

PRELIMINARY CAST ANALYSIS OF THE LAMIA CP-2933 ACCIDENT



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Disclaimer

The opinions expressed in this presentation are the author's own and do not reflect the view of the ITA nor IAE, both institutes from the Brazilian Air Force.

LaMia Accident (Nov 2016)

This study propose apply CAST in the LaMia aircraft accident, happened in Colombia in 2016, killing 71 people.



Before the preliminary accident report(*) was published, this CAST analysis was also based on information from journals and websites

(*) PRELIMINARY REPORT, Investigation COL-16-37-GIA - Fuel Exhaustion, Accident on 29, November 2015, Aircraft AVRO 146-RJ85, Reg. CP2933, La Unión, Antioquia – Colombia, Grupo de Investigación de Accidentes & Incidentes (GRIAA), Bogotá, Colombia. 22 Dec 2016.

LaMia Accident (Nov 2016)

On the night of Nov. 28th, the LaMia CP-2933 aircraft flew from Santa Cruz de la Sierra, Bolivia to Rio Negro/Medellín, Colombia, carrying 73 passengers and 4 crew members. Most of the passengers were members of the Brazilian team Chapecoense Soccer Association, who were traveling from Sao Paulo to play the final game of the South America Soccer Cup against Atlético Nacional in Medellin, Colombia.

Approximately 22h33min (local time) the aircraft crashed in the hill (Cerro Gordo), countryside just outside La Unión in Antioquía Department, three minutes for landing, killed 71 people.

Founded in 2015, LaMia had in operation in 2016 only one Avro RJ85.

The Preliminary Report confirms that the plane carrying Chapecoense team ran out of fuel.



LaMia Accident (Nov 2016)



Source: The Guardian, UK

The LaMia was based in Bolivia and was unable to get the necessary permission to operate from Sao Paulo to Rio Negro/Colombia (due to Chicago Convention). Arrangements were made for the passengers to be flown from São Paulo with another regular flight company to Santa Cruz/Bolivia where there, they boarded the LaMia charter flight.

Events Involved in the LaMia Accident

ID	Event	Questions Raised
1	After the arrival of the aircraft at Santa Cruz around 6pm, the aircraft was refueled, with witness information that the commander have had instructed the maximum fuel load of 9,300 kg. The aircraft weight at takeoff was 42,148 Kg, when the maximum capacity is 41,800 Kg	----
2	The VVI AT officer requested that the flight plan presented should be changed and re-submitted. The dispatcher apparently had refused to change any of the details. At 8:30 pm the officer sent a report to the DGAC regional office giving details of the incident, stating that under the regulations the office was not empowered to reject the submission.	Why the dispatcher not accepted to make the changes, and what kind of authority the AT Controller officer should have had in this situation?
3	The aircraft took off at 10:18 pm and the CVR recorded some of the crew had thought the aircraft would be refueling enroute at Cobija Airport (located close to the border between Bolivia and Brazil), but normally only operates during daylight hours. On 28 November 2016, this airport closed at 10:43 pm	Why the rest of the crew was not sure about where they should refuel in route?

Events Involved in the LaMia Accident

ID	Event	Questions Raised
4	After 42min flying, one of the pilots say that they would divert to Bogota to refuel but 10 min after, the aircraft was transferred to Colombian ATC to continue to the final destination, Rionegro/Medellin Airport	Why did the pilot ignore refuel, on his last chance to do that? Overconfidence that everything would well, as planned?
5	At 2:49 am, when approaching to MDE Airport (Medellin), the pilot asked for priority to land because of fuel problems, without making a formal distress call.	The pilot did not clearly state what was going on because believed that would have control of the situation?
6	In the same time of LaMia approaching, another plane from airline VivaColombia asked for emergency because it had already suffered a fuel leak.	----
7	The air traffic controller responded to Lamia saying that the runway at Medellin would re-open in about seven minutes and suggested will be given priority to land over other flights operated by Avianca.	Some newspapers questioned whether the ATC would have given emergency priority to Colombia flight. Why did not the Lamia's pilot report his situation correctly?

