Investigation report

C4/2008L

Terrain clearance infringement in Helsinki Terminal Control Area on 26 March 2008

Translation of the original Finnish report

UR-GAQ

BOEING 737-300

Onnettomuustutkintakeskus
Centralen för undersökning av olyckor
Accident Investigation Board

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Translation: R&J Language Service

SUMMARY

A serious incident occurred in the Helsinki Terminal Control Area on 26.3.2008 at 14:39 UTC. A Ukraine International Airlines' Boeing 737 airliner descended below its ATC clearance altitude. Accident Investigation Board Finland (AIB) appointed investigation commission C4/2008L for this incident. Investigator Markus Bergman was named Investigator-in-Charge with Investigator Juha Salo as a member of the commission. On 24.4.2008 Investigator Erkki Kantola was named as an additional member to the commission. Speech and Audio Expert Dr. Päivikki Eskelinen-Rönkä assisted the investigators in analysing the recorded radiotelephony.

While being radar vectored to the Helsinki-Vantaa aerodrome the airliner was cleared to 2300 FT. However, it descended to 1400 FT, at its minimum, breaking the minimum terrain clearance with a telecommunications mast ahead of its track. The air traffic controller noticed that the airliner had deviated from its clearance altitude and ordered it to immediately return to 2300 FT.

Investigation revealed that the incident was caused by an incorrect altimeter pressure setting indicating an altitude which was more than 1000 FT erroneous. The wrong altimeter setting was the result of the pilots deviating from their Standard Operating Procedures (SOP). The investigation could not establish an unequivocal reason for the action of the flight crew. The detection of the incident was delayed by the facts that the Enhanced Ground Proximity Warning System (EGPWS) did not warn of the telecommunications mast and that the Minimum Safe Altitude Warning (MSAW) feature in use at Helsinki Air Traffic Control is not utilised for alerting infringements of the minimum safe altitude. Furthermore, investigation revealed that, in violation of airline regulations, the pilots did not report the incident to the aviation authorities or to the airline. The air traffic controller did report the occurrence, albeit simply as an incident. However, by definition, it was a serious incident.

The serious incident was caused when the aircraft descended below its ATC clearance altitude, creating the risk of collision with a telecommunications mast ahead of its track. The cause of breaking the clearance altitude was an erroneous altimeter setting. Contributing factors included inadequacies in Crew Resource Management (CRM) and the fact that the pilots deviated from Standard Operating Procedures (SOP).

The investigation commission issued two recommendations. First: The airline is to ensure that their pilots possess the required information and skills for proper Crew Resource Management, as required by the safe conduct of aviation and compliance with airline operations manuals. Second: Finavia is to incorporate a Minimum Safe Altitude Warning (MSAW) feature for the Helsinki Terminal Control Area in its next radar software update.

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ABBREVIATIONS

ARR	Arrival
ATIS	Automatic Terminal Information Service
ATPL	Airline Transport Pilot Licence
BKN	Broken clouds (5-7/8)
CAT	Category
CRM	Crew Resource Management
DAIW	Danger Area Intrusion Warning
DFDR	Digital Flight Data Recorder
EGPWS	Enhanced Ground Proximity Warning System
FDM	Flight Data Monitoring
FEW	Few clouds (1-2/8)
FL	Flight Level
FT	Feet (dimensional unit)
GEN	General
hPa	Hectopascal
ICAO	International Civil Aviation Organization
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
JAR-OPS	Joint Aviation Requirements
LJKK	Finnish ATC manual
MSA	Minimum Sector Altitude
MSAW	Minimum Safe Altitude Warning
MSL	Mean Sea Level
NM	Nautical Mile
NTSB	National Transportation Safety Board

OM-A	Operations Manual, Part A
OM-B	Operations Manual, Part B
OVC	Overcast (8/8)
PF	Pilot Flying
PNF	Pilot Not Flying
QNE	Altimeter standard pressure setting of 1013.2 hPa
QNH	Altimeter setting, mean sea level pressure
RVR	Runway Visual Range
RWY	Runway
SMS	Safety Management System
SOP	Standard Operating Procedures
SSR	Secondary Surveillance Radar
STCA	Short Term Conflict Alert
TAF	Terminal Area Forecast
TCAS	Traffic alert and Collision Avoidance System
TEMPO	Temporarily
TA	Transition Altitude
TRL	Transition Level
UTC	Co-ordinated Universal Time
X-check	Cross-check

SYNOPSIS

A serious incident occurred on 26.3.2008 at 14:39 on Ukraine International Airlines flight AUI621 from Kiev to Helsinki. The airliner was a Boeing 737-300 turbojet, registration UR-GAQ.

The aircraft deviated from its clearance altitude in the Helsinki Terminal Control Area (TMA), coming dangerously close to the telecommunications mast in Kivenlahti. At their minimum, both vertical and horizontal separations from the mast were less than half of those required. The incident did not result in any injuries or damage.

The air traffic controller filed an air traffic incident report to the authorities. Pursuant to ICAO Annex 13, Accident Investigation Board Finland sent a Notification of an Incident to the State Aviation Administration of Ukraine. On 7.4.2008 AIB Finland appointed investigation commission C4/2008L for this incident. Investigator Markus Bergman was named Investigator-in-Charge with Investigator Juha Salo as a member of the commission. On 24.4.2008 Investigator Erkki Kantola was named as an additional member to the commission. Speech and Audio Expert Dr. Päivikki Eskelinen-Rönkä assisted the investigators in analysing the recorded radiotelephony. Ukraine designated Mr Viktor Shvetz, Chief of aircraft accident investigation office, as their Accredited Representative, assisted by Mr Oleksandr Pechenyuk, Investigator at the aircraft accident investigation office; Mr Yuriy Maksymov, Ukraine International Airlines, Quality Assurance Manager; and Mr Mykolay Prudnikov, Ukraine International Airlines Flight Safety Manager. The US accident investigation authority, the National Transportation Safety Board (NTSB), assisted the investigation commission in the technical analysis related to the aircraft.

All times in this report are in UTC. Statements and comments received were taken into consideration during the writing of the report. Some of them are included as appendices to this report. The investigation report was translated into English. The material used in the investigation is stored at the Accident Investigation Board Finland.

The investigation was completed on 18.3.2009.

1 FACTUAL INFORMATION

1.1 The incident flight

On 26.3.2008 at 12:55 Ukraine International Airlines scheduled flight AUI621 departed Kiev (UKBB), Ukraine, for Helsinki-Vantaa (EFHK), Finland. The aircraft was a Boeing 737-300 airliner, registration UR-GAQ. There were 23 passengers and 6 crew members onboard.

The flight took off one hour late because of a change of aircraft. According to their statement the pilots had taken a breathalyzer test before the flight. Preparations for the flight as well as the flight itself were uneventful until the approach phase. The co-pilot was the Pilot Flying (PF) and the captain the Pilot Not Flying (PNF). During the cruise, prior to beginning the approach, the pilots had listened to and written down the ATIS information which provided them with, among other things, the weather at their destination. The approach was conducted in daylight IMC conditions. It was snowing in the area around Helsinki. According to their statements the captain (PNF) was concentrating on operating the onboard weather radar during the approach.

As they approached Finnish airspace Tallinn ATC had cleared them for Standard Arrival (STAR) INTOR 1B and to descend to FL 100. After having changed over to Helsinki Radar they were initially cleared to continue on INTOR 1B for an approach to Helsinki-Vantaa runway (RWY) 04L. A moment later the air traffic controller told them to fly on heading 310 for radar vectoring for an ILS approach to RWY 04L. They were number two in traffic. The pilots read back the heading but asked the ATC to repeat the runway. Following this the controller cleared AUI621 to descend to 5000 FT on QNH 973 hPa. The pilots read back the clearance correctly, but a moment later they requested the ATC to confirm the clearance altitude 5000 FT.

The air traffic controller told AUI621 to reduce speed to 230 KT, reclearing it a minute later to 2300 FT. After the pilots acknowledged this the controller told them to turn right, to heading 340 degrees.

