



Comments by the Ethiopian Civil Aviation Authority
On
The Investigation of the Accident of Ethiopian
Flight 409, Boeing 737-800 ET-ANB, January 25, 2010
By The Ministry of Public Work & Transport of Republic of
Lebanon

To Be Appended to the Final Report

Part II

Prepared pursuant to Annex 13
to the Convention on
International Civil Aviation

Detailed Comment to be Appended to
the Final Report

Ref.	Draft Report	Ethiopia Append to the draft report
Page 20 1.1	<p><u>History of flight</u></p> <p>The following chronological history of flight is reproduced from verified data retrieved from the aircraft DFDR and CVR, in addition to verified data from Air Traffic Control (ATC) recordings and radar transcripts. Eye witness reports and interviews have also been considered.</p>	<p>The significant eyewitness accounts, including, ATC Controllers were not properly taken in to account. In section 1.18.3.1 of the report it is clearly stated “ The ACC supervisor specified in his report that the Tower controller reported seeing: “ <i>orange light falling into the sea</i>”. The incident Notice filled by the Chief of the ANS mentions under “<i>Remarks</i>” that “<i>we saw an orange explosion on the sky over the sea before the aircraft fell down</i>”¹⁷.</p> <p>These eyewitness accounts were not analyzed in detail as they contained statements regarding a “fire ball” at altitude in the sky. This clearly points to the un controlled maneuvers followed by an explosion in the air, due to shoot-down, sabotage or lightning strike, which resulted in the break-up of the aircraft.</p>
Page 20 1.1	<p>In addition to these operational issues, the crew were heard discussing their lay-over stay in Beirut and the meal which could have affected the quality of their sleep prior to operate the flight. However, their tone of voice and discussions were normal during that phase. The captain was also heard confirming that this was his first flight into Beirut. .</p>	<p>The crew were having conversation and their tone of voice and discussions were normal. However, the report wrongly concluded as a result of lack of understanding the crew conversation in Amharic without the benefit of common cultural assumptions or speech analysis and linguistic test.</p>

<p>Page 21 1.1</p>	<p>At time 00:38:35 Beirut Control advised ET 409, <i>“Sir, I suggest for you due to weather to follow heading two seven zero to be in the clear for fifteen twenty miles then go to CHEKA and it’s up to you, just give me the heading”</i>.</p>	<p>This suggestion was not in accordance with the published ATC SOP and there are indications that this statement involved:</p> <ul style="list-style-type: none"> • Non-standard phraseology; • The instructed heading of 270⁰ was taking the flight directly into the centre of the thunderstorm. It was not understood why the ATC controller repeatedly changed the instructed 315⁰ heading (safest direction) to 270⁰, which led directly into the area of the thunderstorm; <p>This corroborates the fact that Etihad flight prefers to fly heading of 250⁰ to avoid the storm. This is witnessed by Etihad Airways flight EY 533 eventually carried a go-around from runway 16 and landed on runway 03 due to tail-wind. During that go-around EY 533 was given by the Tower the standard go-around procedure for runway 16, which is turn right heading 270° climb 2000 feet. However, they maintained a heading of 250° to avoid the cell west of the field.</p>
<p>Page 21 1.1</p>	<p>At 00:38:44 sounds consistent with trim wheel turning were recorded and heard on the CVR The DFDR recorded simultaneously a pilot commanded nose up trim input for a period of 3” while at the same time maintaining a control column push of 2° in the nose down direction. This resulted in a recorded increase in pitch trim from 7.9 to 8.7 units along with an airspeed of 196 Kts. (Beyond that point, no stabilizer trim manual command was recorded on the DFDR).</p>	<p>Boeing Flight Crew Operation Manual Chapter 9.20.7 third paragraph under Stabilizer Trim Clearly states “Control Column actuated stabilizer cut out switches stop operation of the main electric and Auto pilot trim when the control column movement opposes trim direction.”</p> <p>Based on this fact, if the system allows trimming with opposite direction control column force, it is clearly an indicative of technical malfunction of the integrity in the aircraft control the System.</p>

<p>Page 22</p> <p>1.1</p>	<p>This was associated with a sharp left wheel input of approximately 40° commanded by the crew resulting in a roll angle of 45° and reaching a maximum of 64° left, triggering 5 automatic “<i>bank angle</i>” calls recorded on the CVR between time 00:39:01 and 00:39:30.</p>	<p>Around 00:39:00 the aircraft was entering the heavy rain and the thunderstorm located west of the airport while trying to follow heading 270⁰ as instructed by the ATC. The aircraft was in erratic maneuvers as recorded on the DFDR, most likely caused by the above mentioned likely loss of integrity of the flight control system resulting in severe flight control problems. It is likely that the control problems were further exuberated by the flight entering the thunderstorm.</p>
<p>Page 22</p> <p>1.1</p>	<p>At time 00:39:46 ATC issued a clearance “<i>Ethiopian 409 follow heading two seven zero, turn right heading two seven zero</i>”. ET 409 read back “<i>right heading two seven zero, roger</i>”. The F/O is heard confirming to the captain “<i>two seven zero set</i>”. No other action was recorded in compliance to that instruction.</p>	<p>At time 00:39:46 when ATC instructed the flight to turn heading 270⁰ the flight was on heading of 206. At time 00:40:20, when ATC instructed the flight to the heading 270⁰ the <i>flight was on a heading of 166⁰</i>. At 00:41:05, the ATC again instructed the flight to fly heading 270⁰, when the aircraft was on heading 105⁰. During all these three ATC callouts, as mentioned above, the aircraft was in erratic maneuvers as recorded on the DFDR, most likely caused by the above mentioned likely loss of integrity of the flight control system resulting in severe flight control problems. It is likely that the control problems were further exuberated by the flight entering the thunderstorm, and at this stage of the flight, it was in the centre of the storm making continuous left turn.</p>

