the actual situation.

5.1.8. To analyze the Civil Flight Rules and AIP for consistency with the ICAO regulations in the Procedures for Air Navigation Services - Aircraft Operations (PANS-OPS – Doc 8168 OPS/611) as to visual maneuvering during approach to land. To eliminate the identified inconsistencies.

5.1.9. To carry out extra checks of the operability and recording quality of flight recorders and store the readout results.

5.1.10. To eliminate ambiguities and misinterpretations of the regulations concerning altimeter settings for flight operations and air traffic control in the following documents:

- the Civil Flight Rules for the Kyrgyz Republic, 1999 edition;
- the Kyrgyz AIP;
- Flight Operations Instruction for Manas Aerodrome issued on 01 December, 2004;
- Itek Air Flight Operations Manual dated 20 July, 2007.

To consider revising and, if necessary, amending or supplementing Flight Operation Instructions for other aerodromes and FOMs of other airlines of the Kyrgyz Republic

5.1.11. To arrange extra training sessions for the aviation personnel with regard to the crew actions during the emergency evacuation.

5.1.12. To amend the Civil Flight Rules for the Kyrgyz Republic approved by Order No. 220 of the Minister of Transport and Communications on 03 August, 2003 as to the minimum distances for visual maneuvering areas with regard to aerodrome elevations in accordance with ICAO PANS-OPS provisions.

5.1.13. To develop and implement a regulatory document that would concern the aircraft documentation storage rules with regard to the original and duplicate documentation storage in airlines.

5.1.14 According to IATA Safety Report 2008 recommendation consider revising ATC regulations to avoid the use of 360° turns to lose height on final approach.

5.1.15 To make the distances for the visual maneuvering areas for Kyrgyz aerodromes, including Tamchi Aerodrome comply with the amended Civil Flight Rules for the Kyrgyz Republic.

5.2. It is recommended to the State Enterprise Kyrgyzaeronavigatsia:

5.2.1. To develop and introduce proposals for the Kyrgyz DCA as to QNH and QFE usage on the territory of the Kyrgyz Republic.

5.2.2. To provide consistency of the ATC SOP concerning visual approaches with the requirements of the Civil Flight rules for the Kyrgyz Republic, 1999 edition.

5.2.3. To install aerodrome surveillance and weather radars as well as co-ordinated time system in Manas airport.

5.3 It is recommended to the Aviation Register of IAC

5.3.1 While validating type certificates of foreign manufactured aircraft amend MMELs to exclude aircraft operations with FDR or CVR inoperative.

5.4. It is recommended to Itek Air Airline:

5.4.1. To carry out briefings with the airline's personnel using the Boeing 737-200 EX-009 accident investigation materials. To hold a flight personnel meeting about flight safety level within the airline and to develop measures to improve it paying special attention to visual approach procedures and reacting to TAWS warnings.

5.4.2. To arrange systematic flight crew monitoring on the basis of the flight recorder data in order to identify errors and deviations in aircraft handling and develop the relative preventive measures.