

Analysing the Brazilian Mid-Air

**“News-Based” Analysis of the Mid-Air
Collision over the Amazon Jungle
on Sep. 29, 2006**

Jörn Stuphorn
stuphorn@causalis.com

The Accident (1)



- GOL Flight 1907 reported missing on Sep. 29, 2006
 - Boeing B737-800 operated by Brazilian carrier GOL
 - Radar contact lost at 16:57 BST (Brazil Standard Time)
 - Flight from Manaus to Brasilia
 - Flight 1907 departed Manaus at 15:36 BST
 - rumour said, Boeing could have collided in air with smaller aircraft

The Accident (2)



- Embraer Legacy 600 operated by ExcelAire Inc.
 - Maidenflight from Sao Jose dos Campos via Manaus to U.S.
 - Emergency landing after colliding with „shadow“
 - Legacy damaged at wing and tail
 - Legacy landed at Cachimbo Air Force Base
 - Cachimbo in vicinity (130 miles) of last known position of GOL Flight 1907

The Accident (3)



- To forestall analysis:
 - Mid-Air collision between Boeing B737 and Legacy took place
- Area of collision lies at the border between
 - ATC Brasília and
 - ATC Manaus
- Radar coverage at its limits
- Radio contact notoriously weak

The Analysis

- Information-Base used:
 - collection of newspaper clippings
- Reports analysed in chronological order
 - using information from prior reports
- Uncertain factors and rumour as factors in the analysis allowed
 - leads to graph with increased complexity
 - revision necessary, when central rumour
 - becomes valid or invalid or
 - has to be redrafted

Why „News Based“ ?

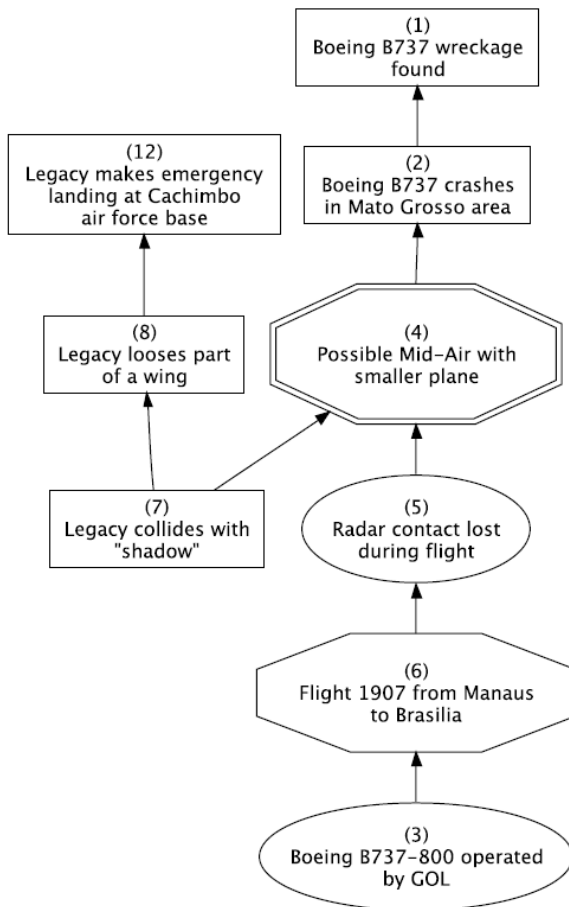
- I am not involved in ongoing investigation
 - Information can only be gathered through newspapers and public statements
 - Fairly easy because of large media interest in the accident
- Accident of Interest because
 - Mid-Air collision between two modern aircraft in controlled airspace
 - Boeing B737-800 was delivered 3 weeks before accident
 - Embraer Legacy 600 was on delivery flight
 - Second mid-air collision in controlled airspace in 6 years

What „News“ were used in Analysis?