		<p>From this scenario it appears that the ATC was unaware of the position of the thunderstorm which was located immediately to the west of the airport. Hence, it appears that the vectoring of flight ET409 did not take into account the weather around the airport, but was mainly executed for separation of the flight from other incoming aircraft.</p>
<p>Page 23 1.1</p>	<p>“The Auto throttle was disconnect via the auto throttle disconnect switch”</p>	<p>The DFDR data confirmed that the Auto Throttle was disconnected at this stage. However, as there are several ways for the Auto Throttle to disconnect, it is not correct to conclude that the disconnection was the done using the Auto Throttle disconnect switch. since there are five ways to disconnect the Auto throttle :</p> <ol style="list-style-type: none"> 1. <i>Moving Auto throttle arm switch to off,</i> 2. <i>Pushing either Auto throttle disengage switches,</i> 3. <i>An Auto throttle system fault is detected,</i> 4. <i>Two seconds have elapsed since landing touch down</i> 5. <i>Thrust lever become separated more than 10 degrees.</i> <p><i>The DFDR Data indicates only that the Auto throttle is disconnected but there is no indication how the Auto throttle is disengaged on the DFDR Data recorder.</i></p>
<p>Page 24 1.1</p>	<p>No indication of the aircraft being hit by a lightning strike was recorded on the CVR or any interference affecting the flight instruments recorded on the DFDR, apart from the short interference recorded during the take-off roll, prior to the aircraft reaching</p>	<p>It cannot be concluded there is no evidence of a lightning strike. There clearly was thunderstorm cells with heavy lightning in the area; only about 8 % of the wreckage was recovered, much more wreckage should have been recovered and examined for, among other things, any signs of lightning strike; and the CVR recording</p>

	<p>80 Kts.</p>	<p>is a poor source of information as a lightning strike may or may not be heard on the CVR. Furthermore, there were two eleven seconds gap in CVR recording in which no recording was available (about 21 seconds was not available during the about five minute duration of the flight.</p> <p><i>As per Boeing clarification ref. 66-ZB-H200-ASI-18635 dated 30 November 2011 “There are several references that the airplane was possibly struck by lightning and that further wreckage recovery would potentially identify damage due to lightning strike.” However, no examination was done on the recovered wreckage; It’s only the horizontal stabilizer section which is the biggest part of the airplane so far recovered. There is no forward and mid section recovered. Furthermore the black soot and the wrinkled area near APU can give a better clue of fire if detailed examination is performed.</i></p>
<p>Page 34 1.11.1</p>	<p>DFDR</p> <p>Initially, there was a concern related to the DFDR data for the Captain and the F/O control inputs, as many of the control inputs registered by the DFDR as F/O actions were known to have been accomplished by the Captain and vice versa.</p>	<p>The report did not acknowledge that the data to the DFDR was cross-referenced to the effect that the Captain side inputs were registered as F/O inputs and vice versa.</p> <p>The DFDR data revealed technical concerns that should be discussed in the report:</p> <p>1. The DFDR data showed a significant number of <u>un-commanded pitch trims</u> without any related control input (indicative of a loss of integrity of the of the flight control system resulting in severe flight control problems).Aileron and rudder (aircraft roll)</p> <p>During the initial turn to heading 315⁰, the flight was turning with a constant rate of turn until 00:38:30. After this and without any</p>

		<p>control wheel input, the bank angle began to increase to 37⁰ which activated an automatic aircraft excessive bank angle warning. The Captain applied left rudder input at 00:38:44, but the aircraft did not respond. This un-commanded roll to the right is recorded on the DFDR which also shows that no related pilot flight control inputs were made.</p>
<p>Page 21</p>	<p>The DFDR records did not show at the same time any commanded trim input; however, it recorded an increase in pitch trim from 7.6 to 7.7 units at time 00:38:23, the recorded airspeed at that time was 206 Kts. The same sounds were heard again on the CVR 7" later, the DFDR records show at that time a speed trim commanded nose up trim input resulting in an increase in pitch trim from 7.7 to 7.8 units. The DFDR recorded airspeed at the time was 209 Kts.</p> <p>The airplane was then returned to wings-level flight at a heading of 204°. However, the pitch attitude continued to increase and the airspeed continued to decrease without any nose down column inputs.</p>	<p><u>Pitch Trim (STAB Trim)</u></p> <ul style="list-style-type: none"> ▪ From 00:38:15 to 00:38:29, according to the DFDR, the STAB trim was trimmed from 7.56 to 7.7 without any trim control input (neither auto pilot nor manual input); ▪ From 00:38:37 to 00:38:42, the DFDR showed a further STAB trim movement from 7.8 to 7.85 without any trim control input; and ▪ From 00:39:40 to 00:40:00 with pitch down control column force applied, the aircraft pitch was increasing from 14.8 to 32.5 and pitch up trim was recorded from 8.6 to 8.83 without any trim control input. <p><i>This is therefore, The DFDR data showed as above significant number of un-commanded pitch trim movement .</i></p>
<p>Page 22</p>		

<p>Page 23</p>	<p>At time 00:40:09 & 00:40:13, the captain said (in Amharic) <i>“what is that?”</i>, then louder, <i>“what is that?”</i> At that time the aircraft altitude was approximately 7700’, the recorded airspeed was 120 kts, the recorded pitch about 4° up, the AOA values 25.5° (left) and 23.6° (right), and the vertical acceleration is 0.6 g. The maximum AOA values were recorded at 00:40:14 as 32.0° (left) and 30.0° (right).</p>	<p>As described above, the DFDR recorded pitch trim movements, which were indicative of a loss of integrity of the of the flight control system resulting in severe flight control problems.</p>
<p>Page 40 1.14</p>	<p>Based on the on-site and lab examination of the recovered wreckage, on the medical and pathological information and on the under-water pictures and video taken of the remaining wreckage, there is no evidence of any pre-impact fire.</p>	<p>Only a recovery of most of the aircraft wreckage from the sea and a detailed examination of the wreckage would provide evidence whether a fire in the air was involved (keeping in mind numerous eyewitness accounts of a “fire ball” at altitude in the sky.</p> <p>Therefore, Ethiopia strongly disagree with the report hasty conclusion based solely on the very limited aircraft wreckage recovered about 8 %, while denying recovery of the major wreckage by the IIC and despite the numerous eye witness accounts of “Fire ball” at altitude in the sky. It is to be recalled that the LIC agreed to address denial of wreckage recovery in the report along with correspondences made in this regard)</p>