Approximately 50 seconds after the pilots read back the new heading the air traffic controller asked AUI621 to confirm that they were maintaining 2300 FT. According to the radar display they were at 1600 FT. Right after having said this, the air traffic controller ordered AUI621 to climb immediately to 2300 FT. AUI621 read back the order and returned promptly to approximately 2300 FT.

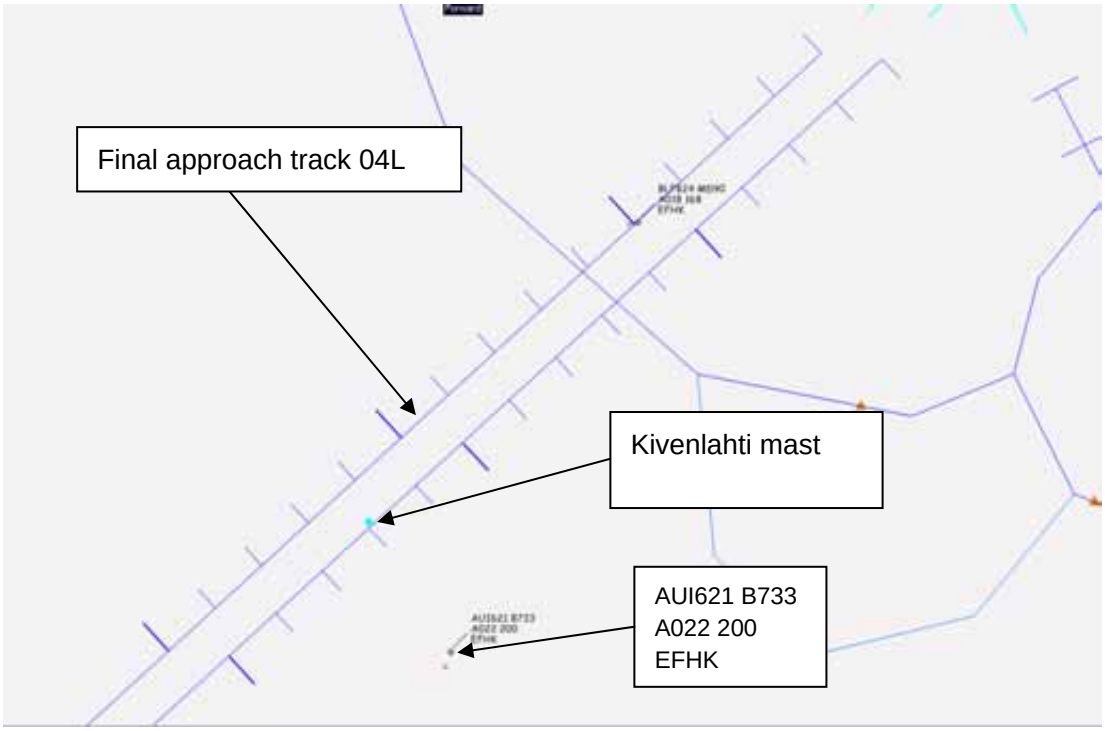

Figure 1: AUI621 descends below its clearance altitude

Figure 2: AUI621 at 1400 FT beside the mast

According to the ATC radar recording and the aircraft's Flight Data Monitoring (FDM) information the aircraft descended to a minimum of 1400-1500 FT MSL. As per the radar recording, AUI621 passed the 1227 FT (MSL) tall Kivenlahti telecommunications mast at a distance of less than 0.7 NM. The required minimum terrain clearance for the mast is 1000 FT, which is complied with when aircraft maintain 2300 FT. Moreover, 2300 FT is also the Minimum Sector Altitude (MSA) in this airspace segment.

After AUI621 read back the order to instantaneously return to 2300 FT the air traffic controller told it to turn right, heading 010, and cleared it for an ILS approach RWY 04L. The pilots read back the clearance. The aircraft drifted a little to the left of the final approach track, only to return and become established on the localizer and the glide path approximately 5.5 NM from the threshold of runway 04L. Following this the air traffic controller handed AUI621 over to the tower frequency.

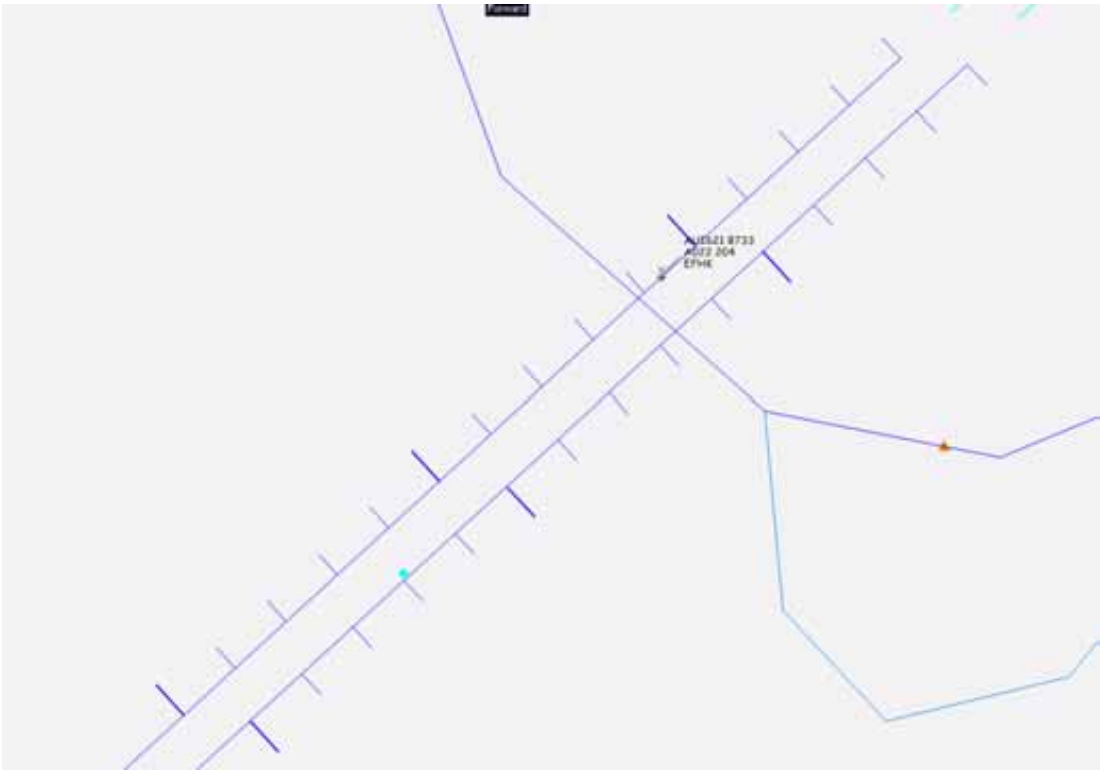

Figure 3: AUI621 established on the final approach track

The final approach and landing were uneventful. The ATC and AUI621 did not discuss the deviation from the ATC clearance altitude nor the serious incident afterwards.

Accident Investigation Board Finland heard of the incident the following day, 27.3.2008, from the air traffic incident report which the air traffic controller had filed. Pursuant to ICAO Annex 13, Accident Investigation Board Finland sent a Notification of an Incident to the State Aviation Administration of Ukraine on 2.4.2008. The Notification was also sent to the ICAO and the NTSB. On 7.4.2008 AIB Finland appointed investigation commission C4/2008L for this incident. On 9.4.2008 Ukraine informed that they would designate an Accredited Representative as well as advisers for the investigation.

1.2 Injuries to persons

There were no injuries to persons. Onboard were 6 crew members and 23 passengers.

1.3 Damage to aircraft

There was no damage to aircraft.

1.4 Other damage

There was no other damage.

1.5 Personnel information

Captain: Age 54

Licence: Air Transport Pilot's Licence (ATPL), valid until 6.4.2008

Medical certificate: Class 1, valid until 10.5.2008

Ratings: All required ratings were valid.