Events Involved in the LaMia Accident

ID	Event	Questions Raised
8	At 2:57am the LaMia pilot declare a fuel emergency, alerted to ATC to a “total electrical and fuel failure” and repeatedly shouted: “Give me vectors”.	-----
9	AT Controller said ‘You are at 8.2 miles from runway, what is your altitude now?’ After 2:58 am no further response was received from LaMia 2933, despite repeated calls by ATC.	-----
10	After 3:10am, the Civil Aviation Authority of Colombia was alerted of the disappearance and subsequent location of the LaMia AVRO RJ85 accident in “Cerro Gordo”, Municipality of La Unión, Antioquia.	-----

CAST Analysis

Establishing the Fundamentals for the Analysis: identification of the hazards that lead to the loss, and the (safety) constraints that must be satisfied in the design and operation

Construct the safety control structure: how the system was designed to work, identifying component responsibilities (requirements) and modeling the control actions (related to the controllers) and feedback loops

For each component (controller) identifying:

- (1) The controller's responsibilities related to preventing the loss
- (2) Their unsafe control actions (UCAs) or lack of actions
- (3) Why they behaved unsafely (the process model flaws/contextual factors)
- (4) Summary of the role of the controller in the accident
- (5) Generate recommendations that will eliminate or reduce the unsafe behavior

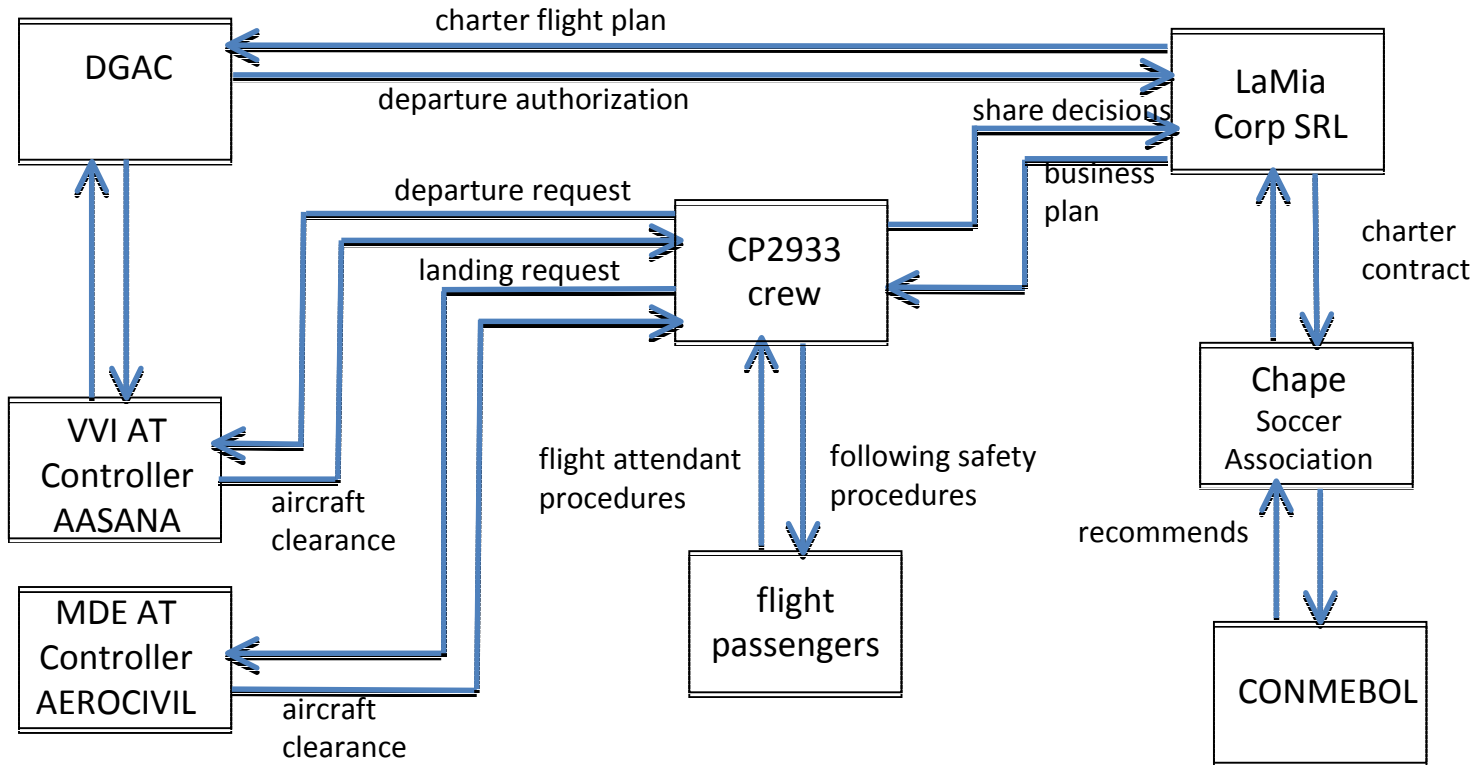
CAST: Identify System Hazard and Safety Constraints