<p>Page 45 1.16.4</p>	<p>Recovery attempt of the CVR U16 Memory Chip</p> <p>The BEA report concluded that: <i>“Based on the external visual inspection and the asymmetrical results of the electrical characterization, it is very probable that the internal die is cracked and the data from U16 cannot be retrieved.”</i></p>	<p>Ethiopia believes that a further attempt to read the information on the U16 Memory Chip should have been undertaken by the manufacturer Honeywell as per the MOU reached with the IC.</p> <p>It is noted that there are two gaps (one 10 seconds and the other 11 seconds at critical moments) with missing voice/sound on the CAM channel of the CVR in the five minute recording of the flight which leads to doubts about the completeness of the record and wavering by the Investigator-in-Charge for recovery to be made by the manufacturer Honeywell.</p>
<p>Page 45 1.16.5</p>	<p>Trim tab test & research</p> <p>The Left Trim Tab was also removed by technical advisors to the Ethiopian team and under the supervision of the IIC, it was then sent to the NTSB and an examination was conducted at the same Boeing facilities on May 11th under the supervision of technical advisors from the investigation committee.</p>	<p>It was noted that following the accident, the FAA issued an emergency Airworthiness Directives 2010-06-51 on 12 March 2010, another Airworthiness Directives 2010-09-05 on 19 April 2010 and an amendment to it (2010-17-19) on 25 August 2010 by the FAA related to the trim tab and as a result of a number of incidents. Also, the Boeing Commercial Aircraft Company issued an amendment on 23 September 2010 to the 737 Flight Crew Operations Manual regarding Elevator Tab Vibration, which among other things recommended “consider landing at the nearest suitable airport”.</p>

		<p>It is recommended that the Elevator Tab Vibration incidents should be described in detailed in the report, that the damage and causes of the elevator tabs be discussed and compared to the damage noted on the elevator tab from flight ET409. The significant indications of a loss of integrity of the of the flight control system resulting in severe flight control problems on flight ET409 would need to be discussed and compared to the known damage from other incidents involving the elevator tab system.</p>
<p>Page 46 1.16.6</p>	<p>Black soot near APU</p> <p>Upon the observation made by the Airworthiness Group on the presence of a “black soot” near the APU exhaust area and some wrinkle on the metal, the IC decided to send a section of fuselage skin from the APU compartment comprising that black soot to the Materials Laboratory of the NTSB for examination. The reason was to determine whether the “black soot” identified in that area was heat related and to determine its origin.</p>	<p>Ethiopia believes that a further laboratory examination of the part is warranted, in order to establish to what extent heat was present and to confirm the origin and material of the “black soot”.</p> <p>Furthermore the black soot and the wrinkled area near APU can give a better clue of fire if detailed examination was performed.</p>
<p>Page 50 1.17.1.11</p>	<p>During interviews conducted in Addis Ababa with the training pilots, the IC was informed that upset recovery training is conducted through a briefing in addition to being part of a full flight simulator training session (FFS – 7). However, the ET VP Flight Operations advised the IC</p>	<p>The information provided in 1.17.1.11 is partially misinterpreted. The upset recurrent (proficiency) training is conducted during the full flight simulator training session with full practice per B737 FCOM non-normal maneuvers. FFS Syllabus Lesson (7) for 737-700/800</p>

	<p>that the “<i>simulators don’t support jet upset recovery training</i>”. Nevertheless, one of the training pilots advised the IC that training pilots can induce a simulated upset by asking the trainee pilot “<i>to turn his head sideways while the training pilot sets the plane to high nose up, more than 25 deg, with no bank angle, high power setting and wings level, then asks the trainee to recover as per the procedure described in the QRH.</i>”</p>	<p>refers.</p> <p>The VP Flight Operations explained that the simulator did not have a feature (button) to select an upset scenario. As the training pilot explained, the upset scenario is selected by the training pilot using manual inputs.</p>
<p>Page 51 1.17.1.12</p>	<p>However, in one of the F/O early fixed base simulator training sessions (FBS – Lesson 7), the following remark was written about his performance as PM: “<i>As a PM interferes with PF duties unnecessarily. Has to be confident with his actions. Should stop asking irrelevant questions. Should stop repeating minor mistakes.</i>”</p> <p>During one of the interviews with a pilot who was very close to the F/O, that pilot recalled hearing from the pilot instructors that had taught the F/O that he was “<i>the best student</i>”. The same interviewed pilot replied to a question from the IC about the F/O assertiveness in the following terms: “<i>assertive with his peers, when he is flying, he will assert himself to defend what he is doing.</i>”</p> <p>Furthermore, in one of the captain’s transition</p>	<p>The training file of the F/O indicated an excellent performance record throughout the full-flight simulator sessions, including his check flight and his six months recurrent proficiency check. The F/O was graded 4 in CRM, which was the highest grade. The final report mentions a remark written early on during the initial training well before the F/O’s 15 session full-flight simulator training. The final report, in this respect, misrepresents the factual content of the training file of the F/O.</p> <p>The comments from the interview with a pilot very close to the F/O are taken out of context and are inappropriate. These direct quotes cannot be included in the report.</p> <p>Regarding the Captain’s training records; it is unprofessional to single out and quote from the training records. The write-ups in training records are made for that purpose only, using some of those write-ups for purposes different from the purposes for which they were developed is not recommended (ICAO Annex 13,</p>

	<p>training report (FFS – 8), the training pilot mentioned about his trainee that “<i>generally lack of concentration is observed</i>”.</p>	<p>Attachment E). A group of single write-ups quoted are usually taken out of their context and could be considered disrespectful.</p>
<p>Page 52 1.17.3</p>	<p>Thirty six air traffic controllers work as three groups; each group works for twenty four hours and rests for forty eight hours. The working hours and rest periods within each shift are planned by the supervisor; typically an ATC controller would work between 2 - 3 hours then take his rest at the designated area.</p> <p>Each group working at the ACC consists of a supervisor and six air traffic controllers who work as Area and Approach controllers and as assistants. The Tower group consists of a supervisor and four controllers who work as Tower and Ground controllers. In addition there is the Flight Information Centre where there are some personnel from the ATC staff & Telecom department handling the work.</p> <p>Typically, the Ground controller would handle flights on taxiways and at gates. He will also issue the initial ATC clearance, start-up and taxi permissions. The Tower controller issues the departure and landing clearances and controls the air traffic within the airport airspace up to 3,000 feet. Above that altitude, the ACC is responsible for the control of arriving, departing and overflying air traffic.</p> <p>According to ATC records, at the time of the</p>	<p>According to the ATC records, at the time of the accident there was one ground controller and one tower controller serving flight ET409. The supervisor was on a “restroom” break.</p> <p>At the time of the accident, the ATC controllers had been on duty for a consecutive time period of 20 hours. A human factors investigation to establish the degree of controller fatigue (including non-standard phraseology, poor coordination among ATC units, Unplanned three different heading clearances, vectoring the aircraft into a thunderstorm cell etc...) would have been warranted.</p> <p>The work schedule for ATC controllers is 24 hours and</p> <p>It was agreed in Paris to include this issue in the analysis in order to develop recommendation to review that work schedule in line with international practice. However, the final report did not include the agreed recommendation.</p>