- Reports from
 - International Herald Tribune
 - online sources
 - mostly reports by agencies like Reuters or Associated Press
 - New York Times
 - online sources (TimesSelect)
 - from Sep. 30, 2006 up to May 05, 2007
- Further sources for greater detail in information
 - clippings from „Flight International“ and „Aviation Week“
 - NTSB Advisory and recommendation

Very limited Information

IHT Sep. 30, 2006

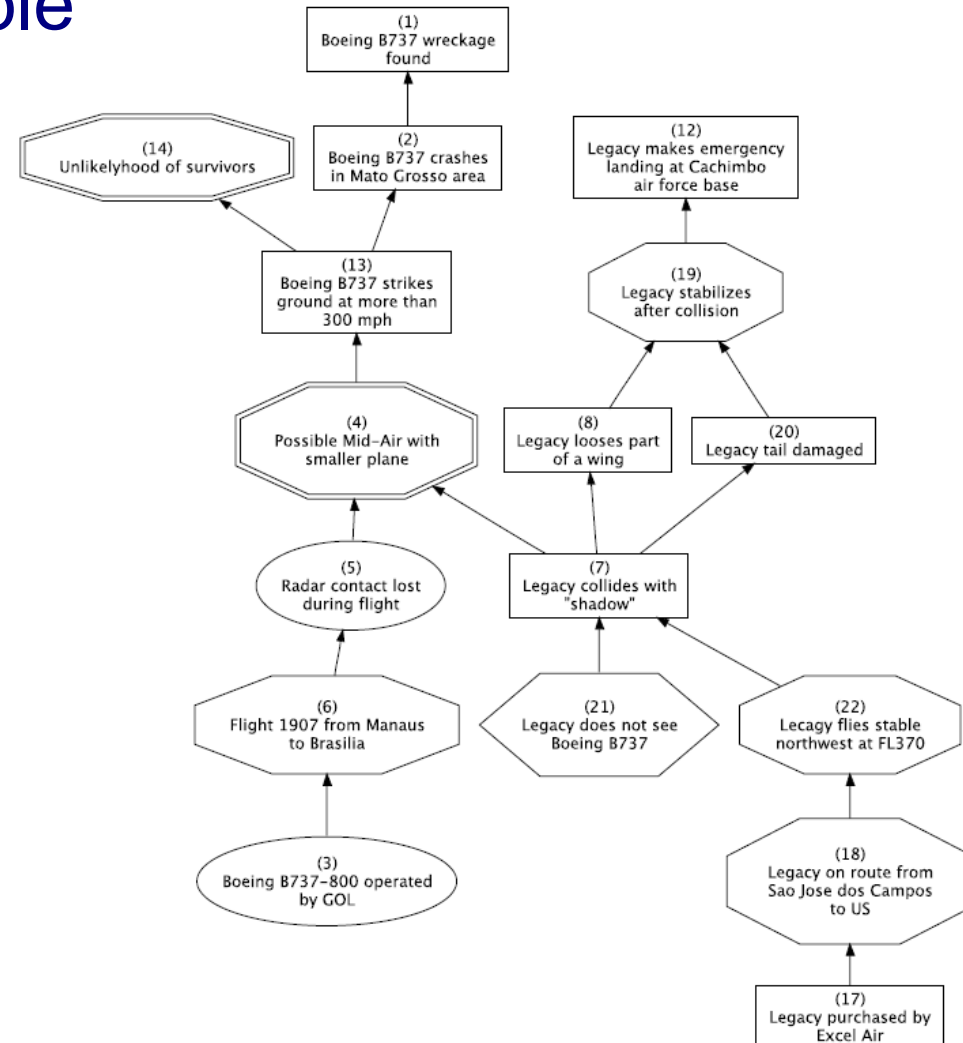


- Uncertain, if mid-air collision has occurred
 - uncertain, if Legacy emergency and Boeing crash are related
- Directions of further investigation:
 - What caused damage on Legacy?
 - Why did Boeing crash?
 - Did Legacy and Boeing collide?

More Details come Public

- Mid-Air collision „possible“
- Information on Legacy flight
- Statements from Legacy crew

