INCIDENT ANALYSIS

Incident description:
Legend of Factorshapes

Unspecified Factortype

Event

Un-Event

State

Process

Assumption

Countermeasure

Contraindication
Why-Because Graph
Timeline of Events

Legacy takes off from Sao Jose dos Campos with destination Manaus.

Legacy cleared by Tower Jose dos Campos for FL370

Legacy flies at FL370

Flight 1907 from Manaus to Brasilia

ATC Brasilia makes blind transmission ordering Legacy Crew to switch radio frequencies

Legacy passes waypoint Brasilia

Boeing B737 flies at FL370

Legacy Transponder not broadcasting

ATC Brasilia looses secondary radar information on Legacy

ATC Brasilia transmits blindly to Legacy

ATC Brasilia has lost primary radar contact with Legacy

Legacy tracked intermittently by primary radar

Legacy crew misheard frequency

Legacy collides with Boeing B737

Legacy transponder resumes broadcasting
## Factor List

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Boeing B737 wreckage found</td>
</tr>
<tr>
<td>2</td>
<td>Boeing B737 crashes in Mato Grosso area</td>
</tr>
<tr>
<td>3</td>
<td>Boeing B737-800 operated by GOL</td>
</tr>
<tr>
<td>4</td>
<td>Possible Mid-Air with smaller plane</td>
</tr>
<tr>
<td>5</td>
<td>Radar contact lost during flight</td>
</tr>
<tr>
<td>6</td>
<td>Flight 1907 from Manaus to Brasilia</td>
</tr>
<tr>
<td>7</td>
<td>Legacy collides with &quot;shadow&quot;</td>
</tr>
<tr>
<td>8</td>
<td>Legacy looses part of a wing</td>
</tr>
<tr>
<td>9</td>
<td>Radar shows altitude difference of about 1000 feet</td>
</tr>
<tr>
<td>10</td>
<td>Boeing B737 carrying 149 passengers, 6 crew</td>
</tr>
<tr>
<td>11</td>
<td>GOL 1907 had 200 flight hours</td>
</tr>
<tr>
<td>12</td>
<td>Legacy makes emergency landing at Cachimbo air force base</td>
</tr>
<tr>
<td>13</td>
<td>Boeing B737 strikes ground at more than 300 mph</td>
</tr>
<tr>
<td>14</td>
<td>Unlikelihood of survivors</td>
</tr>
<tr>
<td>15</td>
<td>Some kind of contact between Boeing 737 and Legacy</td>
</tr>
<tr>
<td>16</td>
<td>Legacy on inaugural flight to United States</td>
</tr>
<tr>
<td>17</td>
<td>Legacy purchased by ExcelAire</td>
</tr>
<tr>
<td>18</td>
<td>Legacy takes off from Sao Jose dos Campos with destination Manaus.</td>
</tr>
<tr>
<td>19</td>
<td>Legacy briefly looses flight stability, but recovers</td>
</tr>
<tr>
<td>20</td>
<td>Legacy tail damaged</td>
</tr>
<tr>
<td>21</td>
<td>Legacy does not see Boeing B737</td>
</tr>
<tr>
<td>22</td>
<td>Legacy flies stable northwest at FL370</td>
</tr>
<tr>
<td>23</td>
<td>Legacy equipped with anticollision device</td>
</tr>
<tr>
<td>24</td>
<td>Boeing B737 equipped with anticollision device</td>
</tr>
<tr>
<td>25</td>
<td>Legacy might have flown off course</td>
</tr>
<tr>
<td>26</td>
<td>Boeing B737 might have had trouble</td>
</tr>
<tr>
<td>27</td>
<td>Boeing B737 might have lost parts</td>
</tr>
<tr>
<td>28</td>
<td>Parts of B737 might have hit Legacy</td>
</tr>
<tr>
<td>29</td>
<td>Possible lack of coordination among air traffic controllers</td>
</tr>
<tr>
<td>30</td>
<td>149 passengers and 6 crew die</td>
</tr>
<tr>
<td>31</td>
<td>Possible negligence or disregard for air-traffic instructions</td>
</tr>
<tr>
<td>32</td>
<td>Failure to detect other aircraft</td>
</tr>
<tr>
<td>33</td>
<td>Air-traffic controllers not alerted of dangerous flight path</td>
</tr>
<tr>
<td>34</td>
<td>Crew ignored instruction to descent from FL370 to FL360 passing Brasilia</td>
</tr>
<tr>
<td>35</td>
<td>Crew decided to fly higher without alerting controllers</td>
</tr>
<tr>
<td>36</td>
<td>Boeing B737 flies at FL370</td>
</tr>
<tr>
<td>37</td>
<td>Boeing B737 visible on radar until accident</td>
</tr>
<tr>
<td>38</td>
<td>Technical warning system does not operate as expected</td>
</tr>
<tr>
<td>39</td>
<td>Crew unable to find proper frequency for Manaus controllers</td>
</tr>
<tr>
<td>40</td>
<td>No radio contact between Legacy and Brasilia or Manaus until collision</td>
</tr>
<tr>
<td>41</td>
<td>TCAS on board Legacy is turned off or not working</td>
</tr>
<tr>
<td>42</td>
<td>Handover from Brasilia to Manaus required</td>
</tr>
<tr>
<td>43</td>
<td>148 passengers and 6 crew die</td>
</tr>
<tr>
<td>44</td>
<td>Controller unable to tune radio correctly</td>
</tr>
<tr>
<td>45</td>
<td>Single electronic failure on board of the Legacy</td>
</tr>
<tr>
<td>46</td>
<td>ATC Brasilia makes blind transmission ordering Legacy Crew to switch radio frequencies</td>
</tr>
<tr>
<td>47</td>
<td>Legacy enters jurisdiction of different ATC Center</td>
</tr>
<tr>
<td>48</td>
<td>Legacy crew misheard frequency</td>
</tr>
<tr>
<td>49</td>
<td>Crew unable to tune radio correctly</td>
</tr>
<tr>
<td>50</td>
<td>Legacy transponder resumes broadcasting</td>
</tr>
<tr>
<td>51</td>
<td>Legacy tracked intermittently by primary radar</td>
</tr>
<tr>
<td>52</td>
<td>Primary radar gives no altitude information</td>
</tr>
<tr>
<td>53</td>
<td>Controller does not warn about possible collision</td>
</tr>
</tbody>
</table>
Software requires altitude information for collision warning