	<p>accident there was one ground controller, one tower controller and a supervisor handling the traffic in the Tower. There was also an Approach controller, an assistant controller and a supervisor handling the traffic in the ACC. All controllers reported for duty at 0700 LT on the morning of 24 January 2010 and were scheduled to come off duty at 0700 LT on 25 January 2010. During this twenty four work period, the supervisor scheduled all shift and rest times. The Lebanese CAA confirmed these times as correct.</p>	
<p>Page 55 1.18.3.3</p>	<p>Other eyewitness</p> <p>Many eye witnesses contacted the government officials stating that they saw at the time of the accident a “ball of fire” falling into the sea at the time and calculated location of the accident.</p> <p>These reports raised many speculations by the media who associated the eye witness reports with the aircraft accident and built various stories and theories based on these accounts. Some various declarations by people who were not associated with the investigation also contributed to fuel some media speculations.</p>	<p>The significant eyewitness accounts, including, ATC Controllers were not properly taken in to account.</p> <p>These eyewitness accounts were not analyzed in detail as they contained statements regarding a “fire ball” at altitude in the sky.</p>

2. Analysis

<p>Page 57 2.1</p>	<p>Neither the DFDR data, nor the CVR data showed any evidence of a warning linked to a system malfunction, or a major failure occurring during the flight.</p>	<p>The aircraft was in erratic maneuvers as recorded on the DFDR, most likely caused by the above mentioned likely loss of integrity of the flight control system resulting in severe flight control problems. It is likely that the control problems were further exuberated by the flight entering the thunderstorm.</p> <p>The DFDR data for the accident flight shows that there were a significant number of un-commanded roll and pitch trim movement.</p>
<p>Page 57 2.1</p>	<p>At the time of the accident, there were light winds, isolated clouds and imbedded cumulonimbus extending between 2,000' and 24,000' to the area SW, NW and NE of BRHIA. This had generated some thunderstorm activities associated with changes in the wind direction and speed, in addition to some rain and light to moderate turbulence around the airport area.</p>	<p>The accident aircraft was vectored into a thunderstorm cell, which included turbulence, lightning, rain and cloud.</p> <p>Lightning strike is one of the possibilities for a "fire ball" which the draft report did not consider. In order to determine whether there was a lightning strike to the aircraft the wreckage should have been recovered from the sea bed (depth was about 45 m which should not constitute a problem for wreckage recovery).</p>

<p>Page 57 2.1</p>	<p>The temperature on ground was 11° indicating that icing conditions would most likely be encountered during climb, once flying into clouds at higher altitude and lower temperature. There was no record on the DFDR or the CVR for the use of anti-icing during the flight; however, there was no record of any system malfunction or failure normally associated with icing.</p>	<p>According to ET procedures, the flight crew would use anti-icing when the ground temperature was 10 degrees C or below. Hence, the flight crew did not use anti-icing, nor were they required to use anti-icing.</p>
<p>Page 58 2.2.1</p>	<p>During the take-off run, the CVR recorded a sound similar to interference on the radio followed by the captain saying <i>“did you see that?”</i> Those two events may refer to lightning activities somewhere in the vicinity of the airport. However, no reaction is recorded from the F/O apart from the standard <i>“80 Knots”</i> call when passing that speed on take-off. Which most probably implies that nothing which might affect the flight had happened; apart from the fact that bad weather was not far from the field, as broadcasted on the ATIS which was copied by the crew.</p>	<p>Following the Interference on the Radio, the captain said <i>“Did you see that”</i> and the F/O confirmed that after 80 Knots call out. This is the time the first 10 seconds CVR data missing happened. During this critical phase of the flight, no call out is allowed except the mandatory conversation by the crew and it is clear that the crew might saw something that affect the flight.</p>
<p>Page 58 2.2.2</p>	<p>The second unusual event is recorded at 00:38:30 when the actual heading of the aircraft exceeded</p>	<p>During the initial turn to heading 315⁰, the flight was turning with a constant rate of turn until 00:38:30. After this and without any</p>

	<p>the 315° selected heading without any action from the PF on the control wheel to reduce the roll or to stop the turn, although the FD gives indication to reduce roll. That inaction was not met by a call from the PM as required by the ET SOP. This exceedance continued for 14” when the aircraft had exceeded the cleared/selected heading by 48° reaching a maximum heading of 003°</p>	<p>control wheel input, the bank angle began to increase to 37° which activated an automatic aircraft excessive bank angle warning. The Captain applied left rudder input at 00:38:44, but initially the aircraft did not respond. This un-commanded roll to the right is recorded on the DFDR which also shows that no related pilot flight control inputs were made.</p>
<p>Page 61 2.2.5</p>	<p>At 00:39:59 the captain was heard saying in Amharic “<i>what is that</i>”, just before the activation of the stick shaker (from 00:40:01 to 00:40:28). That call was repeated twice during the stall. He was also heard saying “<i>speed</i>” as the stick shaker was coming on. His voice indicated a significant stress level. It is not possible to know what he was precisely referring to; referring to “<i>bank angle</i>” is unlikely because those alarms were previously heard; referring to stick shaker would indicate that he did not identify the stall warning which would be surprising for a 737 qualified pilot; referring to the strange displays related to airspeed and/or the aircraft vertical and lateral attitudes on the PFD would indicate a loss of situational awareness; referring to an external factor such as weather would also indicate a loss of situational awareness, since the weather was displayed on the PF’s screen. Therefore, it is more likely that he was referring to the global situation indicating that he didn’t understand why the situation</p>	<p>In the later stage of the flight, it does not serve any purpose to analyze the flight crew actions with reference to an intact aircraft. As described above in several places, it is likely that a loss of integrity of the flight control system resulted in severe flight control problems, and the flight control problems were further exuberated by the flight entering the thunderstorm cell.</p> <p>The reference to the Captain not identifying the stall warning (stick shaker) is inappropriate.</p> <p>The repeated questions by the Captain recorded on the CVR “What is that” are likely references to the flight control problems which had resulted from the loss of integrity of the flight control system.</p>

	was degrading in such a way.	
Page 61 2.2.5	<p>He then called 5 times “go around”; starting from the moment he pushed the throttle. The TO/GA switches on the thrust levers were pushed, with no change in the FD modes since the TO/GA mode was already engaged. The F/O said in a cool voice “Roger Go around ”confirming that this mode was active. This action was in line with the initial approach to stall recovery procedure in force at the time of the accident and could have contributed in aggravating the situation by increasing the AOA, had the thrust been at a lower power setting²¹. However, neither the thrust was reduced since take-off to produce such an effect nor the pilot followed the laid down approach to stall recovery procedure in force at the time of the accident.</p> <p>The increase in the AOA was the direct result of the aircraft being out of trim and the pilot failure to adjust the attitude by pushing on the control column</p>	<p>The flight crew actions were in accordance with the Boeing stall recovery procedures in effect at the time of the accidents (it was later shown that the application of full thrust exaggerated the pitch up attitude; whether the thrust had been at a lower or higher power setting, the maximum power applied could contribute in aggravating the situation by increasing the AOA.). Furthermore this situation had been witnessed by the IIC in this Final report as “Those changes in flight control inputs and maintaining the thrust at go-around didn’t allow the captain to recover from stall situation or from the pitch down attitude, but indicates that he was still struggling to save the situation”. That is why subsequently after the accident Boeing has changed its procedures on stall recovery.</p>
Page 57	Furthermore, the recorders data and the pieces of	Presently the recovered wreckage is about 8% with more than