Flying experience	Last 24 hours	Last 30 days	Last 90 days	Total hours
All types	0	approximately 21 h	approximately 139 h	approximately 20479 h
Type in question	0	approximately 21 h	approximately 139 h	approximately 10170 h

Co-pilot: Age 44

Licence: Air Transport Pilot's Licence (ATPL), valid until 25.4.2008

Medical certificate: Class 1, valid until 25.4.2008

Ratings: All required ratings were valid.

Flying experience	Last 24 hours	Last 30 days	Last 90 days	Total hours
All types	approximately 2 h	approximately 72 h	approximately 233 h	approximately 8602 h
Type in question	approximately 2 h	approximately 72 h	approximately 233 h	approximately 929 h

Air traffic controller at Helsinki Radar: Age 41

Licence: Air traffic controller, valid until 31.1.2012

Medical certificate: Valid until 17.9.2008

Ratings: All required ratings were valid.

1.6 Aircraft

UR-GAQ was a 136 seat Boeing 737-300 twin-turbojet airliner, registered in Ukraine, owned by Wells Fargo Bank Northwest, National Association and operated by Ukraine International Airlines. The serial number of the aircraft is 28869.

According to the airline's Boeing 737 Operations Manual (OM-B) UR-GAQ was fitted with an EGPWS system. In addition to providing terrain proximity warnings, the system also alerts of obstacles included in the database.

The aircraft's certificate of airworthiness was valid until 14.4.2008 and its certificate of registration was valid until 15.4.2010.

1.7 Meteorological information

Weather in the Helsinki area at the time of the occurrence was cloudy and snowy.

Helsinki-Vantaa weather forecast (TAF) used by the pilots in briefing: *TAF EFHK, filed at 08:35 UTC for the period 09-18 UTC. Wind 350 degrees 15 knots, visibility 8000 metres, light snow, BKN at 2000 FT, TEMPO 09-18 UTC visibility 2000 metres, snow showers, BKN at 1200 FT.*

The Automatic Terminal Information Service (ATIS A-H at 13:48-15:19) reported runway and apron conditions as follows: Estimated surface friction on runway 04L medium to good on all parts of the runway. Mean depth deposit 1 mm; blowing and compacted snow as well as frozen ruts and ridges. Extent of runway contamination 10 per cent at the width of 52 metres. Estimated friction medium on taxiways, and medium to poor on the apron.

Weather, according to Automatic Terminal Information Service, was as follows: ATIS C at 14:17 UTC: *Transition level 65, wind 320 degrees 10 knots, visibility 4000 metres, light snow, BKN at 1900 FT, OVC at 2500 FT, temperature -3 degrees dew point -6 degrees, QNH 973, TEMPO visibility 8 kilometres.*

ATIS D at 14:38 UTC: *Transition level 65, wind 320 degrees 10 knots, visibility 2500 metres, RVR available from ATC frequencies, light snow, FEW at 800 FT, BKN at 1900 FT, OVC at 2200 FT, temperature -3 degrees dew point -5 degrees, QNH 973, TEMPO visibility 6000 metres.*

1.8 Aids to navigation and radars

The Eurocat radar system used by Helsinki Approach comprises the following warning systems: STCA (short term conflict alert), DAIW (danger area intrusion warning) and MSAW (minimum safe altitude warning).

The warning systems are not fully operational. The STCA often generates false alarms triggered by closing or crossing tracks of aircraft being radar vectored under vertical separation. The DAIW feature can be used to delineate a danger area or gunnery range. However, the use of the DAIW is not entirely without problems. If the area in question contains sharp angles the danger area will not be symmetrical, but will increase in the direction of the sharp angle. This, in turn, results in false alarms when vectoring to the permissible distance of 3 NM from the danger area. Neither is the MSAW entirely practical because all MSAW-designated areas are simultaneously active. In other words, it is impossible to designate only one target (such as the Kivenlahti telecommunications mast). When the so-called “independent” method is used for approaches to runways 22L/22R or 04L/04R there is a MSAW-created Non-Transgression Zone, a so-called “barrier” between them. The purpose of this is to warn of aircraft which may deviate from their localizer paths to the other runway’s final approach track during parallel approaches. The “barrier” also sounds a warning should departing aircraft execute their initial turn in the wrong direction. The MSAW area is 4000 FT high, extending to 9 or 10 NM from the thresholds of the runways (22/04). It would be impracticable to use the MSAW as protection for the Kivenlahti mast because the “barrier” would then also be active, triggering false alarms, for instance, when runways 15/33 were in use.

A software update of the radar system in Helsinki is being planned. The intention is to incorporate improved warning systems in the new software.

Helsinki ATC radar system displays the altitude of an aircraft in hundreds of feet with the SSR label. When an approaching aircraft is still above the Transition Level (TRL), its altitude is displayed in flight levels. Then the label only shows a number, such as 150 or 090. When the aircraft is below the TRL the label shows altitude (from mean sea level MSL), denoted by the identifier A. For instance, 4000 FT is displayed as A040. Correspondingly, when an aircraft is climbing but still below the Transition Altitude (TA), the label indicates MSL altitude. Above the TA, the label indicates flight levels.

The prevailing QNH can be entered into the system at any ATC radar console, making it thus identical on all displays. The system automatically calculates the TRL by using the prevailing QNH. Transition Altitude is fixed at 5000 FT in Finland, irrespective of the QNH.

1.9 Communications

Radiotelephony was proper and clear.

1.10 Aerodrome information

The incident occurred in the Helsinki Terminal Control Area in Finland as AUI621 was approaching Helsinki-Vantaa International Airport. Helsinki TMA is category C airspace. At the location of the occurrence its lower limit is 1300 FT and upper limit FL245.

Helsinki-Vantaa is located at 60°19'02"N, 024°57'48"E. Aerodrome elevation is 179 FT MSL. There are three runways: 04L/22R, 04R/22L and 15/33. Finavia is the operator of the aerodrome as well as its Air Navigation Service provider.

AUI621 flew an ILS CAT I approach, landing on the 3060 metre long and 60 metre wide runway 04L (04 Left).

1.11 Flight recorders

Neither the Cockpit Voice Recorder data nor the Digital Flight Data Recorder information was provided to the investigators, which hampered the investigation. Instead, the investigation used Flight Data Monitoring (FDM) data from the flight. Ukraine International Airlines downloaded the FDM data in Ukraine. The information is in numeric form. Said data provided essential information to the investigation.

While FDM data and DFDR recordings are essentially analogous, the manner of recording the information as well as the purpose for which the data are used are dissimilar. Flight Data Monitoring information is data that are digitally recorded on routine flights and which are used in a proactive and non-punitive fashion for the purpose of advancing flight safety. The recording and analysis of FDM data is a normal element of the operator's Safety Management System (SMS).

1.12 Wreckage and impact information

Not relevant to the investigation.

1.13 Medical and toxicological information

No medical or toxicological tests were conducted.

1.14 Fire

There was no fire.

1.15 Rescue operations and survival aspects

Rescue was not required.

1.16 Test and research

Honeywell, the manufacturer of the aircraft's EGPWS equipment, conducted simulator runs in order to determine whether the system should have warned the pilots of the telecommunications mast. For this purpose the investigation commission provided them with the recorded FDM data as well as ATC radar recordings. On the basis of available information it can be said that the EGPWS should have sounded an alert about the telecommunications mast. However, in order to obtain conclusive proof of this the investigation should have had access to recorded EGPWS information from the incident flight, but such information was not available.

1.17 Organizations and management

Organizations and management was not investigated.

1.18 Other information

1.18.1 The definition "Level Bust"

Eurocontrol defines any unauthorised vertical deviation of more than 300 feet from an assigned level (reduced to 200 feet within RVSM airspace) as "level bust" (European Action Plan for the Prevention of Level Bust, Edition 1.0, 7/2004). Level bust occurs most often during climb (47%), followed by descent (33 %) and cruise (20 %). According to Eurocontrol statistics (Annual Safety Report 2007) there were approximately 520 reported incidents of level bust in 2005 and approximately 450 in 2006, correspondingly.