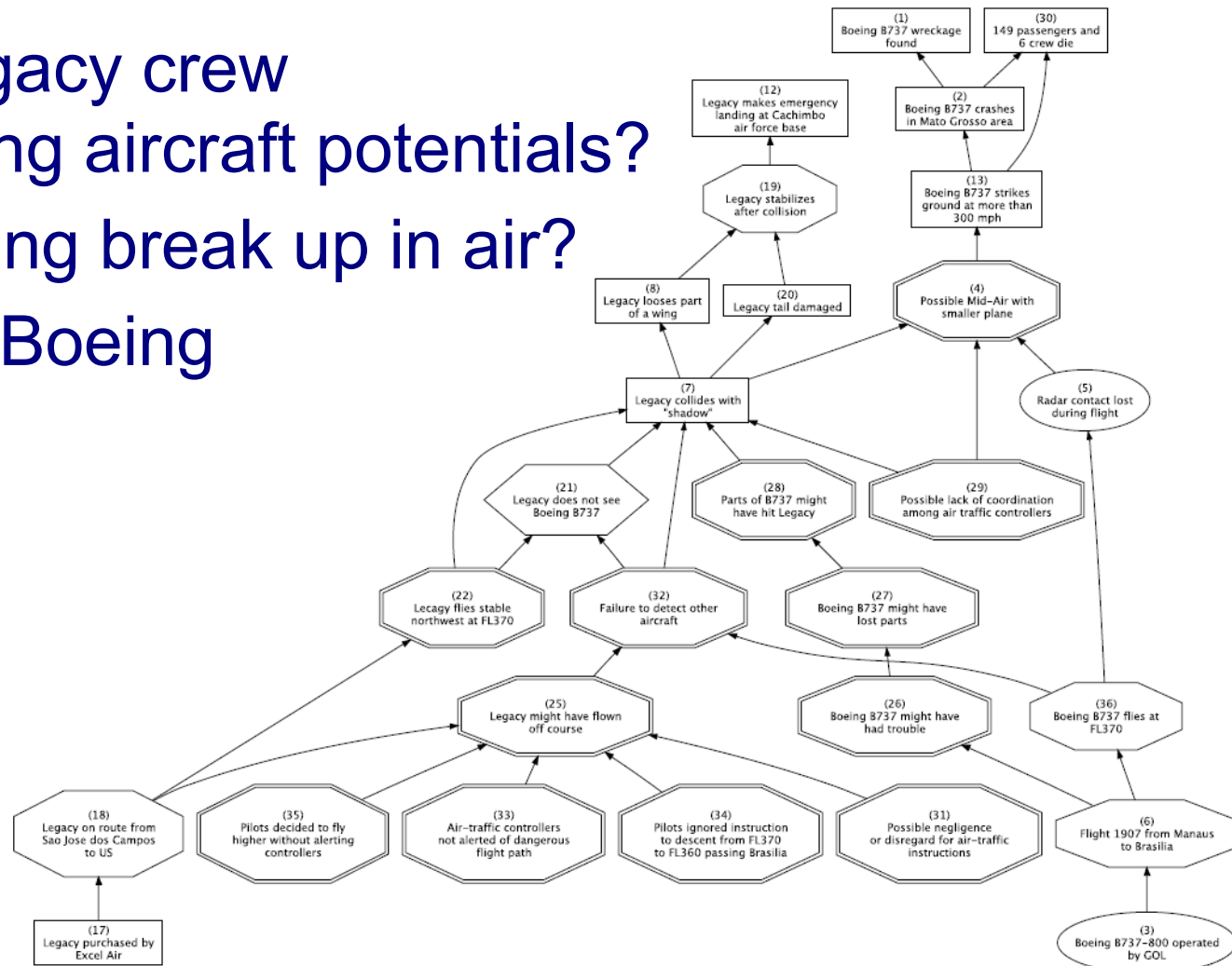
IHT Oct. 2, 2006



Speculation on the Causes

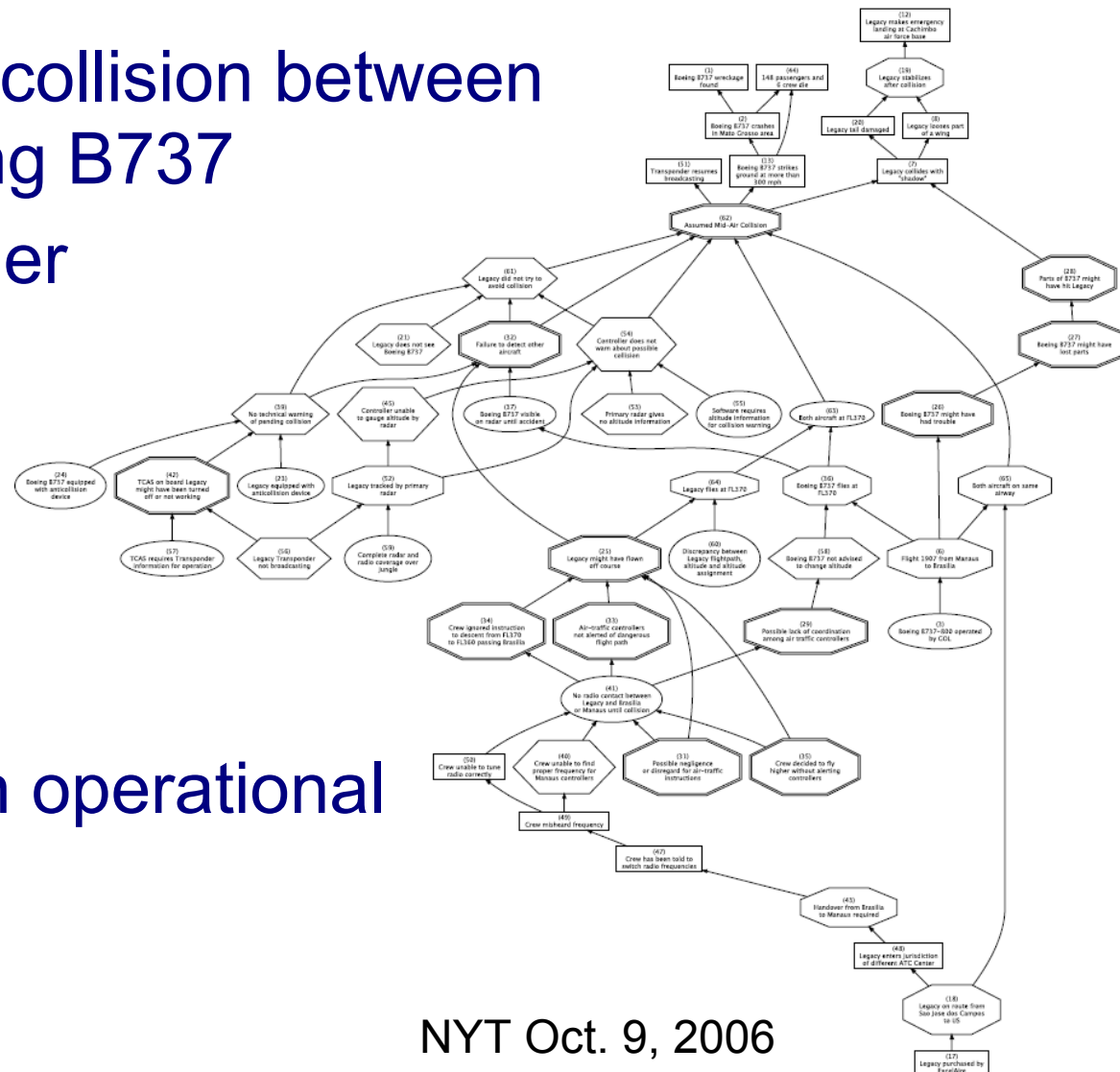
NYT Oct. 4, 2006

- Was the Legacy crew demonstrating aircraft potentials?
- Did the Boeing break up in air?
- Did parts of Boeing hit Legacy?