<p>2.1</p>	<p>the wreckage retrieved from water do not show any evidence of a lightning strike that may have jeopardized the flight.</p>	<p>90% of the wreckage is still under water. Without recovering the wreckage from the sea bed and examining it, the possibility of a lightning strike cannot be ruled out.</p>
<p>Page 65 2.2.11 Event 11</p>	<p>” Ball of fire” In the analysis of ball of fire it was stated in the report that</p> <ul style="list-style-type: none"> • Neither the CVR & DFDR pattern reflected signs of an explosion or an aircraft break-up as a result of such an explosion. • “No sign of any explosion or fire were detected on the wreckage weather recovered under water. • “No sign consistent with fire or explosion were detected during the autopsies carried on some of the bodies”. • The only loud noise recorded on the CVR was consistent with the calculated time the main aircraft body impacted the water surface. 	<p>The eyewitness accounts contained statements regarding a “fire ball” at altitude in the sky. This clearly points to an explosion in the air, such as shoot-down, sabotage, break-up of the aircraft or lightning strike which all possibilities were not examined and analyzed in detail.</p> <p>From the data obtained from DFDR and CVR, the recorders stopped recording at an altitude of 1’300 feet with a loud noise recorded on the CVR and no further data was obtained. The simultaneous disappearance of the aircraft from the ATC radar confirms an explosion and .disintegration of the aircraft on the sky.</p> <p>With only 5 Autopsy results presented out of 90 victims, Is it possible to reach a “no sign of fire” conclusion?</p>
<p>Page 65 2.2.11</p>	<p>The presence of thunderstorm activities in that area could have also created such an impression; especially that they produce loud noises similar to the noise produced by explosions and that they were present and active around the area of the crash.</p>	<p>The explosion of the airplane on the sky was clearly stated on this report by the well experienced ATC controllers.</p> <ul style="list-style-type: none"> • The incident Notice filled by the Chief of the ANS mentions under “<i>Remarks</i>” that “<i>we saw an orange explosion on the</i>

		<p><i>sky over the sea before the aircraft fell down”¹⁷.</i></p> <ul style="list-style-type: none"> • One of the Tower controllers advised that he saw “<i>a light over the CostaBrava</i>” (SW of BRHIA). • The ACC supervisor specified in his report that the Tower controller reported seeing: “<i>orange light falling into the sea</i>”. <p>While the fact is indicated as stated above, Why is the IIC challenging the well experienced ATC Controllers as if they can not differentiate an explosion of an airplane and a thunder storm activity?</p>
<p>Page 66</p> <p>2.3.1.1</p>	<p>The ET 409 crew experience was within the minimum criteria stipulated in the ET Procedures in the following terms: “<i>Captain who has less than 300 hours and F/O who has less than 100 hours on type shall not be rostered together.</i>²⁴”</p> <p>The ET 409 crew met those requirements since the Captain had 188 hours and the F/O had 350 hours on type; therefore they could legally be paired together. That level of experience, although within the required approved standard, did not constitute a comfortable margin that would allow the crew to have enough confidence in the operation of the aircraft under demanding conditions, especially when we consider that the captain’s experience on the B737-700/800 was acquired in</p>	<p>The Captain and the F/O on flight ET409 met the requirement on the FOPM, and could therefore be paired together and the flight time acquired till the accident flight is within the Regulatory body’s limit.</p>

	the 51 days preceding the accident, which might have affected the purpose for setting that experience level.	
Page 67 2.3.1.3	Despite the fact that the approach to stall recovery procedure was changed after the accident, had the crew applied the procedure in force at that time, they could have recovered, as demonstrated during the M-Cab sessions.	<p>The M-Cab simulation performed at Boeing did not consider factors affecting the flight like meteorological, technical anomalies and other external factors.</p> <p>It serves no purpose to conduct a simulation on the assumption that the aircraft was intact, when in fact there was significant evidence, including the DFDR data, that the integrity of the flight control system had been compromised for reasons that remain to be established.</p>
Page 68 2.3.2	In his endeavor to help ET 409 avoid weather, the Tower controller amended the clearance to the aircraft from a LATEB 1 D departure to a right turn direct Chekka as he was clearing the flight for take-off. Had the aircraft followed the initial standard departure it would have had to climb to 5,000" prior to turn right to Chekka, which would have taken it 5-7 miles SW of the field. An active CB was identified close to the airport towards the SW. Following the LATEB 1D SID route would have lead the flight right into that CB. However, he Tower controller called by phone the Area controller to advise him about the new instruction to ET 409. The Area controller, who was handling at the time two arrivals from the	From the ATC weather radar image and the meteorological report at the time LATEB 1 D departure would have been a better route to avoid the CB. From the ATC script it is clear that the ATC had no awareness about the location of thunder storm.

	<p>North, advised the Tower to amend the clearance to a heading of 300° or 315°, which the Tower controller did prior to transfer ET 409 to the Area controller. That constituted 2 changes in less than a minute, but did not seem to affect at that stage ET 409 who acknowledged reception of both clearances and acted accordingly.</p> <p>Normal ATC SOP calls for the Tower controller to verify with the Area prior to amend the departure clearance. According to the Tower controller, this SOP was not followed in order not to delay the take-off clearance given to ET 409. However, this had no effect on the communication exchange with the flight, since the new heading was immediately well received and acknowledged by the flight crew. Nevertheless, the ATC personnel should act in accordance with the laid down SOP.</p>	
<p>Page 71</p>	<p>Beyond that point, the ATC controller was unaware of the problems the crew had to control the aircraft, especially that no particular call indicating such difficulties was received, and all the clearances issued to the crew were read back in a calm and relaxed voice, with the exception of the last non-standard “roger, roger” call back transmitted by the F/O one minute prior to the crash and the open microphone sound he got as a reply to the last instruction the flight crew could have heard around 20” prior to the crash.</p>	<p>From the CVR data the continuous open mic indicates the desperate attempt from the pilot to transmit message to the ATC. If the ATC did not receive distress call it does not mean that the crew did not attempt to transmit.</p> <p>“Roger Roger “ was standard reply phraseology for that particular communication.</p>