System hazard: flying without enough fuel on board

Safety constraints:

1. The air company dispatcher must be supply an flight plan with enough fuel to the enroute plus endurance flight.
2. Pilots must be assure that the aircraft have enough fuel to the enroute plus reserve fly of 30 minutes at 1,500 feet above the aerodrome.
3. Air Traffic Control must take measures to avoid that the aircraft fly without enough fuel on board.

CAST: Safety Control Structure



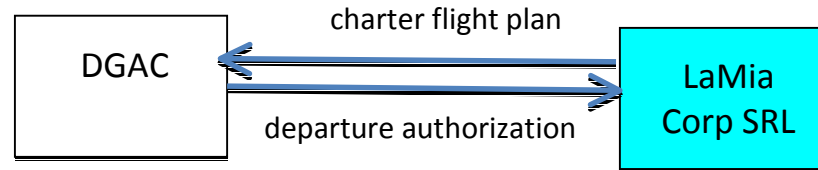
LaMia Corp SRL : Línea Aérea Mérida Internacional de Aviación

DGAC (General Directorate of Civil Aviation, Bolivia) : is responsible for the technical supervision of aircraft in Bolivia and to approve the flight plan

Chape: Chapecoense Soccer Association, Brazil, including players, coaching and other club staff , guests and journalists

CONMEBOL: South American Soccer Confederation, South America.

Controller: LaMia Corp SRL



Controller's responsibilities:

Provide the charter flight plan according safety regulations

Unsafe Control Actions UCA:

UCA.4 Asked authorization without the appropriate reserve fuel when submitted the flight plan

UCA.5 Not included SID when submitted the flight plan

UCA.6 Not included second alternative airport in the route when submitted the flight plan

Process/Mental Model Flaws:

Had an inaccurate view of the risk that existed in using limited fuel reserve

Believed that the aircraft enroute fuel is enough

Summary of the role of the controller in the accident

The LaMia defined a flight plan for the journey between Santa Cruz and Medellin as 4 hours 22 minutes, the same of aircraft's endurance, giving him absolutely no margin for error.

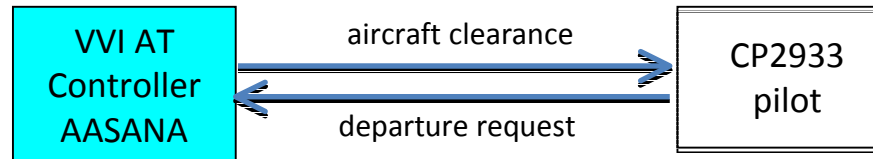
LaMia not included a SID from Santa Cruz, no second alternate airport, and the estimated enroute time was the same as the endurance.

The dispatcher had only signed the plan but had not printed his name

Recommendations:

Review the company's business plan and the risks involved

Controller: VVI AT Controller (take off)



Controller's responsibilities:

Provide clearances to aircraft for safe departures
Observe the flight plan in detail and take notes regarding safety

Unsafe Control Actions UCA:

UCA.7 Issued takeoff clearance when the flight plan compromised safety

Process/Mental Model Flaws:

Believed that the pilot had control of the situation
VVI AT Controller believed that had no power to ground the aircraft

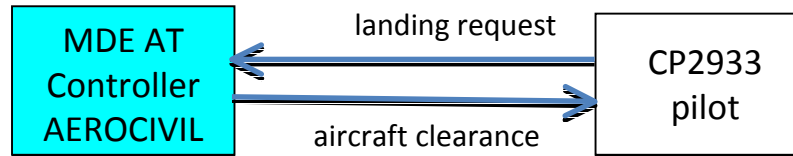
Summary of the role of the controller in the accident

The VVI AT Controller requested that the flight plan was changed and re-submitted. The dispatcher argued that the actual flight time would be less than that on the plan.

