



MINISTÉRIO DAS OBRAS PÚBLICAS, TRANSPORTES E COMUNICAÇÕES
GABINETE DE PREVENÇÃO E INVESTIGAÇÃO DE ACIDENTES COM AERONAVES
GPIAA

FINAL INCIDENT REPORT

Ultimate Aircraft Services

Cessna 208B

N21070

Flores Airport

24th of December 2008

ESTÁ CONFORME O ORIGINAL

GPIAA

Homologo nos termos do n.^o
3 do art.^o 26.^o do D.L. 318/99,
de 11/02/1999

2009-06-12

O Director,

A handwritten signature in blue ink, appearing to read 'Fernando Ferreira dos Reis', is written over a horizontal line.

Fernando Ferreira dos Reis

NOTE

This report states the technical findings regarding the circumstances and probable causes which led to this incident.

In accordance with Annex 13 to the International Civil Aviation Organisation Convention, Chicago 1944, Council Directive 94/56/EC, 21st NOV 1994, and article 11th n^o 3 of Decree-Law n^o 318/99, 11th AUG 1999, the sole purpose of this investigation is to prevent aviation accidents. It is not the purpose of any such accident investigation and the associated investigation report to apportion blame or liability.

The only aim of this technical report is to collect lessons which may help to prevent future accidents.

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SYNOPSIS

By 10:43 UTC¹, on the 24th of December 2008, Cessna aircraft, registration N21070, took-off from St. Johns (CYYT) airport, in Canada, with destination Sta Maria (LPAZ) airport, in Azores, Portugal, with estimated time of arrival (ETA) at 18:13.

It was a delivery flight and the aircraft was equipped with extra fuel tanks, allowing the extension of flight route legs, especially for Atlantic Ocean crossing.

After about three hours, flight time, the pilot noticed there was some problem with fuel transfer from auxiliary tanks into right main tank. He tried to solve the fault, unsuccessfully and decided to land in Flores island, instead of continue to destination.

Landing in Flores was uneventful (at 16:58). Next day fuel transfer system became functional and flight was continued to final destination.

***This report has been released in Portuguese and English Languages.
In case of conflict, Portuguese version will take precedence.***

¹ - All times referred in this report, unless other specified, are UTC (Universal Time Coordinated) times. On that date, local time in CYYT was equal to UTC -3:30 and in Azores was equal to UTC -1:00.

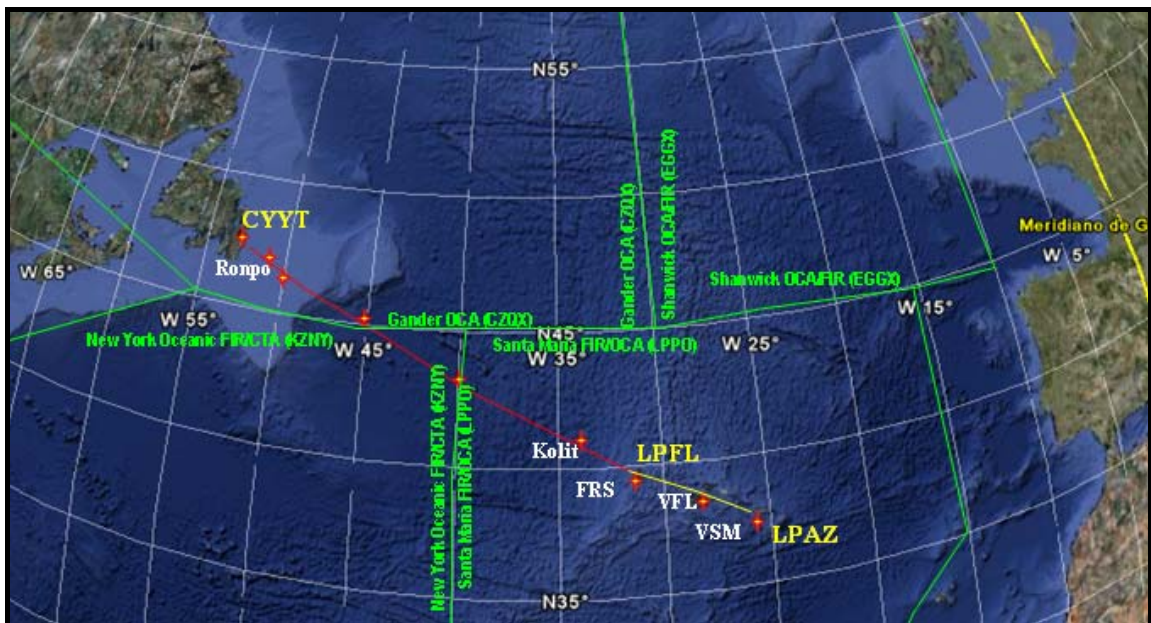
1. FACTUAL INFORMATION

1.1 History of the Flight

Cessna 208B s/n 208B2014 aircraft, USA registration N21070, had to be delivered to its buyer (in Middle East) and a delivery flight was programmed.