<p>Page 74 2.4.3</p>	<p>The engine N1 that was applied during takeoff was consistent with a 22k de-rate thrust setting²⁹. With a 22k de-rate thrust setting, a weight of 70,443 kg (155,300 lb), and a center of gravity of 18%, the Airplane Flight Manual (AFM) for ET-ANB defines the recommended takeoff stabilizer as approximately 6.9 units. The event weight and balance form listed the stabilizer setting as 5.26 units³⁰. This is 1.64 units in the airplane nose-down direction beyond that recommended in the AFM.</p>	<p>The available engine ratings on the ET-ANB B737-800 aircraft are 24k, 26k and 27k. Therefore, the calculations in the analysis using 22k are incorrect since the airplane didn't have a provision for 22K ratings.</p>
<p>Page 75 2.5</p>	<p>Human Factors</p>	<p>The entire section 2.5 is inappropriate and inaccurate based false premises and hasty conclusions. It is based on unfounded judgments, hypotheses are put forward and opinions are expressed, which are not based upon either factual evidence or researched data.</p> <p>Re. 2.5, It serves no purpose to analyze the Captain's control inputs and actions on the assumption that the aircraft was intact, when in fact there was significant evidence, including the DFDR data, that the integrity of the flight control system had been compromised for reasons that remain to be established.</p> <p>Re. 2.5.1. In 1.1 above, it was suggested that this statement be amended to read along the lines: "Before engine start-up, the flight</p>

		<p>crew was heard on the CVR discussing some non-pertinent issues (related to their lay-over stay in Beirut). Nevertheless, their tone of voice and discussions were normal.</p> <p>When the DFDR clearly shows both flight crew were actively making control inputs in an effort to control an aircraft, the integrity of which had been compromised for reasons that remain to be established.</p> <p>Re. 2.5.2 and 2.5.3. These two paragraphs are developed based on misguided assumptions, partial statements by colleagues and the families of the flight crew which have been taken out of context and presented disrespectfully.</p>
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3. Conclusions

3.1 Findings

	3.1.1 The Aircraft	
5-	The aircraft flew in an out of trim situation for most of the time, while all systems were functioning properly.	There were several un commanded stabilizer trim movements recorded on the DFDR and the stabilizer trim values opposite to the pitch control input by the pilot are indicative of a technical malfunction of the integrity in the aircraft pitch control system.

6-	The aircraft behavior was the result of its response to the pilot's input throughout the flight.	Ethiopia does not agree. There were several un commanded stabilizer trim movements recorded on the DFDR and the stabilizer trim values opposite to the pitch control input by the pilot are indicative of a technical malfunction of the integrity in the aircraft pitch control system.
7-	There was no evidence of any defect or malfunction in the aircraft that could have contributed to the accident.	Ethiopia does not agree. There were several un commanded stabilizer trim movements recorded on the DFDR and the stabilizer trim values opposite to the pitch control input by the pilot are indicative of a technical malfunction of the integrity in the aircraft pitch control system
8	The aircraft was structurally intact till the last couple of seconds prior to the accident. However, the aircraft could have began to experience loss of structural integrity when passing 1290 feet during the final dive (2" before impact) due to the excessive speed and loads. However, the wreckage lay-out and CVR recording supports that it's main body was destroyed by impact forces with the water.	Ethiopia does not agree. The data obtained from the DFDR, CVR and the ground radar indicated that the recordings stopped recording at an altitude of 1'300 feet, due to the breaking up or disintegration of the aircraft in the air by explosion.
9-	No signs of fire or explosion were detected in the aircraft wreckage.	Ethiopia does not agree. Such a conclusion cannot be made when only some 8 % of the wreckage was recovered. The eyewitness accounts contained statements regarding a "fire ball" at altitude in the sky. This clearly points to an explosion in the air, such as break-up of the aircraft or lightning strike, sabotage, or shoot-down, all possibilities should have be examined and analyzed in detailed.
3.1.2 The Flight Crew		

6	The captain's actions, statements and degraded performance during that period were consistent with the effects of spatial disorientation and loss of situational awareness that could have been the result of a subtle incapacitation, although there was insufficient evidence to determine the reasons of that incapacitation.	Ethiopia does not agree. A finding related to subtle incapacitation is incorrect and inappropriate, when the DFDR clearly shows both flight crew members making control inputs in an effort to control an aircraft, the integrity of which had been compromised for reasons that remain to be established.
7	The F/O failure to abide by all the airline SOPs and intervene with the captain throughout most of the events of the flight, even when called to do so, contributed to the flight crew degraded performance.	Ethiopia does not agree. There is no evidence of a failure of the F/O to function effectively and failure to abide by all airlines SOP. There is no evidence of "degraded performance" on the part of the Captain.
3.1.3 Flight Operations		
3-	The aircraft anti-icing system was not used despite the fact that the aircraft most probably flew in icing conditions; however, the performance analysis conducted based on the DFDR data indicates that icing was not a factor in the accident.	Ethiopia does not agree. In accordance with the Boeing FCOM and company SOPs, usage of the anti-icing system was not required.
4-	The crew did not discuss or perform any tactical action to deviate from CB clouds present in the area around the airport at the time of the flight.	Ethiopia does not agree. The departure clearance direct to CHEKA was clear of bad weather, and hence there was no need to discuss a deviation. From the CVR and ATC transcripts, it is evident that the ATC controller is using non-standard phraseology, and vectors the flight directly into the thunderstorm cell.