Radio-Contact and Transponder

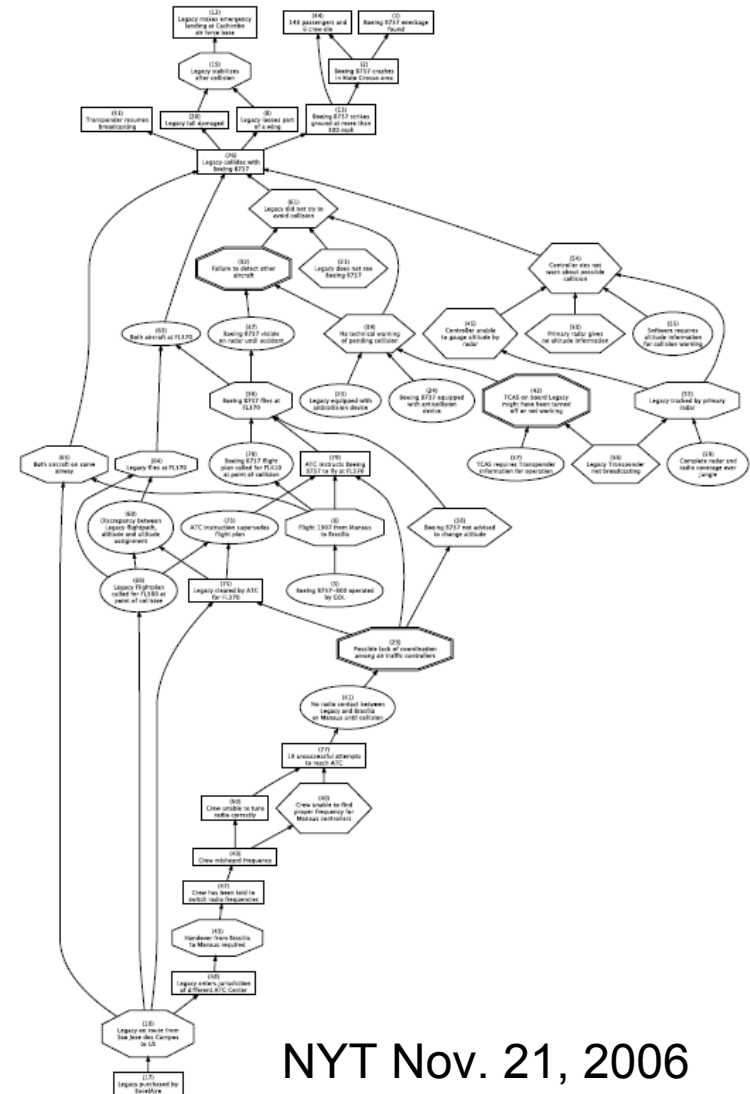
- Assumed Mid-Air collision between Legacy and Boeing B737
- Legacy transponder was not working
- Intermittent radio contact between Legacy and ATC
- TCAS is based on operational transponder



NYT Oct. 9, 2006

Clearances and Flight Plans

- ATC cleared both aircraft for FL370 on the same airway
 - Boeing submitted flight plan requesting FL370 as cruise altitude
 - Legacy submitted flight plan
 - FL370 up to Brasilia
 - FL360 up to TERES
 - FL380 after TERES
 - Legacy was cleared by ATC for FL370



NYT Nov. 21, 2006

System Failures (1)

- TCAS error messages presented
 - Newspapers IHT and NYT only distributed the information that the Legacy's crew has missed the TCAS failure message
 - NTSB Safety Recommendation provided very detailed information
 - Failure notice displayed as static text
 - using inconspicuous colouring
 - no aural signal used to alert the crew