Level bust incidents fall under the following three main categories:

– An aircraft in level flight deviates from its clearance altitude
– A climbing or descending aircraft does not capture its clearance altitude accurately enough
– The aircraft reaches the correct altitude, but the altimeter setting is incorrect.

This incident was a typical level bust occurrence.

Eurocontrol asserts that safety cultures and reporting systems have improved during the past years, enabling statistics such as these. Even though the authorities and companies have invested a lot in preventative action the number of reported level bust incidents has not diminished. The introduction of TCAS (Traffic Alert and Collision Avoidance System) has reduced the risk of mid-air collision. Nevertheless, it has had no effect on the number of level bust incidents.

1.18.2 Incident reporting

The air traffic controller on duty at Helsinki approach control 'radar east' filed a written report of the incident in accordance with aviation regulation GEN M1-4. However, the controller did not immediately report the matter to the ACC as is required by a serious incident. The controller did not inform the flight crew of AUI621 of his intent to report the occurrence. The flight crew did not report the occurrence to the airline or to the Ukrainian aviation authority before the State Aviation Administration of Ukraine had received knowledge of the incident from Finland.

Finland's national aviation regulation GEN M1-4 states: '*Whenever possible, any other persons involved in the incident shall be notified of the intention to file a report*.' The same regulation goes on by stating: '*When an air traffic controller or flight information service officer knows about an accident or serious incident, he/she shall immediately report it to the area control unit within his/her area of responsibility, which in turn shall report it to the Accident Investigation Board and Finnish Civil Aviation Authority without delay*.' In their comments to the draft final report, Finavia state that the air traffic controller submitted the report as per Appendix C of Finavia's SMS manual.

The Operations Manual A (11.4) of Ukraine International Airlines requires that the pilot-in-command reports to the airline any incident that endangered, or could have endangered the safety of operation. When a report to the aviation authorities is also required, the report must be despatched within 72 hours of the time when the incident was identified. Examples of occurrences (OM-A 11.4.3.6) which must be reported to the aviation authorities are, among others, unintentional and significant (more than 300 FT) deviations from the intended altitude as well as incorrect altimeter settings.

The investigation commission requested the airline to provide the statistics for all of their accident, incident or occurrence reports which were related to deviations from ATC clearances for the past three years. The airline replied that they had not filed any such reports. The investigation commission also asked for a complete list of the incidents that the airline's pilots reported during 2007. This information, however, was not provided.

The investigation commission repeatedly requested that the Ukrainian Accredited Representative provide their national regulations pertaining to mandatory occurrence reporting of aviation accidents, incidents and deviations. They were never made available.

1.18.3 International investigation cooperation

On 9.4.2008 Ukraine notified that they would assign an Accredited Representative as well as advisers to the investigation. A meeting attended by the investigation commission and the Ukrainian representatives was held in Helsinki on 22-23.4.2008. Forms of cooperation during the investigation were agreed upon in the meeting.

The Accredited Representative said that the Ukrainian accident investigation authority had already conducted its own investigation on the AUI621 incident and published an investigation report before the meeting in Helsinki. The report included safety recom-

mendations. Despite repeated requests neither the Ukrainian report nor information on the safety recommendations were made available to the Finnish investigation commission. Neither did the Accredited Representative inform the investigation commission of any measures which the airline has possibly taken on the grounds of the incident or the Ukrainian investigation. In their statement to the draft final report the airline informed AIB Finland that they have issued internal recommendations to the Training Manager, Chief Pilot and pilots. These recommendations are mostly associated with the shortcomings revealed in this investigation:

> *We have issued internal company recommendations to UIA Training Manager, Chief Pilot and pilots:*
>
> *- Evaluate adequacy of CRM training (cross-check / coordination)*
> *- Enhance error management and decision making training*
> *- Assess SOP deviation policy*
> *- Upgrade LOSA checklists in part of CRM and operations procedures*
> *- Encourage pilots to submit voluntary reports*

It was agreed that all communication between Finland and Ukraine be conducted via the Ukrainian Accredited Representative. In spite of the investigation commission's repeated requests the Ukrainian Accredited Representative did not provide all of the requested information or material. This impeded and slowed down the investigation.

The investigation commission asked the US National Transportation Safety Board (NTSB) for help in the analysis of the aircraft's technical equipment. The NTSB provided the answers from Boeing, the aircraft manufacturer, and Honeywell, the manufacturer of the EGPWS system, to the investigation commission's questions.

1.18.4 Airline information

Ukraine International Airlines, established in 1992, transports passengers and air freight. The company's fleet includes 15 Boeing 737 airliners and its shareholders include the State Property Fund of Ukraine (61.6%), Austrian Airlines (22.5%), Aer Cap (6%) and the European Bank for Reconstruction and Development (9.9%).

1.18.5 The airline's operations manuals

Ukraine International Airlines' flight operations and flight crew procedures are regulated, among other things, by the General Flight Operations Manual, OM-A, which is based on JAR-OPS 1. It contains national rules and regulations as well as ICAO standards and procedures. In addition, the Flight Crew Operations Manual, OM-B, is in use. This is the flight operations manual compiled by the Boeing Company to Ukraine International Airlines. OM-B contains aircraft type-specific limitations, procedures as well as performance and system descriptions required by aircrews. The issues linked or related to the incident being investigated are regulated in OM-A and OM-B.

2 ANALYSIS

2.1 Air traffic control action

The air traffic controller was on duty at Helsinki approach control sector “radar east”. Runway 04L was in use for arrivals and 04R for departures. As per procedure, “radar east” can control both arrivals as well as departures in its sector. When required, the control of arriving traffic is handed over to “arrival east”.

Traffic was slow at the time of the occurrence, obviating the use of “arrival east”. A Blue1-airline’s MD90, callsign BLF824, was approaching from the southwest. It was number one in traffic for runway 04L. Ukraine International Airlines’ AUI621 was approaching from the south. Tallinn ATC had cleared it to FL 100 via the standard arrival route INTOR 1B. The air traffic controller at “radar east” decided to vector AUI621 for an ILS approach as number two in traffic.

The controller told AUI621 to fly on heading 310 for radar vectoring, runway 04L. The flight crew read back the heading but requested that the controller repeat the runway. Then the controller cleared AUI621 to descend to 5000 FT on QNH 973 hPa. This is normal procedure because departing traffic following standard instrument departure (SID) routes automatically climb to 4000 FT on QNH. The flight crew read back the clearance altitude and the QNH. A moment later AUI621 requested confirmation of their clearance altitude, 5000 FT. The air traffic controller confirmed this and the flight crew read the altitude back.

Standard pressure-based (QNE) flight levels are given in three digits (FL 100, 310, etc.). On the other hand, altitudes below the transition level which are based on the local QNH are normally given in four digits. This being the case, the pilot can infer from ATC clearance which altimeter setting he must use.

Next the air traffic controller instructed AUI621 to reduce speed to 230 KT, which the aircraft read back correctly. Then the controller cleared AUI621 to descend to 2300 FT, which is also the Minimum Sector Altitude. This guaranteed a terrain clearance of at least 1000 FT from all obstacles within the aircraft’s radar track. After the aircraft read back the altitude the controller told it to turn to heading 340. By maintaining this heading, followed by a turn towards a 30 degree angle with the final approach track the aircraft would have captured the ILS localizer at approximately 7.5-8 NM from the touchdown point. The aircraft would have then established on the ILS LLZ before following the 3 degree glide path. Runway 04L glide path begins at 2300 FT, 7 NM from touchdown. The vectoring of AUI621 was executed in accordance with ATS regulations and training as well as ICAO recommendations.