5-	The aircraft did not follow any assigned heading provided by the ATC, despite the fact the crew was acknowledging the headings and the F/O was selecting them on the MCP.	Ethiopia does not agree. It appears likely that the integrity of the pitch control system had been compromised for reasons that remain to be established.
6-	The aircraft went twice into stall situations for prolonged times (27" & 26") and there was sufficient altitude available to recover from stall each time.	Ethiopia does not agree. The DFDR recorded "stick-shaker" activation, not stall. The aircraft was in erratic maneuvers as recorded on the DFDR, most likely caused by a loss of integrity of the pitch flight control system resulting in severe flight control problems. It is likely that the control problems were further exuberated by the flight entering the thunderstorm.
7-	The aircraft flew many times in a "cross lateral control" situations induced by the pilot actions on the control wheel and rudder pedals.	Ethiopia does not agree. The aircraft was in erratic maneuvers as recorded on the DFDR, most likely caused by a loss of integrity of the pitch flight control system resulting in severe flight control problems.
8-	During the final phase of the flight the aircraft went into an uncontrolled spiral dive induced by the pilot inconsistent inputs on the aircraft flight controls.	Ethiopia does not agree. The aircraft was in erratic maneuvers as recorded on the DFDR, most likely caused by a loss of integrity of the pitch flight control system resulting in severe flight control problems. It is likely that the control problems were further exuberated by the flight entering the thunderstorm
10-	The ATC controllers provided proper instructions and follow-up to the flight.	Ethiopia does not agree. From the ATC transcripts, there are indications of confusion and poor coordination between ACC and TWR regarding the headings (vectors) to be given to flight ET 409. Subsequently, the ATC controller is using non-standard phraseology, and vectors the flight directly into a thunderstorm cell.

12-	The aircraft did fly in heavy rain and icing conditions, but it did not encounter any severe turbulence or lightning strike.	Ethiopia does not agree. There is no evidence of icing conditions. There is no indication of the severity of the turbulence in the thunderstorm cell, and it cannot be ruled out that the aircraft was hit by lightning.
3.1.4 The Operator		
3-	The SOP for the PM to monitor the PF and call any deviation was not properly implemented and was not effective in preventing the continued degradation in the captain's performance during that flight.	Ethiopia does not agree. The operator policies and CRM program were fully implemented and up-to-date. There was no degradation in the Captain's performance. See also comment to 3.1.2, finding no. 7 above.
4-	The CRM training provided by the operator was not effective in promoting F/O's assertiveness and leadership.	Ethiopia does not agree. The operator policies and CRM program were fully implemented and up-to-date. Among other things, CRM is included in the training and every simulator session.
5-	The operator FOQA program did not identify trends that could have lead to such an accident.	Ethiopia does not agree. The relevance of this finding in relation to the occurrence is difficult to assimilate. The monitoring and trend analysis is done by IATA/CAE-Flight Scape. The Flight Scape program does probably not include trends related to in-flight break-ups.
3.1.5 ATS and Airport Facilities		
		<p>Ethiopia had suggested a finding to be inserted dealing with the possible fatigue encountered by the ATC controllers due to the fact that the accident happened at the end of their 24 h shift.</p> <p>In addition, the following remarks hadn't been addressed properly in this section in detail:</p> <ul style="list-style-type: none"> • Non-standard phraseology;

		<ul style="list-style-type: none"> • The instructed heading of 270⁰ was taking the flight directly into the centre of the thunderstorm. It was not understood why the ATC controller changed the instructed 315⁰ heading (safest direction) to 270⁰, which led directly into the area of the thunderstorm; • The instructions may have become confusing to the flight crew. • Poor coordination among ATC units • Unplanned clearance • Being unaware of the location of storm • Separation from conflicting traffic
4	The coordination between the Tower and Area controller was not in line with the ATC SOP, although this had no particular bearing on the accident.	From the ATC voice transcript Its obvious that the poor coordination ,conflicting clearances in a very short period of time and directing the flight into the centre of the storm had increased work load on the pilots.
5-	The ATC controller requested ET 409 repetitively to turn to a heading of 270 in order to avoid weather, traffic and mountains.	Ethiopia does not agree. The heading 270 degrees steered the aircraft straight into the thunderstorm cell. That's why Etihad crew followed heading 250 ⁰ instead of 270 ⁰ It is clearly indicated in the report section 1.18.3.2 ." During that go-around EY 533 was given by the Tower the standard go-around procedure for runway 16, which is turn right heading 270° climb 2000 feet. However, they maintained a heading of 250° to avoid the cell west of the field."
6-	The ATC controllers provided prompt and efficient assistance to the flight crew, that assistance was not	<ul style="list-style-type: none"> • Ethiopia strongly does not agree. The ATC controller is using non-standard phraseology, and vectors the flight directly into

	effective.	<p>the thunderstorm cell.</p> <p>In addition</p> <ul style="list-style-type: none"> • The instructions were confusing to the flight crew. • Poor coordination among ATC units • Unplanned clearance • Being unaware of the location of storm • Separation from conflicting traffic <p>With all these remarks it is unprofessional to say prompt and efficient assistance was given by ATC controllers.</p>
3.1.6 Flight Recorders		
4	One out of the 24 CVR's memory chips (U16) was unreadable and prevented getting the full audio CAM track, creating a gap of 10" of missing recording on the CAM during the flight.	There are two gaps of 10" and 11" of missing recording of the CAM during the flight.
5-	The quality of the audio information recorded was good. All information was transcribed.	Ethiopia suggests a rewording as follows: The quality of the audio information was good. All information was transcribed, except for the missing two 11 second gaps on the CAM channel.
3.1.7 Medical		
1-	As a result of the impact, there was no possibility to	Ethiopia disagrees. The word "disintegration" should had been

	carry an autopsy on the flight crew.	used instead of “impact”.
4-	Post-mortem examination and autopsies of some bodies that were recovered in unacceptable conditions revealed no signs consistent with fire or explosion.	All 90 persons on board were identified. Some bodies were buried without examination. Post-mortem examination and autopsies were done on five bodies only. With only 5 Autopsy results presented out of 90 victims, it is impossible to reach at such conclusion.
3.1.8 Survivability		
1-	The accident was not survivable due to the magnitude of the acceleration forces and the impact with the water surface.	The accident was not survivable due to the explosion on air.
3.2 Causes		
3.2. Probable Causes		
1-	The flight crew’s mismanagement of the aircraft’s speed, altitude, headings and attitude through inconsistent flight control inputs resulting in a loss of control.	Ethiopia strongly disagrees. From the analysis of the data collected from DFDR,CVR,ATC Recordings and eye witness accounts, the most probable cause of the accident on flight ET409, ET-ANB on 25, January 2010 was the breaking-up or disintegration of the aircraft as result of explosion in the air at 1300ft, because of possible shoot-down, sabotage or lightening strike,