Legacy Transponder not broadcasting

TCAS requires Transponder information for operation

Boeing B737 not advised to change altitude

Complete radar and radio coverage over jungle

Discrepancy between Legacy flightpath, altitude and altitude assignment

Legacy does not take evasive action

Assumed Mid-Air Collision

Both aircraft at FL370

Legacy flies at FL370

Both aircraft on same airway

Legacy TCAS manufactured by Honeywell

FAA had ordered recall on TCAS model used in Legacy

TCAS device tended to stop broadcasting unexpectedly in certain circumstances

Legacy Flightplan called for FL380 at point of collision

Boeing B737 CVR lost in rainforest

Brazilian Air Traffic System run by Brazilian Air Force

Takeoff Clearance called for FL370 for the entire route

ATC instruction supersedes flight plan

Boeing B737 CVR found

Legacy cleared by Tower Jose dos Campos for FL370

Legacy collides with Boeing B737

19 unsuccessful attempts to reach ATC Brasilia

Boeing B737 flight plan called for FL410 at point of collision

ATC Manaus instructed Boeing B737 to fly at FL370

ATC believed the Legacy to fly at FL360

Possible Cause for (56)

Avionics component has operational problems

Avionics component returned to Honeywell

Honeywell returned avionics component to Embraer

Embraer installed avionics component

One transponder and some radio communications systems installed in avionics component

Cockpit systems do not effectively alert Legacy crew of anti-collision equipment failure

Boeing unable to avoid collision

Boeing crew has no visual identification of conflicting traffic

Legacy not advised to change altitude

Boeing B737 spirals out of control

Boeing B737 breaks up in mid-air

Both aircraft on airway UZ6 in opposite directions

Radar coverage limits at boarder between airspace sectors

Notoriously unreliable radio communications in area of collision

Boeing B737 in contact with Manaus

Legacy technically under control of ATC Brasilia

Controller Brasilia does not warn Legacy

Controller Manaus did not warn Boeing B737

No handover of Legacy from Brasilia to Manaus

Unknown cause

Legacy winglet severed Boeing B737 hydraulic and electrical lines

Legacy winglet compromised Boeing B737 left wing's aileron actuators

Legacy winglet deforms Boeing B737 wing

Procedure to maintain current flight level "for a short time"

Legacy does not change altitude

Boeing B737 does not take evasive action

ATC Brasilia looses secondary radar information on Legacy

ATC Brasilia has lost primary radar contact with Legacy
ATC Brasilia transmits blindly to Legacy
Secondary radar information transmits altitude information
ATC monitoring system automatically updates altitude information on controller's display
Legacy passes waypoint Brasilia
System "feature": Displayed altitude set to altitude given in flight plan after passing of waypoint
Brazilian military 3-d primary radar provides flight altitude information
Military Primary radar altitude information presented to civilian controllers
Military 3-D primary radar altitude information inaccurate
Long-Range triangulation
Controller does not trust primary radar altitude information
Legacy enters UZ6
UZ6 connects Manaus and Brasilia
Boeing B737 uses UZ6
Legacy flightplan
Planned altitude change from FL370 to FL360 after passing waypoint Brasilia
Planned altitude change from FL360 to FL380 after passing TERES
Legacy crew identifies TCAS failure
TCAS unit displays "TCAS OFF in small white letters on flight display"
ATC shift change
Controller's electronic flight strip showed Legacy as assigned to FL360
Boeing B737 flightplan requested FL370 as cruise altitude
No aural warning on TCAS failure
Boeing B737 does not change altitude
Legacy maintains FL370
Placing of Legacy crew feet might have disabled Legacy communication devices
**Factor List - Details**