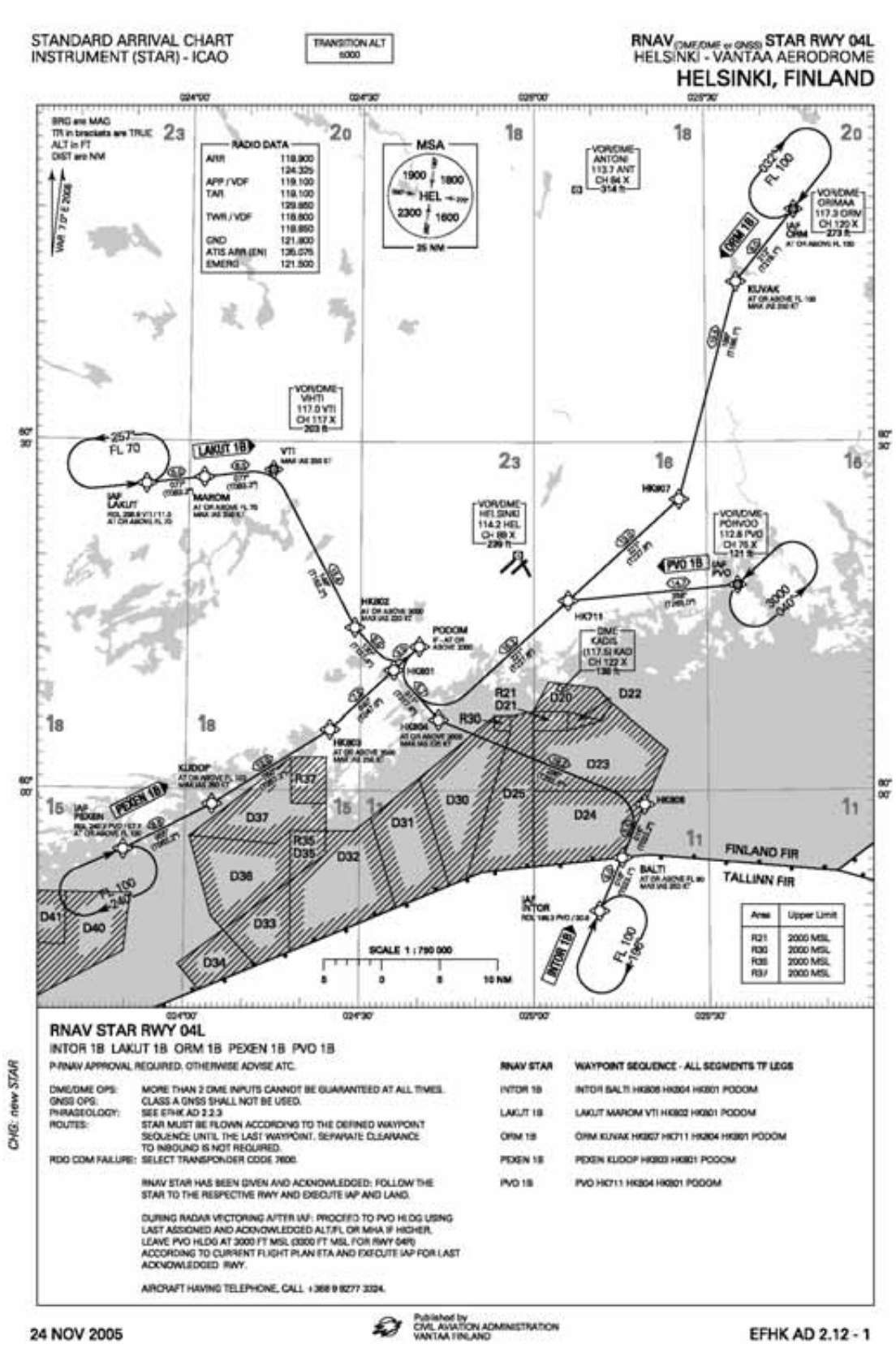

Figure 4: INTOR 1B standard arrival route (© Finavia, Permission 4/590/2007)

The air traffic controller was using an approximately 30 NM range on the radar display while vectoring AUI621. Since there was simultaneously departing traffic from RWY 04R the air traffic controller increased the range in order to find out to what altitude the departing aircraft could be cleared, lest it have to remain at 4000 FT as per the SID route.

Since AUI621 had read back the clearance altitude and QNH correctly the air traffic controller was under the impression that it would comply with the clearance. The clearance altitude is considered to be reached when pressure altitude information on the radar display indicates that the aircraft has maintained this altitude, to 300 FT, for at least three radar video refresh cycles, three sensor refresh cycles or 15 seconds, whichever is the longest (Finnish ATC manual, 3.4.2). AUI621 was first cleared to descend to 5000 FT and then recleared to 2300 FT QNH. The aircraft was constantly descending and, therefore, the air traffic controller was not in a position to check its true altitude in level flight.

However, after having reset the radar display range back to ca. 30 NM the air traffic controller noticed that AUI621's altitude indicated 1700 FT, and it was still descending. For a moment the controller thought that this might have been a measuring error. Still, the air traffic controller ordered the aircraft to immediately climb back to 2300 FT. The aircraft acknowledged this. The minimum altitude of AUI621 which the air traffic controller saw on the radar screen was 1400 FT. The controller estimated that it took approximately 20 seconds for the altitude indication of AUI621 to increase, measured from the time when the aircraft was detected flying at 1700 FT. Radar and radiotelephony recordings corroborate the air traffic controller's estimation:

14:38:04	AUI621 passed its clearance altitude 2300 FT.
14:38:24	According to the radar recording the aircraft was at 1700 ft. As per the air traffic controller's statement, the controller detected that AUI621 was below the clearance altitude when its altitude on the radar display was 1700 FT.
14:38:30	The controller told AUI621 to immediately climb to 2300 FT.
14:38:39	AUI621 acknowledged this order.
14:38:39	AUI621 descended to 1400 FT, at its minimum.
14:38:41	The air traffic controller cleared AUI621 for an ILS approach.
14:38:44	AUI621 passed 1500 FT in a climb.

During the time when the air traffic controller ordered AUI621 to climb and when the flight crew read this back the aircraft was already so close to the final approach track that the heading which joined it at 30 degrees angle to the inbound track took it past the ILS localizer beam. The air traffic controller told the aircraft that it was approximately half a mile left of LLZ and asked whether it could make a straight-in approach. The flight crew replied that they could do this and turned to 060 degrees to capture the LLZ. By this time AUI621 was close to reaching 2300 FT. It became established on the ILS localizer and glide path approximately 5.5 NM from the touchdown. The final approach and landing were uneventful.

2.2 Pilot action

The description of what the flight crew did during the flight is largely based on translations of the pilots' informal reports as well as the minutes made of the co-pilot's interview. These were forwarded to the investigation commission by the Ukrainian aviation authority. At the request of the Finnish investigation commission the Ukrainian Accredited Representative and his advisers organized an interview of the co-pilot on 30.5.2008. The captain had left the airline soon after the incident. According to the Accredited Representative it was no more possible to interview the captain with regard to the investigation. Neither was it possible to obtain a more detailed statement of what transpired during the flight. Still, from the point of view of the investigation, it would have been of paramount importance to interview the captain. The Finnish investigation commission did not have the opportunity to talk to the pilots during the investigation.

The weather was snowy as AUI621 was approaching Helsinki. ATC radiotelephony recordings reveal than another aircraft asked for permission to deviate from its route to avoid a cloud. The captain states in his report that, due to the snowy weather in Helsinki, he switched the weather radar on during the approach and mentioned this to the co-pilot. Simultaneously the air traffic controller assumed radar vectoring of AUI621, telling it to fly on heading 310. The captain said that they focused so much of their attention on the weather radar and the air traffic controller's order that they forgot to change the altimeters' standard pressure setting (QNE) to the local QNH and read the DESCENT-APPROACH checklist, required for that phase of the flight. As per the captain's report they noticed the incorrect altimeter setting when they were flying at 2700 FT (QNE) after which they climbed to 2300 FT on QNH 973, the correct altitude. According to the captain they had already noticed the incorrect altitude before the air traffic controller told them to climb to 2300 FT. After this the approach was uneventful. In Helsinki the pilots received no additional information or remarks regarding the incident and, therefore, they did not report it in Ukraine either.