2	The flight crew failure to abide by CRM principles of mutual support and calling deviations hindered any timely intervention and correction.	Ethiopia does not agree. The operator policies and CRM program were fully implemented and up-to-date. Among other things, CRM is included in the training and every simulator session.
3.2.2 Contributing Factor		
1	The manipulation of the flight controls by the flight crew in an ineffective manner resulted in the aircraft undesired behavior and increased the level of stress of the pilots	Ethiopia strongly disagrees. <i>There were significant indications of a loss of integrity of the pitch flight control system resulting in severe flight control problems on flight ET409.</i> <i>The ATC use of non- standard phraseology ,poor coordination among its units in issuance of conflicting clearances, poor separation among conflicting traffic and vectoring the aircraft in to thunder storm cell west of the airport contributed to the accident by adding work load and stress on the pilots</i>
3	The prevailing weather conditions at night most probably resulted in spatial disorientation to the flight crew and lead to loss of situational awareness.	Ethiopia strongly disagrees. No indication of spatial disorientation and loss of situational awareness is observed from the DFDR and CVR data. But There were significant indications of a loss of integrity of the pitch flight control system resulting in severe flight control problems on flight ET409.
4	The relative inexperience of the Flight Crew on type combined with their unfamiliarity with the airport contributed, most likely, to increase the Flight Crew workload and stress.	Though It was his first flight for the captain on B737 aircraft to Beirut, he had flown to this Airport numerous times with B757and B767 aircraft . The F/O was more than familiar to the airport as he had flown there several times.

5	The consecutive flying (188 hours in 51 days) on a new type with the absolute minimum rest could have likely resulted in a chronic fatigue affecting the captain's performance.	Ethiopia is agrees. The rest and duty times of the flight crew were in accordance with the Ethiopian CAA regulations and the company requirements. It is most unlikely that fatigue would be involved within the first five minutes of flight and, thus, a contributory factor.
7	The aircraft 11 bank angle aural warnings, 2 stalls and final spiral dive contributed in the increase of the crew workload and stress level.	Ethiopia strongly disagrees. There were significant indications of a loss of integrity of the pitch flight control system resulting in severe flight control problems on flight ET409. The flight crew actions were in accordance with the Boeing stall recovery procedures in effect at the time of the accidents (it was later shown that the application of full thrust exaggerated the pitch up attitude; subsequently after the accident Boeing has changed its procedures on stall recovery) .
8	Symptoms similar to those of a subtle incapacitation have been identified and could have resulted from and/or explain most of the causes mentioned above. However, there is no factual evidence to confirm without any doubt such a cause.	Ethiopia does not agree. A finding related to subtle incapacitation is incorrect and inappropriate, when the DFDR clearly shows both flight crew members making ``desperate`` control inputs in an effort to control an aircraft`, the integrity of which had been compromised for reasons that remain to be established.
9	The F/O reluctance to intervene did not help in confirming a case of captain's subtle incapacitation and/or to take over control of the aircraft as stipulated in the operator's SOP.	Ethiopia does not agree. A finding related to subtle incapacitation is incorrect and inappropriate, when the FDR clearly shows both flight crew members making ``desperate`` control inputs in an effort to control an aircraft`, the integrity of which had been compromised for reasons that remain to be established.

		Poor coordination among ATC- units, non-standard phraseology, various heading changes, and deviation from ATC- SOPs...). have caused high work load and confusion to the flight crew.
		The 24 h consecutive work schedule of ATC officers and maning (one ATCO per unit) has resulted in fatigue affecting the performance.
		<i>Un awareness of an ATC controller about the bad weather have contributing to vectoring the flight towards the storm</i>
4. Safety Recommendations.		
4.1 The Operator		
4.1.1	The operator should revise his CRM program in order to stress on the F/O assertiveness and leadership requirements especially in periods of abnormal performance.	<p>Ethiopian Airline conducts CRM program for crew. CRM issues are also included in the airline SOP in details.</p> <p>The ET Flight Operations Policy Manual (FOPM) contains a section on CRM. That section divides the crew performance competences into 3 areas: technical competence, procedural competence and interpersonal competence. The technical competence includes manual flying skill, knowledge of systems and use of automation. The Procedural competence skill includes knowledge of the procedures and adherence to procedures. The interpersonal competence includes Threat & Error management, communication, leadership and teamwork, workload management, situational awareness and</p>

		<p>decision making.</p> <p>In the interpersonal competence section, pilots are encouraged to announce ambiguities and uncertainties so an understanding can be gained. The PM is required to call attention to deviations from desired attitude, speed, heading, altitude or track using appropriate call outs as outlined in the B737 SOP¹⁵. If the deviation is not corrected he must again make the appropriate call.</p>
4.1.2	The operator should consider its classification of airports where non-technical constraints might affect flight operations and brief their flight crew accordingly.	The Operator has identified and categorized Airport classification in its Flight Operations Route Manual. There is Training and briefing requirement in the Airlines Policy for the Airports with technical constraints.
4.1.3	The operator should re-examine his crew pairing and scheduling policies in order to ensure a less stressful cockpit environment.	Ethiopia disagrees. There have been no indications that the operator crew pairing and scheduling policies have not been safe and effective. The crew pairing more than satisfies the approved regulatory requirement
4.1.4	The operator should consider establishing write up criteria for pilots training files in order to avoid the adverse effects of any miss-interpretation by the trainees.	<p>The training file of the F/O indicated an excellent performance record throughout the full-flight simulator sessions, including his check flight and his six months recurrent proficiency check. The F/O was graded 4 in CRM, which was the highest grade. The final report mentions a remark written early on during the initial training well before the F/O's 15 session full-flight simulator training. The final report, in this respect, misrepresents the factual content of the training file of the F/O.</p> <p>The comments from the interview with a pilot very close to the F/O are taken out of context and are inappropriate. These direct quotes</p>

		<p>cannot be included in the report.</p> <p>Regarding the Captain's training records; it is un professional to single out and quote from the training records. The write-ups in training records are made for that purpose only, using some of those write-ups for purposes different from the purposes for which they were developed is not recommended (ICAO Annex 13, Attachment E). A group of single write-ups quoted are usually taken out of their context and could be considered disrespectful</p>
4.1.5	The operator should consider developing his safety oversight program in order to detect such potential flight crew performance.	Ethiopian Airlines has SMS program in place. The FOQA uses the monitoring and trend analysis by IATA/CAE-Flight scape. This program does not include trends related to in flight break-ups.
	4.4 Lebanon	
		<p>The Lebanon CAA shall</p> <ul style="list-style-type: none"> • revise the working schedule for ATC personnel in regard to fatigue control mechanism • Establish procedure for monitoring ATC personnel on the use of ATCI manual and SOP
		The Lebanese CAA should ensure implementation of ICAO English language proficiency, ATCI manual, work schedule and proper weather awareness to its ATM.

	4.5 Boeing	
		The autopilot system on B737 aircraft needs to be modified to engage regardless of forces applied to the controls and to provide an alert if the autopilot does not engage.