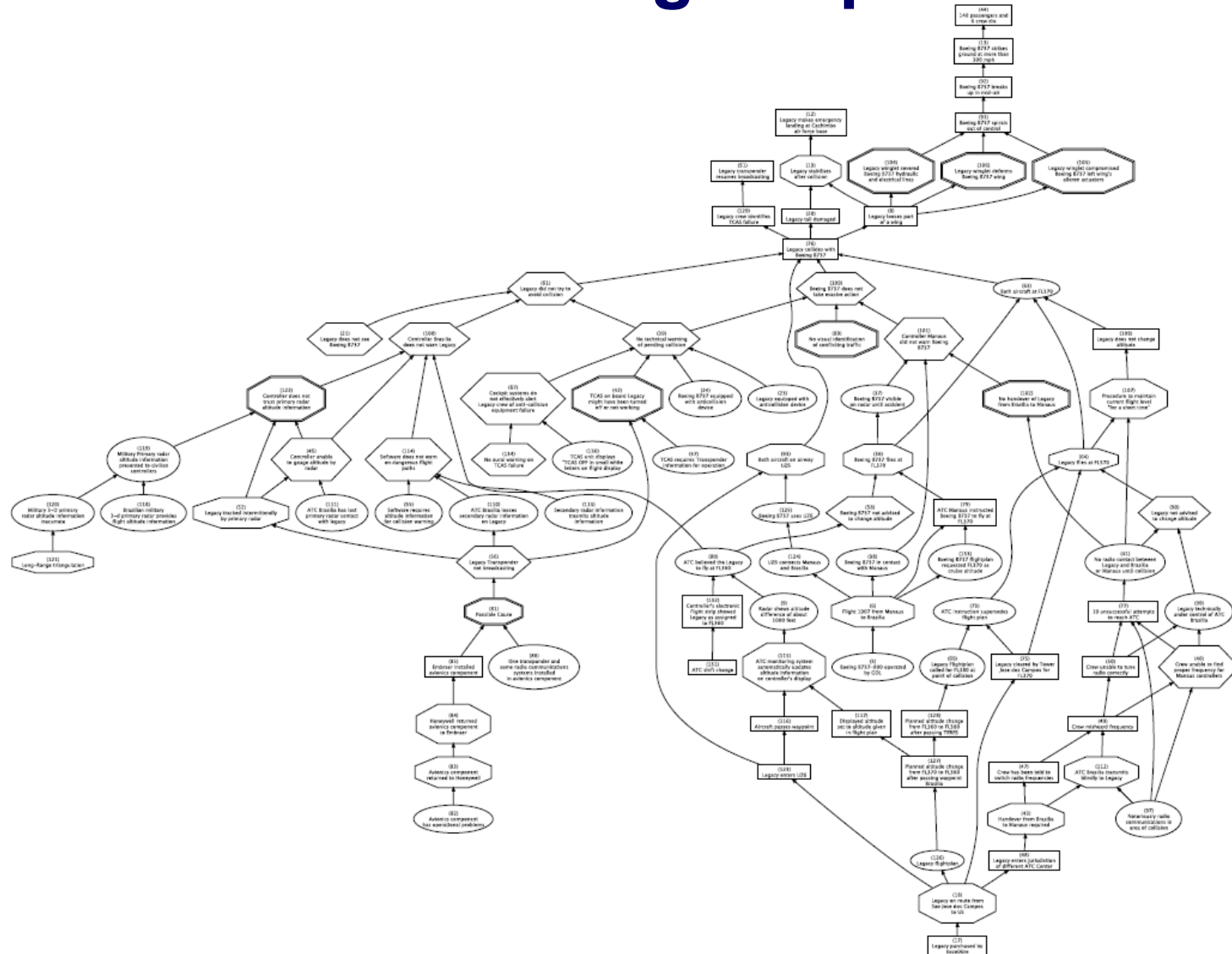
Expanding Information-Base and Graph

- Flight International provided detailed additional information
 - Events after collision
 - Flight Routes and Plans
 - ATC related Information
 - ATC assignment of aircraft
 - ATC interna (shift-change)
 - Details on ATC software characteristics
- NTSB recommendation
 - TCAS failure seems to have been overlooked

System Failures (2)

- ATC software „updated“ assigned altitude automatically
 - The brasilian ATC software switches the assigned altitude for an aircraft to the altitude requested by the flightplan
 - It is not verified that aircraft is cleared for this altitude

The Resulting Graph



Apparent causes of the Collision

- Collision took place after failure to handover Legacy from ATC Brasilia to ATC Manaus
 - Radio coverage not 100%
 - Radar coverage at its limits
- Transponder on-board Legacy not operating
 - Legacy crew did not notice transponder failure
- ATC Manaus did not advise Boeing to change altitude
 - Radar software displayed assumed altitude
 - Software automatically sets the displayed altitude to planned altitude after waypoint is passed

Apparent Causes of the Collision

- Legacy crew did not recognise TCAS failure
 - Failure signal could be overheard
- Legacy wing-tip could inflict severe damage on Boeing
- TCAS does not operate without transponder info
- ATC unable to judge altitude correctly
- ATC software automatically changes displayed information without prior verification

Questions Raised:

- Had Legacy crew experience with Brazilian airtraffic conditions?
- What information was available to ATC
 - ATC Manaus received 3 minutes after the collision transponder signals from the Legacy
- Was ATC Manaus informed by Brasilia on status of Legacy?
 - Why has Manaus not intervened?
- Why was the Transponder inactive?
- Why have neither Boeing nor Legacy seen each other?

Lessons Learned - Analysis Method

- WBA can be used for analysing incidents with
 - ongoing investigation
 - uncertain information base
 - incomplete information
- WBA can point out
 - directions for further investigation
 - problematic argumentation
 - unclear information
- Assumptions have to be questioned and removed when enough detailed information is available

Lessons Learned - Ongoing Investigations

- Audit trail for changes in factors could support analysis report
- Possibility to connect investigation directions to analysis could be helpful
- Substitution of factor type „assumption“ with more detailed classification, e.g.
 - assumed event,
 - assumed un-event, or
 - assumed state

Lessons Learned - Information Sources

- Higher level of detail by use of specialised newspapers (at least in this case)
- Newspapers tend to contradict with each other
 - target audience is different
 - quoted sources present different view on incident

The End

Thanks for listening!