The co-pilot states in his report that, according to ATIS information, it was snowing heavily in Helsinki. Helsinki ATC told them to fly on heading 310 for radar vectoring to runway 04L and cleared them to descend to 2300 FT. They failed to change their altimeter settings because they devoted so much attention to monitoring the weather situation. The air traffic controller gave them a new heading, 340, and the flight crew monitored the situation visually. Evidently this means that they looked outside or at the weather radar display. The co-pilot says in his report that he noticed the erroneous altimeter setting when they were near the final approach track. He says that he set his altimeter to QNH973 and, simultaneously, initiated a climb. According to the co-pilot it was only after this that the air traffic controller ordered AUI621 to climb to 2300 FT. The autopilot was on throughout the entire incident, only to be disengaged just before landing. The co-pilot said that the approach and landing were uneventful.

According to the minutes made of the co-pilot's interview there were cumulus clouds and light turbulence in Helsinki at the time of the approach. The captain was in charge of radiotelephony and monitored cloudiness on the weather radar screen. When the co-pilot was asked to provide his estimate on why they had descended below the clearance altitude he replied that, as per SOP, the PNF shall call out their passing the transition level,

at which time the altimeters are to be set to the correct QNH. Furthermore, the PNF shall verify and call out the altimeter settings. The co-pilot said that the captain did not call out passing the transition level because he was busy monitoring the weather, informing the co-pilot about a snow cloud on the radar screen. The co-pilot, in turn, said that he was concentrating on flying the aircraft because they were already close to the final approach track of their runway.

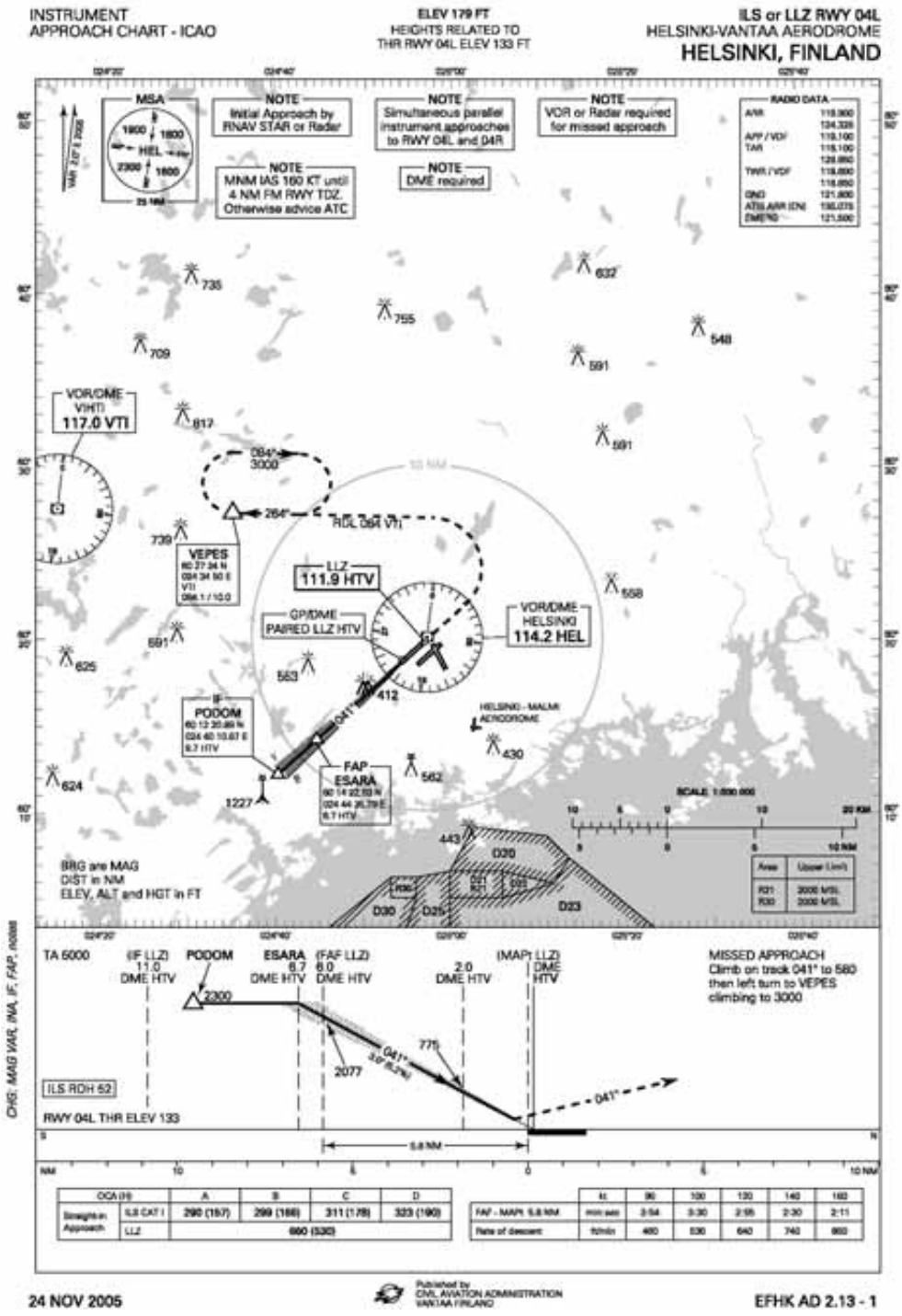

Figure 5: ILS 04L (© Finavia, Permission 4/590/2007)

The co-pilot said that he had spotted the ground and noted that the altimeter indication did not correspond to his idea of their true altitude. He noticed that they had forgotten to set their altimeters to the local QNH, which he then set and initiated a climb. After this he ordered that the QNH be set and the DESCENT-APPROACH checklist be read. The checklist was read at the behest of the co-pilot, albeit belatedly. The captain reported the completion of the checklist.

Judging by radar, radiotelephony and flight data recordings made available to the investigation commission, the aircraft began to climb only after the air traffic controller ordered it to do so. Nonetheless, it is possible that the pilots noticed the erroneous altitude themselves at the same time as the air traffic controller gave them the order.

The recorded altitude information indicated standard pressure 1013.2 hPa until landing. The investigation commission repeatedly asked the Ukrainian Accredited Representative to request the airline to provide the DFDR data, which would include at least the captain's and co-pilot's altimeter indications and, if possible, the standby altimeter setting during the approach. Neither replies nor the requested data was ever received. In their statement to the draft final report the airline informed the Finnish investigation commission that the Flight Data Recorder does not record information on individual altimeter settings or readings. Because of this missing information it is impossible to conclusively ascertain when the altimeter settings were changed or to which value each altimeter was set during the time of the incident and the final approach.

During his interview the co-pilot was asked what, in his opinion, should be done in order to prevent similar incidents from happening. He replied that:

- More training should be given in order to improve flight crews' CRM capabilities.
- Crew vigilance should be emphasized.
- All flight crew members should constantly keep an eye on each other during the flight (monitor and cross-check).

Airline Operations Manuals OM-A and OM-B give altimeter setting procedures. OM-A 8.3.3.3:

8.3.3.3 Setting Procedures

Altimeters are to be set, and cross-checked whenever a new setting is applied, in accordance to Table.

Flight stage	#1	#2	Standby	Metric	Remarks
Before take-off	**QNH***(QFE)**	**QNH***(QFE)**	**QNH***(QFE)**	QFE	Aerodrome setting
Climb	**QNH***(QFE)**	**QNH***(QFE)**	**QNH***(QFE)**	QFE	If remaining below Transition Altitude (1)
Climb	1013,2	1013,2	**QNH***(QFE)** Origin	1013,2 (760)	When cleared to a flight level (1)
En route	1013,2	1013,2	1013,2	1013,2 (760)	
Descent	1013,2	1013,2	**QNH***(QFE)** Destination	1013,2 (760)	When cleared to intermediate Flight Levels
Descent	**QNH***(QFE)**	**QNH***(QFE)**	**QNH***(QFE)**	QFE	When cleared to an altitude and no further flight level reports are required by ATC
Initial approach	**QNH***(QFE)**	**QNH***(QFE)**	**QNH***(QFE)**	QFE	Aerodrome QNH
Final approach or Missed approach	**QNH***(QFE)**	**QNH***(QFE)**	**QNH***(QFE)**	QFE	Aerodrome QNH

Furthermore, OM-A 8.3.3.6 section two lays down that altimeters shall be set from QNE to QNH at transition level during descent. The same section also mentions that when the aircraft has been cleared to descend to *altitude* the PF can set his altimeter to QNH even before passing the transition level, so long as flight level information is indicated on some other altimeter, set to QNE, on the flight deck.