1. **Boeing B737 wreckage found**
   - Type of Factor: Event
   - Date/Time:
   - Actors involved: Boeing B737-800
   - Annotation: Reuters report, IHT Sep 30, 2006

2. **Boeing B737 crashes in Mato Grosso area**
   - Type of Factor: Event
   - Date/Time:
   - Actors involved: Boeing B737-800
   - Annotation: evidenced by Factor 1

3. **Boeing B737-800 operated by GOL**
   - Type of Factor: State
   - Date/Time:
   - Actors involved: Boeing B737-800
   - Annotation: Reuters report, IHT Sep 30, 2006

4. **Possible Mid-Air with smaller plane**
   - Type of Factor: Assumption
   - Date/Time:
   - Actors involved: Boeing B737-800
   - Annotation: Reuters report, IHT Sep 30, 2006
   - Embraer Legacy
   - quoting local officials and media reports

5. **Radar contact lost during flight**
   - Type of Factor: State
   - Date/Time:
   - Actors involved: Boeing B737-800
   - Annotation: Radar operator
   - Reuters report, IHT Sep 30, 2006

6. **Flight 1907 from Manaus to Brasilia**
   - Type of Factor: Process
   - Date/Time: 29.09.2006 15:35:00
   - Actors involved: Boeing B737-800
   - Annotation: Reuters report, IHT Sep 30, 2006

7. **Legacy collides with "shadow"**
   - Type of Factor: Event
   - Date/Time:
   - Actors involved: Embraer Legacy
   - Annotation: Statement of Defense Minister Waldir Pires on Band TV

8. **Legacy looses part of a wing**
   - Type of Factor: Event
   - Date/Time:
   - Actors involved: Embraer Legacy
   - Annotation: Statement of Defense Minister Waldir Pires on Band TV

9. **Radar shows altitude difference of about 1000 feet**
   - Type of Factor: State
   - Date/Time:
   - Actors involved: Boeing B737-800
   - Annotation: Embraer Legacy
   - AirTrafficControl Brasilia (CINDACTA 1)
   - AirTrafficControl Manaus
   - Reuters report, IHT Sep 30, 2006
10 Boeing B737 carrying 149 passengers, 6 crew  
Type of Factor: Unspecified  
Date/Time:  
Actors involved: Boeing B737-800  
Annotation: Reuters report, IHT Sep 30, 2006  
Statement by GOL

11 GOL 1907 had 200 flight hours  
Type of Factor: Unspecified  
Date/Time:  
Actors involved: Boeing B737-800  
Annotation: Reuters report, IHT Sep 30, 2006

12 Legacy makes emergency landing at Cachimbo air force base  
Type of Factor: Event  
Date/Time:  
Actors involved: Embraer Legacy  
Annotation: Reuters report, IHT Sep 30 2006  
Statement of Defense Minister Waldr Pires on Band TV

13 Boeing B737 strikes ground at more than 300 mph  
Type of Factor: Event  
Date/Time:  
Actors involved: Boeing B737-800  
Annotation: AP report, IHT Oct 1, 2006  
quoting Jose Carlos Pereira, president of Brazil's airport authority

14 Unlikelyhood of survivors  
Type of Factor: Assumption  
Date/Time:  
Actors involved: Boeing B737-800  
Annotation: AP report, IHT Oct 1, 2006  
quoting Jose Carlos Pereira, president of Brazil's airport authority

15 Some kind of contact between Boeing 737 and Legacy  
Type of Factor: Unspecified  
Date/Time:  
Actors involved: Boeing B737-800  
Embraer Legacy  
Annotation: AP report, IHT Oct 1, 2006  
quoting Jose Carlos Pereira, president of Brazil's airport authority

16 Legacy on inaugural flight to United States  
Type of Factor: Unspecified  
Date/Time:  
Actors involved: Embraer Legacy  
Annotation: AP report, IHT Oct 1, 2006

17 Legacy purchased by ExcelAire  
Type of Factor: Event  
Date/Time:  
Actors involved: Embraer Legacy  
Annotation: AP report, IHT Oct 1, 2006  
quoting Embraer and Milton Zuanazzi, general director for Brazil's Civil Aviation Agency Authority

18 Legacy takes off from Sao Jose dos Campos with destination Manaus.  
Type of Factor: Process  
Date/Time: 29.09.2006 14:51:00  
Actors involved: Embraer Legacy  
Annotation: AP report, IHT Oct 1, 2006  
quoting Diane McNulty, New York Times spokeswomen
19 Legacy briefly loses flight stability, but recovers
Type of Factor: Process
Date/Time: 
Actors involved: Embraer Legacy
Annotation: AP report, IHT Oct 1, 2006 quoting Joe Sharkey, passenger on Legacy after Diane McNulty