Arriving at St. Johns (CYYT) on the 21st of December, the aircraft has been refuelled at 19:30, that same day, and it was hangared at Irving Aviation Services until the 23rd, when it was expected to fly to Sta. Maria (LPAZ), in Azores. By that morning the weather was windy & cold, the aircraft became ice covered and no de-icing facilities were available, forcing to the postponement of the flight for the next day. With weather improvement forecasted for the 24th, the flight to Sta. Maria was planned to leave St. Johns by 10:30 (seven o'clock local), apparently leaving the aircraft outside at Shell Aerocentre FBO.

With full tanks (692USG \approx 13H00) and only one pilot aboard, N21070 took-off from CYYT at 10:43 and proceeded according planned routing (*picture nr. 1*) climbing to FL130.



Picture Nr: 1

As per pilot operating instructions, pilot took-off on main tanks and selected right wing fuel tank after level-off. Auxiliary tanks were selected only after $\frac{1}{2}$ right main tank consumption.

After passing 040°W (*approximately 3 hours flight time*) the pilot noticed that fuel was not flowing regularly from auxiliary tank and tried to identify the fault and correct it. Being not succeeded on solving the problem, considering that remaining fuel on main tanks was not enough to reach LPAZ safely, the pilot declared fuel emergency and requested landing in LPFL, situated enroute to LPAZ, only available for domestic flights.

Landing permission was granted and N21070 landed at LPFL, uneventfully, by 16:58.

1.2 Injuries

The pilot, the only person on board the aircraft, suffered no injuries.

1.3 Aircraft Damage

There was no damage to the aircraft.

1.4 Other Damage

There was no third party damage reported.

1.5 Flight Crew

There was only one pilot aboard, with following references:

Sex:	M
Age:	61
Nationality:	United States of America
Flight License:	ATPL
Validity:	04-02-09
Ratings:	Citation 500/10/25; Beechcraft 1900/300; Lear Jet
Last Medical Examination:	10-02-08
Flight Experience:	14 650

1.6 Aircraft

1.6.1 General



Picture Nr: 2

The 208B Grand Caravan first flew in 1990 and is a stretched version of the basic Caravan powered by a 505kW (675shp) PT6A-114, mounted with a McCauley three bladed, constant speed, full feathering, reversible, 106inch diameter propeller. It has a maximum take-off mass (MTOM) of 8750lbs (3969kgs) and can seat up to 14 passengers for a range of 917NM (1698km) at a maximum altitude of 25000ft (7620m) and a maximum cruising speed of 184kts (341km/h).

Aircraft s/n 208B 2014, registration N21070, has been equipped with extra tanks, extending its endurance to 13H00, receiving a special authorization for a MTOM of 11826lbs (5364kgs), only effective for delivery flight.

1.6.2 Fuel System

The extra tank system was provided by Weaver Aero International, Inc., conforming to Tank Drawing #WAI-208/208B and consisting of two 180USG capacity tanks installed inside the cabin, equipped with a pack of two electric fuel pumps & ferry fuel valves. Ventilation was provided through holes in the fuselage.

Fuel from extra tanks was sent to right wing tank and from there to the engine. For that purpose right wing tank should be used first (until about ½ capacity) and only then extra fuel could be used, always monitoring right tank fuel level.

Special Pilot Operation Instructions have been published, stating procedures to be followed during different phases of system operation and some placards should be put inside cockpit, well in pilot field of view (*picture nr. 3*).

NO SMOKING							
USE FUEL FROM THE EXTENDED RANGE FUEL SYSTEM ONLY DURING LEVEL FLIGHT	USE JET A FUEL ONLY						
REFUEL WITH ALL DOORS OPEN FOR VENTILATION	<table> <tr> <td>Vne (Never Exceed) must not exceed</td> <td style="text-align: center;">136</td> <td>knots IAS</td> </tr> <tr> <td>Vno (max structural) must not exceed</td> <td style="text-align: center;">115</td> <td>knots IAS</td> </tr> </table>	Vne (Never Exceed) must not exceed	136	knots IAS	Vno (max structural) must not exceed	115	knots IAS
Vne (Never Exceed) must not exceed	136	knots IAS					
Vno (max structural) must not exceed	115	knots IAS					