The OM-B includes, among other things, B737 pilots' SOPs as well as checklists for cockpit procedures.

CHECKLIST	CALL	READ	VERIFY	RESPOND
BEFORE START	COMMANDER	FIRST OFFICER	BOTH	COMMANDER
AFTER START	COMMANDER	FIRST OFFICER	BOTH	COMMANDER
BEFORE TAKEOFF	COMMANDER	FIRST OFFICER	BOTH	COMMANDER
AFTER TAKEOFF	*PILOT FLYING*	*PILOT MONITORING*	*BOTH*	*PILOT MONITORING*
DESCENT-APPROACH	*PILOT FLYING*	*PILOT MONITORING*	*BOTH*	*PILOT MONITORING*
LANDING	*PILOT FLYING*	*PILOT MONITORING*	*BOTH*	*PILOT FLYING*
SHUTDOWN	COMMANDER	FIRST OFFICER	BOTH	COMMANDER
SECURE	COMMANDER	FIRST OFFICER	BOTH	COMMANDER

The position of the control or indication is visually verified and stated in response to a checklist challenge. When a disagreement between the response and checklist answer occurs, it is mandatory that the checklist be discontinued until the item is resolved and than continue again.

Altimeter settings and related callouts are regulated by the SOPs. During the descent, when approaching the transition level, the PNF shall call out "*Transition Level". The* PF must respond: "*Set pressure xxx hPa (QNH)"* and the PNF then verifies that all altimeters are correctly set. Then he shall respond: "*xxx hPa set and X-check*". Altimeter settings and air pressure settings are rechecked during the reading of the DESCENT-APPROACH checklist. If the pilot whose duty it is to call for a checklist or to make some other report fails to do so, the other pilot shall either remind him of it or, alternatively, do it himself.

On the basis of information made available to the investigation it cannot be unequivocally established why the pilots deviated from SOP and failed to change the altimeter settings at the appropriate time.

Radiotelephony recordings reveal that the pilots requested the air traffic controller to repeat the clearance a little after they received it and acknowledged it correctly. It is impossible to say whether this was due to problems in crew communication. The quality of the recorded radiotelephony was good and communication was loud and clear. Had the Cockpit Voice Recording been available to the investigation it would probably have been easier to establish probable cause.

Judging by information made available to the investigation it is probable that the incident was caused by unsatisfactory crew resource management (CRM). It is clear that the pilots did not fully comply with SOPs as per manuals. It is also possible that there were inadequacies in crew communication. Nevertheless, on the basis of the investigation it is difficult to assess the grounds for any failures in CRM or communication. Within the scope of this investigation it was not possible to extensively establish the attitudes of the airline's pilots towards regulations, rules or compliance with SOPs. Neither was it possible to assess the level of their training or their CRM skills.

It cannot be assumed that the pilots had shortcomings in their skills or capabilities with regard to flying the aircraft or operating in the Helsinki Terminal Control Area. The captain, especially, had extensive total and type-specific flying experience. The co-pilot's total flying experience was also quite significant and his type-specific experience was ample enough to exclude it as a contributing factor.

On the basis of the investigation it can be stated that contributing factors cannot be found in the airline's Operations Manuals OM-A or OM-B. The manuals, including regulations, rules, instructions and procedures are comprehensive and clear.

Ukraine International Airlines OM-B, SOP 1.3, section 1.9, refers to a Boeing Co. study of jet transport accidents. According to it 33 per cent of accidents studied were caused by deviations from SOP, and 26 per cent were caused by inadequate cross-check by the second crew member.

2.3 Warning systems

There are warning systems available to both aircraft and air traffic control systems which reduce the probability of incidents such as the one being investigated, and which could ultimately prevent an incident from turning into an accident. In this incident no onboard or ATC warning systems (EGPWS, MSAW) could have prevented the level bust. However, they might have expedited the detection of the situation and, thus, alleviated the seriousness of the incident.

According to the airline's Boeing 737 OM-B, UR-GAQ was fitted with an EGPWS system which also warns of obstacles in addition to the terrain. Through the Ukrainian Accredited Representative the investigation commission asked the airline to provide information on whether said obstacle warning feature was active and whether it warned of Kivenlahti telecommunications mast during the approach. In their statement to the draft final report the airline stated that while the EGPWS system was on during the incident it did not warn of the telecommunications mast. Honeywell, the EGPWS manufacturer, confirmed that Kivenlahti telecommunications mast is indeed in the EGPWS database of the aircraft in question and, based on radar and FDM recordings used in the investigation, they conducted simulator runs of the incident flight. On the basis of the simulator runs it can be said that the EGPWS should have warned the pilots of the telecommunications mast. The airline reported that they had inspected the installation and functioning of the EGPWS system on UR-GAQ and that no shortcomings were detected.

The investigation could not establish why the EGPWS did not warn the pilots of the Kivenlahti telecommunications mast. This would have required the original DFDR and EGPWS recordings. However, the investigation did not have access to these data.

In theory it is possible that:

- The system sounded an alert but it was not detected during or after the flight,
- The aircraft's track did not call for an EGPWS alert,
- The EGPWS feature in question was turned off on the flight deck, or
- The EGPWS malfunctioned.

The investigation commission does not issue a safety recommendation with regard to the EGPWS because such a recommendation could not be focused on a clear shortcoming. However, the investigation commission emphasizes that a properly functioning and correctly used EGPWS system efficiently prevents an incident such as this one from developing into an accident.

2.4 Reporting of the incident

The air traffic controller categorized the occurrence as an incident and on the basis of this interpretation filed a written report following the instructions in Finavia's Safety Management System. In hindsight it can be said that the occurrence had all the hallmarks of a serious incident. An urgent report to the area control unit would have made it possible for the aviation and accident investigation authorities to receive prompt information of the occurrence. This would have made it easier to investigate the incident and would have made it possible to interview the pilots in Helsinki right after the occurrence. Similarly, the CVR and FDR recordings would have been made available to the investigation.

The pilots did not comply with the airline's regulations because they did not report the occurrence to the airline or the Ukrainian aviation authority on their own initiative. It is possible that they were unaware of the seriousness of the situation. Neither did the air traffic controller tell them of the incident or the intention to report it. Then again, the airline's OM-A requires that erroneous altimeter settings or deviations from an ATC clearance altitude exceeding 300 FT be reported to the airline. It was impossible to evaluate the pilots' action in relation to Ukrainian national incident reporting regulations because, despite repeated requests, they were not made available to the investigation commission.

The airline's OM-A, Chapter 11, lays down instructions for reporting procedures, justifying reports with the fact that they promote aviation safety. The only purpose of pilots' reports should be the prevention of accidents and incidents, instead of attribution of blame or liability. Incidents and deviations often reveal the existence of safety risks, enabling the initiation of corrective action for the purpose of promoting the safety of aviation.

3 CONCLUSIONS

3.1 Findings

1. The pilots and the air traffic controller had valid licences and the required ratings.

2. The “radar east” air traffic controller was radar vectoring AUI621 to runway 04L at the Helsinki-Vantaa aerodrome.

3. The radar controller handled arrivals as well as departures in the sector.

4. Traffic was slow in the Helsinki Terminal Control Area.

5. The co-pilot of AUI621 was the pilot flying (PF) and the captain was the pilot not flying (PNF).

6. Helsinki weather was cloudy and snowy.

7. The PNF concentrated on operating the onboard weather radar.

8. Radiotelephony between the air traffic controller and the flight crew was proper and clear. The pilots, however, asked the air traffic controller to confirm some of the clearances.

9. AUI621 was initially cleared to descend to 5000 FT on QNH 973 and later recleared to the initial approach altitude 2300 FT, which was also the Minimum Sector Altitude.