20 Legacy tail damaged
Type of Factor: Event
Date/Time: 
Actors involved: Embraer Legacy

21 Legacy does not see Boeing B737
Type of Factor: UnEvent
Date/Time: 
Actors involved: Embraer Legacy, Boeing B737-800

22 Legacy flies stable northwest at FL370
Type of Factor: Assumption
Date/Time: 
Actors involved: Embraer Legacy

23 Legacy equipped with anticollision device
Type of Factor: State
Date/Time: 
Actors involved: Embraer Legacy, Collision Avoidance System
Annotation: New York Times Oct 01, 2006 quoting "authorities"

24 Boeing B737 equipped with anticollision device
Type of Factor: State
Date/Time: 
Actors involved: Boeing B737-800, Collision Avoidance System
Annotation: New York Times Oct 01, 2006 quoting "authorities"

25 Legacy might have flown off course
Type of Factor: Assumption
Date/Time: 
Actors involved: Embraer Legacy
26 Boeing B737 might have had trouble
Type of Factor: Assumption
Date/Time: Oct 02, 2006
Actors involved: New York Times
Annotation: quoting "Others"

27 Boeing B737 might have lost parts
Type of Factor: Assumption
Date/Time: Oct 02, 2006
Actors involved: New York Times
Annotation: quoting "Others"

28 Parts of B737 might have hit Legacy
Type of Factor: Assumption
Date/Time: Oct 02, 2006
Actors involved: Boeing B737-800
Embraer Legacy
Annotation: New York Times
Oct 02, 2006
 quoting "Others"

29 Possible lack of coordination among air traffic controllers
Type of Factor: Assumption
Date/Time: Oct 03, 2006
Actors involved: Radar operator
Annotation: IHT
Oct 03, 2006
 quoting Brazilian news reports

30 149 passengers and 6 crew die
Type of Factor: Event
Date/Time: Oct 04, 2006
Actors involved: Boeing B737-800
Annotation: New York Times
Oct 04, 2006
 revised to 148 pax, 6 crew by Factor 44

31 Possible negligence or disregard for air-traffic instructions
Type of Factor: Assumption
Date/Time: Oct 04, 2006
Actors involved: New York Times
Annotation: Oct 04, 2006

32 Failure to detect other aircraft
Type of Factor: Assumption
Date/Time: Oct 04, 2006
Actors involved: Boeing B737-800
Embraer Legacy
Annotation: New York Times
Oct 04, 2006

33 Air-traffic controllers not alerted of dangerous flight path
Type of Factor: Assumption
Date/Time: Oct 04, 2006
Actors involved: Radar operator
Annotation: New York Times
Oct 04, 2006
34 Crew ignored instruction to descent from FL370 to FL360 passing Brasilia
Type of Factor: Assumption
Date/Time: 
Actors involved: Embraer Legacy
Annotation: New York Times
Oct 04, 2006
quoting prosecutor Mr. Alves

35 Crew decided to fly higher without alerting controllers
Type of Factor: Assumption
Date/Time: 
Actors involved: Embraer Legacy
Annotation: New York Times
Oct 04, 2006
quoting prosecutor Mr. Alves

36 Boeing B737 flies at FL370
Type of Factor: Process
Date/Time: 29.09.2006 15:58:00
Actors involved: Boeing B737-800
Annotation: New York Times
Oct 02, 2006

37 Boeing B737 visible on radar until accident
Type of Factor: State
Date/Time: 
Actors involved: Boeing B737-800
AirTrafficControl Manaus
Annotation: New York Times
Oct 05, 2006
quoting Braizilian Air Force investigators

39 Technical warning system does not operate as expected
Type of Factor: UnEvent
Date/Time: 
Actors involved: Embraer Legacy
Collision Avoidance System
Annotation: New York Times
Oct 05, 2006
quoting Testimony of Legacy pilots

40 Crew unable to find proper frequency for Manaus controllers
Type of Factor: UnEvent
Date/Time: 
Actors involved: Embraer Legacy
Annotation: New York Times
Oct 05, 2006
quoting Testimony of Legacy pilots

41 No radio contact between Legacy and Brasilia or Manaus until collision
Type of Factor: State
Date/Time: 
Actors involved: Embraer Legacy
AirTrafficControl Brasila (CINDACTA 1)
AirTrafficControl Manaus
Annotation: New York Times
Oct 05, 2006
quoting Testimony of Legacy pilots
42 TCAS on board Legacy is turned off or not working
Type of Factor: Assumption
Date/Time: 
Actors involved: Embraer Legacy
Collision Avoidance System
Annotation: New York Times
Oct 05, 2006
quoting prosecutor Adriano Alves

43 Handover from Brasilia to Manaus required
Type of Factor: Process
Date/Time: 
Actors involved: Embraer Legacy
AirTrafficControl Brasila (CINDACTA 1)
AirTrafficControl Manaus
Annotation: New York Times
Oct 05, 2006
quoting Testimony of Legacy pilots

44 148 passengers and 6 crew die
Type of Factor: Event
Date/Time: 
Actors involved: Boeing B737-800
Annotation: New York Times
Oct 06, 2006
revised passenger count by GOL

45 Controller unable to gauge altitude by radar
Type of Factor: UnEvent
Date/Time: 
Actors involved: Embraer Legacy
AirTrafficControl Brasila (CINDACTA 1)
Annotation: New York Times
Oct 06, 2006
quoting Brazilian officials