Recommendations:

AASANA (ATC in Bolivia) must have authority to allow or not aircrafts to take off or landing in case of unsafe circumstances, such as misunderstand related to the flight plan

Controller: MDE Controller (landing)



Controller's responsibilities:

Operate the air traffic accordance with ATC clearances and Colombian Aeronautical Regulations, RAC

Unsafe Control Actions UCA:

UCA.8 The MDE AT Controller could not verify in time when LaMia was in an emergency situation (not only priority landing)

Process/Mental Model Flaws:

It would not be "uncommon" for air traffic controllers to prioritize a national flight (in this case, an unscheduled VivaColombia flight) higher than a foreign charter flight

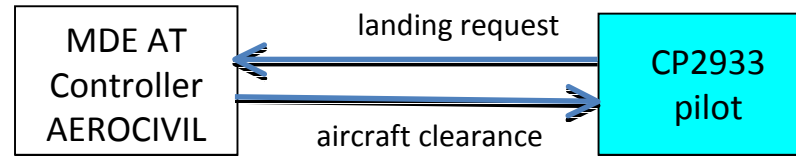
Summary of the role of the controller in the accident

Need to manage two aircraft requesting priority and emergency landing at the same time

Recommendations:

Improve the communication between MDE AT Controller and the pilot in order to avoid misinterpretation about the landing priority and procedures about approach, taxi, departure or checking

Controller: CP2933 pilot



Controller's responsibilities:

Operate the aircraft in accordance with LaMia procedures, ATC clearances and DGAC regulations.

Provide enough fuel to reach destination plus one missed approach plus extra 30 minutes

Unsafe Control Actions UCA:

UCA.9 The aircraft was fueled with total autonomy (AVR-RJ85 autonomy=1,600 nautical miles) even when the fuel was not enough to destination (VVI to MDE=1,588 nautical miles ->

UCA.10 The pilot didn't inform correctly the aircraft situation to MDE AT Controller when the fuel was almost exhausted

Process/Mental Model Flaws:

To postpone a chartered flight in a time-sensitive industry is not good for business

Pilot is one of the LaMia's owner

Overconfidence of the pilot about aircraft flight autonomy

Believe in perform a normal cruise flight, good conditions of the air traffic in the moment of landing

The penalty for any air company caught flouting regulations is huge

Summary of the role of the controller in the accident

The pilot did not clearly the emergency situation because believed that would have control of the situation and to avoid penalties

Recommendations:

Improve the communication between pilots and AT Controller in order to avoid misinterpretation about the flight plan and emergency situations

FINAL COMMENTS

The magnitude of the impact and the subsequent damages of the accident - without fire, suggests that the aircraft suffered from fuel exhaustion.

The General Director of LaMia Corp and former Director of DGAC are father and son, respectively (LaMia CEO was arrested accused to traffic of influence).

The VVI Air Traffic Controller, who was responsible for authorizing the plane to take off, filed an petition of refuge in the border town of Corumba, and was released to remain temporarily in Brazil while their legal status is resolved (she requested that status by said pursued by the authorities of his country).

FINAL COMMENTS

"LaMia had previous experience transporting football teams. They had flown the Argentina national team as well as Bolivia and a total of 30 teams." (CONMEBOL)

The Colombian media reported that the Avro RJ85 jet made four other trips with soccer teams (such as the Argentina) where it almost ran out of fuel, since August.

Since Dec 1st, DGAC suspended the operational license of LaMia Corp.



FINAL COMMENTS

Based on the preliminary report, the LAMIA accident investigation will continue:

*"The investigation into the accident continues and will concentrate on issues related to **fuel planning, decision making, operational oversight, survival and organizational oversight.**"*

LaMia Preliminary Report, GRIAA, Dec. 2016.



This is a preliminary version of LaMia's CAST. However, CAST has already been able to observe aspects that GRIAA intends to investigate in future, such as:

Fuel planning: UCA.4, UCA.6

Decision making: UCA.1, UCA.2, UCA.3, UCA.7, UCA.8

Operational Oversight: CAST Recommendations of the VVI ATC AASANA controller

Organizational Oversight: CAST Recommendations of the DGAC controller

Thank you

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