10. During the approach the pilots failed to change their altimeter settings from QNE to QNH at the appropriate phase of the flight, as per the SOP.

11. Because of the erroneous air pressure setting the aircraft was actually flying approximately 1100 FT below the altitude indicated by the altimeters.

12. The pilots had not read the DESCENT-APPROACH checklist before the incident occurred.

13. Investigation could not unequivocally establish when altimeter settings were changed or the settings of each altimeter at the time of the incident and during the final approach.

14. As per the air traffic controller’s account, the controller noticed that AUI621 had descended below its clearance altitude of 2300 ft when its altitude according to the radar display was 1700 FT.

15. Helsinki ATC’s MSAW feature is not used in order to warn of aircraft penetrating the Minimum Safe Altitude.

16. The air traffic controller told AUI621 to immediately climb to 2300 FT. As per recordings, the aircraft began to climb only after the ATC issued the order.

17. According to information provided by the airline the EGPWS system did not warn the pilots of the Kivenlahti telecommunications mast.

18. Simulations conducted by the EGPWS manufacturer indicated that the system should have warned the pilots of AUI621 of the Kivenlahti telecommunications mast.

19. Detection of the occurrence was delayed by the facts that the EGPWS system did not warn of the telecommunications mast and that the MSAW feature was not in use in the ATC's radar system.

20. According to the radar display the minimum altitude to which the aircraft descended was 1400 FT.

21. AUI621 passed the 1227 FT tall Kivenlahti telecommunications mast at the distance of less than 0.7 NM. Vertical separation to the mast was less than 200 FT.

22. The air traffic controller filed an air traffic incident report but did not mention this to the pilots.

23. The pilots did not file an air traffic incident report.

24. The investigation commission did not receive all of the material it requested. This hampered and slowed down the investigation.

25. Pursuant to the Eurocontrol ESARR-2 classification, the severity of the occurrence was a Serious Incident (A).

3.2 Probable cause

The serious incident was caused when the aircraft descended below its ATC clearance altitude, creating the risk of collision with a telecommunications mast ahead of its track. The cause of breaking the clearance altitude was an erroneous altimeter setting.

Contributing factors included inadequacies in Crew Resource Management and the fact that the pilots deviated from Standard Operating Procedures.

4 RECOMMENDATIONS

1. Investigation revealed that the pilots did not fully comply with the SOPs and that Crew Resource Management was unsatisfactory. It was impossible to specify the reasons for the shortcomings in CRM. After the incident the airline reported that they have issued internal recommendations to the Training Manager, Chief Pilot and pilots. Said recommendations are mostly associated with the shortcomings revealed in this investigation

> It is recommended that the airline ensure that their pilots possess the required information and skills for proper Crew Resource Management, as required by the safe conduct of aviation and compliance with airline operations manuals.

2. The radar system in use at Helsinki Approach includes a Minimum Safe Altitude Warning (MSAW) feature. However, the feature is not operationally usable. In this incident neither the warning systems on the aircraft nor the ones used by the ATC would have prevented the level bust. However, they could have expedited the detection of the situation, thereby alleviating the seriousness of the incident.

> It is recommended that Finavia incorporate a Minimum Safe Altitude Warning (MSAW) feature for the Helsinki Terminal Control Area in its next radar software update.

Helsinki 18.3.2009

Markus Bergman

Erkki Kantola

Juha Salo

Ukraine International
AIRLINES

Attn: Mr. Markus Bergman
Investigator-in-charge
Accident Investigation Board
Sörnäisten rantatie 33 C
FI-00580 Helsinki
Finland

Ref. Request for comments # 415/5L from 23rd September 2008

Our Ref. No. 5.1.8-208 from 26.09.2008

Subject: Submission of Ukraine International Airlines to the draft report C4/2008L from 22.09.2008 of Terrain clearance infringement in the Helsinki Terminal Control on 26.03.2008

Dear Mr. Bergman,

First of all let us express our thanks for your efforts in investigation of a serious incident occurred in the Helsinki Terminal Control Area on 26.03.08 with our aircraft Boeing 737, Registration Marks UR-GAQ and the chance to give our comments on the draft report.

In general, we are comfortable with findings and recommendations. However, our experts being a party to this investigation would like to make some comments to the Draft Final Report C4/2008L.

1. There is a sound recommendation in the Report about incorporation of MSAW in the next radar software update. We think it logical and in-line with ICAO ISARPs to include lack of MSAW feature to contributing factors. This inclusion would assume some changes in the report Summary also.

2. Chapter 1.18.3. From our side, we have issued internal company recommendations to UIA training Manager, Chief Pilot and pilots:

- Evaluate adequacy of CRM training(cross-check/coordination)
- Enhance Error Management and Decision Making training
- Assess SOP deviation policy
- Upgrade LOSA checklists in part of CRM and Operations Procedures
- Encourage pilots to submit voluntary reports

3. Chapter 2.1, page 13. We propose to delete the following text, because this is not radar and radiotelephony recordings and can not be confirmed only by comparing timings of aeroplane evaluation taken from DFDR and ATC-crew radiotelephony recordings:

"14:38:24 The air traffic controller detected this when the aircraft was at 1700 FT"

Appendix 1/2(3)

4. Chapter 2.2, page 16. As it was cleared to us by UIA engineering Department, DFDR receives information from Air Data Computer and no information is recorded for altimeters (#1, #2 and Standby).

Due to this we propose to delete text of third paragraph:

> "The flight data recorder's altitude information indicated standard pressure 1013.2 hPa until landing. The airline said that the DFDR receives its information from the captain's altimeter. This would indicate that the captain did not set his altimeter to QNH before landing. If, indeed, he failed to do so during the flight, it contradicts with both pilots' statements. The investigation commission repeatedly asked the Accredited Representative to request the airline to provide the DFDR data, which included the captain's and copilot's altimeter indications and, if possible, the standby altimeter data during the approach. Neither replies nor the requested data were ever received. Because of this missing information …".

5. "Chapter 2.3, page 18. We would suggest to clarify EGPWS issue having in mind our E-mail to Ukraine CAA (a copy is attached). Probably, Honeywell could comment technical aspects of the question (if provided with the approach trajectory and relative mast position). If this issue could not be clarified at that time, we propose to replace text of item 2.3 by the following:

> "No EGPWS warning was recorded on DFDR during approach and landing phase of this flight".

We would like to make extraction from our message 27 August 2008 sent to our SAA, concerning EGPWS:

1. Installed EGPW P/N 965-0976-060-216-216 (Honeywell manufacture p/n 960-0337-002) type MK-V with GPS module and mercury card.

In accordance with Boeing SB737-34-1853 loaded terrain Data base P/N 718-1330-443, S/N 19739. Was operational at the time of incident.

For understanding do the radio mast (ground obstacle) coordinates are inputted into the data base as a ground obstacle - is necessary to know coordinates of man made mast and to contact Honeywell for clarification do they put it into the data base.

We assumed that as soon as the EGPWS has not initiated any signals/commands for crew during approach - probably this obstacle (radio mast) coordinate are not into data base. And it is recommended to inform Honeywell to check the data base and correct if required

6. Chapter 3.1, page 21. We propose to change the text of finding item 12 by the following:

> "The pilots had deviated from DESCENT-APPROACH checklist procedure"

7. Chapter 3.1, page 21. Having in mind that MSAW recommendation is clear enough we propose to delete finding item 14, because it could not be supported by objective evidence.

8. Chapter 3.1, page 22. We propose to delete assumption about interaction ATC – Pilot in item 16 and would propose the following text:

> "The air traffic controller told AUI621 to immediately climb to 2300 FT".

9. Chapter 3.2. It is logical and in-line with ICAO ISARPs and Flight Safety Foundation recommendations to include lack of MSAW feature to contributing factors

We proposed to commission communicate the Honeywell for clarification input of radio mast coordinates (man made obstacle) into the EGPWS data base.

Copy of the letter is send to our SAA.

We would appreciate the above proposals to be taking into account in the Final Report.

Sincerely yours,

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