46 Single electronic failure on board of the Legacy
Type of Factor: Assumption
Date/Time: 
Actors involved: Embraer Legacy
Annotation: New York Times
Oct 06, 2006
quoting Technical Experts

47 ATC Brasilia makes blind transmission ordering Legacy Crew to switch radio frequencies
Type of Factor: Event
Date/Time: 29.09.2006 15:51:00
Actors involved: Embraer Legacy
AirTrafficControl Brasila (CINDACTA 1)
Annotation: New York Times
Oct 06, 2006
quoting police official
48 Legacy enters jurisdiction of different ATC Center  
Type of Factor: Event  
Date/Time:  
Actors involved: Embraer Legacy  
AirTrafficControl Brasila (CINDACTA 1)  
AirTrafficControl Manaus  
Annotation: New York Times  
Oct 06, 2006  
quoting police official

49 Legacy crew misheard frequency  
Type of Factor: Event  
Date/Time: 29.09.2006 16:53:00  
Actors involved: Embraer Legacy  
AirTrafficControl Brasila (CINDACTA 1)  
Annotation: New York Times  
Oct 06, 2006  
quoting police official

50 Crew unable to tune radio correctly  
Type of Factor: Event  
Date/Time:  
Actors involved: Embraer Legacy  
Annotation: New York Times  
Oct 06, 2006  
quoting police official

51 Legacy transponder resumes broadcasting  
Type of Factor: Event  
Date/Time: 29.09.2006 17:02:00  
Actors involved: Embraer Legacy  
Radar operator  
Annotation: New York Times  
Oct 06, 2006  
quoting Brazilian officials

52 Legacy tracked intermittendly by primary radar  
Type of Factor: Process  
Date/Time: 29.09.2006 16:38:00  
Actors involved: Embraer Legacy  
AirTrafficControl Brasila (CINDACTA 1)  
Annotation: New York Times  
Oct 06, 2006  
quoting General Pinheiro  
refined by Flight International Nov. 21-27, 2006

53 Primary radar gives no altitude information  
Type of Factor: Un-Event  
Date/Time:  
Actors involved: Radar operator  
Annotation: New York Times  
Oct 06, 2006

54 Controller does not warn about possible collision  
Type of Factor: Un-Event  
Date/Time:  
Actors involved: Radar operator  
Annotation: New York Times  
Oct 06, 2006  
quoting General Pinheiro
55 **Software requires altitude information for collision warning**
Type of Factor: State
Date/Time:
Actors involved: Radar operator
Annotation: New York Times
Oct 06, 2006
deduced from 54

56 **Legacy Transponder not broadcasting**
Type of Factor: UnEvent
Date/Time: 29.09.2006 16:02:00
Actors involved: Embraer Legacy
Annotation: New York Times
Oct 06, 2006
quoting General Pinheiro

57 **TCAS requires Transponder information for operation**
Type of Factor: State
Date/Time:
Actors involved: Collision Avoidance System
Embraer Legacy
Annotation: New York Times
Oct 06, 2006

58 **Boeing B737 not advised to change altitude**
Type of Factor: UnEvent
Date/Time:
Actors involved: Boeing B737-800
AirTrafficControl Manaus
Annotation: New York Times
Oct 06, 2006
derived from available information and statement from John Cox

59 **Complete radar and radio coverage over jungle**
Type of Factor: State
Date/Time:
Actors involved: Radar operator
Annotation: New York Times
Oct 06, 2006
quoting General Vilarinha

60 **Discrepancy between Legacy flightpath, altitude and altitude assignment**
Type of Factor: State
Date/Time:
Actors involved:
Annotation: New York Times
Oct 06, 2006

61 **Legacy does not take evasive action**
Type of Factor: UnEvent
Date/Time:
Actors involved: Embraer Legacy
Annotation: Derived from Crew Testimony

62 **Assumed Mid-Air Collision**
Type of Factor: Assumption
Date/Time:
Actors involved: Boeing B737-800
Embraer Legacy
Annotation: superseded by Factor 76
Both aircraft at FL370
Type of Factor: State
Date/Time:
Actors involved: Boeing B737-800
Embraer Legacy
Annotation:

Legacy flies at FL370
Type of Factor: Process
Date/Time: 29.09.2006 15:33:00
Actors involved: Embraer Legacy
Annotation: Testimony of Legacy Crew

Both aircraft on same airway
Type of Factor: Process
Date/Time:
Actors involved: Boeing B737-800
Embraer Legacy
Annotation: Derived from Flightplans

Legacy TCAS manufactured by Honeywell
Type of Factor: State
Date/Time:
Actors involved:
Annotation: New York Times
Oct 08, 2006
quoting ExcelAire

FAA had ordered recall on TCAS model used in Legacy
Type of Factor: Assumption
Date/Time:
Actors involved:
Annotation: New York Times
Oct 08, 2006
quoting ExcelAire
False information, corrected by New York Times, Oct 09, 2006

TCAS device tended to stop broadcasting unexpectedly in certain circumstances
Type of Factor: Assumption
Date/Time:
Actors involved:
Annotation: New York Times
Oct 08, 2006
quoting ExcelAire
TCAS on board Legacy was not recalled by FAA, New York Times Oct 09, 2006

Legacy Flightplan called for FL380 at point of collision
Type of Factor: State
Date/Time:
Actors involved: Embraer Legacy
Annotation: New York Times
Oct 12, 2006
quoting police officials
70 Boeing B737 CVR lost in rainforest
Type of Factor: State
Date/Time: 
Actors involved: Boeing B737-800
Annotation: New York Times
Oct 12, 2006
superseded by Factor 74

71 Brazilian Air Traffic System run by Brazilian Air Force
Type of Factor: State
Date/Time: 
Actors involved: 
Annotation: New York Times
Oct 12, 2006

72 Takeoff Clearance called for FL370 for the entire route
Type of Factor: Event
Date/Time: 
Actors involved: Radar operator
Embraer Legacy
Annotation: New York Times
Oct 28, 2006
quoting Crew lawyer Robert A. Torricella Jr.
supported by Factor 75

generalised, following New York Times, Nov 21, 2006

73 ATC instruction supersedes flight plan
Type of Factor: State
Date/Time: 
Actors involved: Embraer Legacy
Air Traffic Control at Sao Jose dos Campos Airport, Brazil
Annotation: New York Times
Oct 28, 2006
quoting Crew lawyer Roberto A. Torricella Jr.

74 Boeing B737 CVR found
Type of Factor: Event
Date/Time: 
Actors involved: 
Annotation: New York Times
Oct 28, 2006

75 Legacy cleared by Tower Jose dos Campos for FL370
Type of Factor: Event
Date/Time: 29.09.2006 15:11:00
Actors involved: Pilot of Embrear Legacy 600XL
Air Traffic Control at Sao Jose dos Campos Airport, Brazil
Annotation: AP report, IHT
Nov 02, 2006
quoting Brazilian newspaper "Folha"
"Folha" allegedly gained access to CVR transcript
confirmed by Brazilian Air Force preliminary report

76 Legacy collides with Boeing B737
Type of Factor: Event
Date/Time: 29.09.2006 16:57:00
Actors involved: Boeing B737-800
Embraer Legacy
Annotation: New York Times
Nov 21, 2006
19 unsuccessful attempts to reach ATC Brasilia
Type of Factor: Event
Date/Time:
Actors involved: Embraer Legacy
Annotation: New York Times
Nov 21, 2006

Boeing B737 flight plan called for FL410 at point of collision
Type of Factor: State
Date/Time:
Actors involved: Boeing B737-800
Annotation: New York Times
Nov 21, 2006

ATC Manaus instructed Boeing B737 to fly at FL370
Type of Factor: Event
Date/Time:
Actors involved: Boeing B737-800
AirTrafficControl Brasilia (CINDACTA 1)
Annotation: New York Times
Nov 21, 2006

ATC believed the Legacy to fly at FL360
Type of Factor: State
Date/Time:
Actors involved: AirTrafficControl Brasilia (CINDACTA 1)
AirTrafficControl Manaus
Embraer Legacy
Annotation: AP report, IHT
Dec 05, 2006
quoting Brig. Gen. Luiz Carlos da Silva Bueno

Possible Cause for (56)
Type of Factor: Assumption
Date/Time:
Actors involved:
Annotation: structural node

Avionics component has operational problems
Type of Factor: State
Date/Time:
Actors involved: Collision Avoidance System
Annotation: AP report, IHT
Apr 21, 2007
quoting ExcelAire report to Brazilian federal police

Avionics component returned to Honeywell
Type of Factor: Process
Date/Time:
Actors involved: Collision Avoidance System
Annotation: AP report, IHT
Apr 21, 2007
quoting ExcelAire report to Brazilian federal police

Honeywell returned avionics component to Embraer
Type of Factor: Process
Date/Time:
Actors involved: Collision Avoidance System
Annotation: Derived from 83 and 85
85 **Embraer installed avionics component**

Type of Factor: Event

Date/Time:

Actors involved: Embraer Legacy

Annotation: AP report, IHT

Apr 21, 2007

quoting ExcelAire report to Brazilian federal police

86 **One transponder and some radio communications systems installed in avionics component**

Type of Factor: State

Date/Time:

Actors involved: Collision Avoidance System

Annotation: AP report, IHT

Apr 21, 2007

quoting ExcelAire report to Brazilian federal police

87 **Cockpit systems do not effectively alert Legacy crew of anti-collision equipment failure**

Type of Factor: UnEvent

Date/Time:

Actors involved: Collision Avoidance System

Embraer Legacy

Annotation: IHT

May 03, 2007

quoting US air safety investigators

88 **Boeing unable to avoid collision**

Type of Factor: Event

Date/Time:

Actors involved: Boeing B737-800

Annotation:

89 **Boeing crew has no visual identification of conflicting traffic**

Type of Factor: Assumption

Date/Time:

Actors involved: Boeing B737-800

Annotation:

90 **Legacy not advised to change altitude**

Type of Factor: UnEvent

Date/Time:

Actors involved: Embraer Legacy

AirTrafficControl Brasila (CINDACTA 1)

Annotation:

91 **Boeing B737 spirals out of control**

Type of Factor: Event

Date/Time:

Actors involved: Boeing B737-800

Annotation: Flight International

Oct 10-16, 2006

92 **Boeing B737 breaks up in mid-air**

Type of Factor: Event

Date/Time:

Actors involved: Boeing B737-800

Annotation: Flight International

Oct 10-16, 2006
93 Both aircraft on airway UZ6 in opposite directions
Type of Factor: Process
Date/Time: 
Actors involved: Boeing B737-800
Embraer Legacy
Annotation: Flight International
Oct 10-16, 2006

96 Radar coverage limits at border between airspace sectors
Type of Factor: Unspecified
Date/Time: 
Actors involved: 
Annotation: Flight International
Oct 10-16, 2006

97 Notoriously unreliable radio communications in area of collision
Type of Factor: State
Date/Time: 
Actors involved: 
Annotation: Flight International
Oct 10-16, 2006
quoting local pilots

98 Boeing B737 in contact with Manaus
Type of Factor: State
Date/Time: 
Actors involved: Boeing B737-800
AirTrafficControl Manaus
Annotation: Flight International
Oct 10-16, 2006

99 Legacy technically under control of ATC Brasilia
Type of Factor: State
Date/Time: 
Actors involved: Embraer Legacy
AirTrafficControl Brasila (CINDACTA 1)
Annotation: Flight International
Oct 10-16, 2006

100 Controller Brasilia does not warn Legacy
Type of Factor: UnEvent
Date/Time: 
Actors involved: AirTrafficControl Brasila (CINDACTA 1)
Embraer Legacy
Annotation: Splitted up Factor 54

101 Controller Manaus did not warn Boeing B737
Type of Factor: UnEvent
Date/Time: 
Actors involved: AirTrafficControl Manaus
Boeing B737-800
Annotation: Splitted up Factor 54

102 No handover of Legacy from Brasilia to Manaus
Type of Factor: Assumption
Date/Time: 
Actors involved: Embraer Legacy
AirTrafficControl Brasila (CINDACTA 1)
AirTrafficControl Manaus
Annotation: Needed factor for Factor 101
103 Unknown cause
Type of Factor: Assumption
Date/Time: 
Actors involved: 
Annotation: 

104 Legacy winglet severed Boeing B737 hydraulic and electrical lines
Type of Factor: Assumption
Date/Time: 
Actors involved: Boeing B737-800
Embraer Legacy
Annotation: Flight International
Oct. 17-23, 2006

105 Legacy winglet compromised Boeing B737 left wing's aileron actuators
Type of Factor: Assumption
Date/Time: 
Actors involved: Boeing B737-800
Embraer Legacy
Annotation: Flight International
Oct. 17-23, 2006

106 Legacy winglet deforms Boeing B737 wing
Type of Factor: Assumption
Date/Time: 
Actors involved: Boeing B737-800
Embraer Legacy
Annotation: Flight International
Oct. 17-23, 2006

107 Procedure to maintain current flight level "for a short time"
Type of Factor: Process
Date/Time: 
Actors involved: Embraer Legacy
Annotation: Flight International
Oct. 17-23, 2006

citing ICAO procedures for pilots under ATC control by radar, who are aware they have lost communication

108 Legacy does not change altitude
Type of Factor: Event
Date/Time: 
Actors involved: Embraer Legacy
Annotation: Derived from 64, 90, 107

109 Boeing B737 does not take evasive action
Type of Factor: UnEvent
Date/Time: 
Actors involved: Boeing B737-800
Annotation: Flight International
Oct 21-27, 2006

110 ATC Brasilia looses secondary radar information on Legacy
Type of Factor: State
Date/Time: 29.09.2006 16:02:00
Actors involved: AirTrafficControl Brasila (CINDACTA 1)
Embraer Legacy
Annotation: Flight International
Oct 21-27, 2006
111 ATC Brasilia has lost primary radar contact with Legacy
Type of Factor: State
Date/Time: 29.09.2006 16:30:00
Actors involved: AirTrafficControl Brasilia (CINDACTA 1), Embraer Legacy

112 ATC Brasilia transmits blindly to Legacy
Type of Factor: Process
Date/Time: 29.09.2006 16:26:00
Actors involved: AirTrafficControl Brasilia (CINDACTA 1), Embraer Legacy

113 Secondary radar information transmits altitude information
Type of Factor: State
Date/Time:
Actors involved:
Annotation:

115 ATC monitoring system automatically updates altitude information on controller's display
Type of Factor: Process
Date/Time:
Actors involved: AirTrafficControl Brasilia (CINDACTA 1)
Annotation: Flight International Dec. 05-11, 2006 quoting IFATCA

116 Legacy passes waypoint Brasilia
Type of Factor: Event
Date/Time: 29.09.2006 15:56:00
Actors involved: Embraer Legacy
Annotation: Flight International Dec. 05-11, 2006 quoting IFATCA

117 System “feature”: Displayed altitude set to altitude given in flight plan after passing of waypoint
Type of Factor: State
Date/Time:
Actors involved: AirTrafficControl Brasilia (CINDACTA 1)
Annotation: Flight International Dec. 05-11, 2006 quoting IFATCA

118 Brazilian military 3-d primary radar provides flight altitude information
Type of Factor: State
Date/Time:
Actors involved:
Annotation: Flight International Dec. 05-11, 2006 quoting IFATCA

119 Military Primary radar altitude information presented to civilian controllers
Type of Factor: State
Date/Time:
Actors involved:
Annotation: Flight International Dec. 05-11, 2006 quoting IFATCA
120 Military 3-D primary radar altitude information inaccurate
Type of Factor: State
Date/Time:
Actors involved:
Annotation: Flight International
Dec. 05-11, 2006
quoting IFATCA

121 Long-Range triangulation
Type of Factor: Process
Date/Time:
Actors involved:
Annotation: Flight International
Dec. 05-11, 2006
quoting IFATCA

122 Controller does not trust primary radar altitude information
Type of Factor: Assumption
Date/Time:
Actors involved: AirTrafficControl Brasila (CINDACTA 1)
Annotation:

123 Legacy enters UZ6
Type of Factor: Event
Date/Time:
Actors involved: Embraer Legacy
Annotation:

124 UZ6 connects Manaus and Brasilia
Type of Factor: State
Date/Time:
Actors involved:
Annotation:

125 Boeing B737 uses UZ6
Type of Factor: State
Date/Time:
Actors involved: Boeing B737-800
Annotation:

126 Legacy flightplan
Type of Factor: State
Date/Time:
Actors involved: Embraer Legacy
Annotation:

127 Planned altitude change from FL370 to FL360 after passing waypoint Brasilia
Type of Factor: State
Date/Time:
Actors involved:
Annotation: Flight International
Dec. 05-11, 2006

128 Planned altitude change from FL360 to FL380 after passing TERES
Type of Factor: State
Date/Time:
Actors involved: Embraer Legacy
Annotation: Flight International
Oct. 17-23, 2005
129 Legacy crew identifies TCAS failure
Type of Factor: Event
Date/Time: 
Actors involved: Embraer Legacy
Collision Avoidance System
Annotation: Flight International
May 8-14, 2007

130 TCAS unit displays "TCAS OFF in small white letters on flight display
Type of Factor: State
Date/Time: 
Actors involved: Embraer Legacy
Collision Avoidance System
Annotation: Flight International
May 8-14, 2007

131 ATC shift change
Type of Factor: Event
Date/Time: 
Actors involved: AirTrafficControl Brasila (CINDACTA 1)
Embraer Legacy
Annotation: Flight International
May 8-14, 2007

132 Controller's electronic flight strip showed Legacy as assigned to FL360
Type of Factor: Event
Date/Time: 
Actors involved: AirTrafficControl Brasila (CINDACTA 1)
Embraer Legacy
Annotation: Flight International
May 8-14, 2007

133 Boeing B737 flightplan requested FL370 as cruise altitude
Type of Factor: State
Date/Time: 
Actors involved: Boeing B737-800
Annotation: NTSB Safety Recommendation
May 2, 2007

134 No aural warning on TCAS failure
Type of Factor: UnEvent
Date/Time: 
Actors involved: Collision Avoidance System
Embraer Legacy
Annotation: NTSB Safety Recommendation
May 2, 2007

135 Boeing B737 does not change altitude
Type of Factor: Event
Date/Time: 
Actors involved: Boeing B737-800
Annotation: 

136 Legacy maintains FL370
Type of Factor: State
Date/Time: 
Actors involved: Embraer Legacy
Annotation: 

137 Placing of Legacy crew feet might have disabled Legacy communication devices
Type of Factor: Assumption
Date/Time: 
Actors involved: 
Annotation: 
### Actor List

<table>
<thead>
<tr>
<th>Role</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GOL Flight 1907</td>
<td>Boeing B737-800</td>
</tr>
<tr>
<td>Embraer Legacy</td>
<td>Embraer Legacy</td>
</tr>
<tr>
<td>Radar operator</td>
<td>Radar operator</td>
</tr>
<tr>
<td>ATC Brasilia</td>
<td>AirTrafficControl Brasila (CINDACTA 1)</td>
</tr>
<tr>
<td>ATC Manaus</td>
<td>AirTrafficControl Manaus</td>
</tr>
<tr>
<td>TCAS System</td>
<td>Collision Avoidance System</td>
</tr>
<tr>
<td>Joseph Lepore</td>
<td>Pilot of Embrear Legacy 600XL</td>
</tr>
<tr>
<td>Sao Jose dos Campos Tower</td>
<td>Air Traffic Control at Sao Jose dos Campos Airport, Brazil</td>
</tr>
</tbody>
</table>