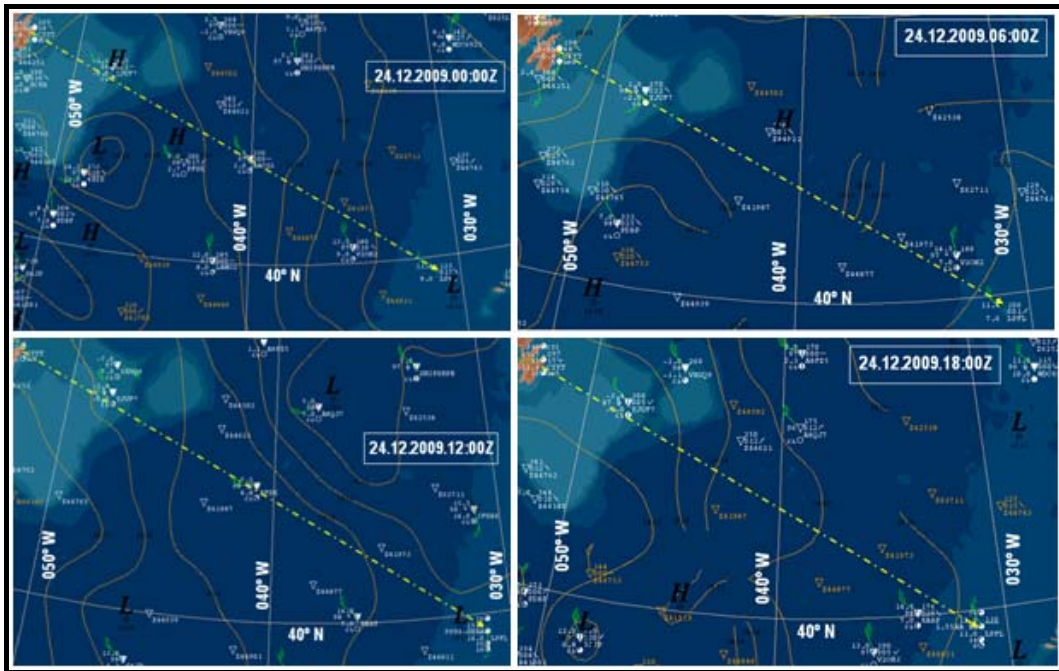
Picture Nr: 3

1.7 Meteorology

A general meteorological situation information was obtained from Environnement Canada, regarding the route to be flown by N21070, on the 24th of December 2008, together with respective weather charts. Situation report is reproduced bellow, with associated charts on picture nr. 4.

“A ridge of high pressure prevails over the Maritimes in the morning of December 24th and extended approximately 400 nautical miles east of St. John’s. When the plane took off the weather conditions was nice at St .John’s; few clouds and winds from the north-west at 15 knots.

A 1008mb low pressure system was located near 47N 036W. The cold front extended southward from the low center through 30N given rain/showers and thunderstorms approximately 100 nautical miles to the west of Flores in the morning (1200Z). A few hours later the cold front passes over Flores (near 1600Z) given rain, mist and showers. The surface winds observed with the passage of the cold front was from the north-west and gusting up to 40 Knots and remained strong several hours after.”



Picture Nr: 4

Regarding actual weather information, some “METAR” from St. Johns and Flores, covering N21070 flight times are reproduced bellow.

CYYT (St.John’s)

METAR CYYT 240900Z 30016G24KT 15SM SCT025 -8.3/-13.2 A3033 RMK SC3 SLP280 52024 SKY44=

METAR CYYT **241000Z** 31013G19KT 15SM FEW025 -9.4/-16.6 A3036 RMK SC2 SLP290 SKY22=

METAR CYYT **241100Z** 31016KT 15SM FEW025 -10.4/-17.6 A3038 RMK SC2 SLP297 SKY22=

METAR CYYT 241200Z 29015KT 15SM FEW021 SCT230 -9.3/-15.0 A3040 RMK SC2CI0 SLP304 52024 SKY34=

LPFL (Flores)

METAR LPFL 241400Z 18017KT 3000 -DZRA BR SCT005 BKN015 BKN070 15/14 Q1014=

METAR LPFL 241500Z 18014KT 4000 -RA BR SCT005 SCT012 BKN070 16/15 Q1012=

METAR LPFL 241530Z 32017G30KT 270V360 2000 -RA BR SCT005 BKN010 13/12 Q1013=

METAR LPFL **241600Z** 34021G40KT 300V360 1500 RA BR BKN008 BKN015 12/11 Q1013=

METAR LPFL **241630Z** 33019G34KT 300V020 1400S 9000N RA FEW008 BKN015 12/11 Q1013=

METAR LPFL **241700Z** 34022G35KT 300V360 4000S RA BR FEW008 BKN014 12/11 Q1013=

1.8 Navigation Aids

The aircraft was carrying standard navigation equipment plus GNSS equipment.

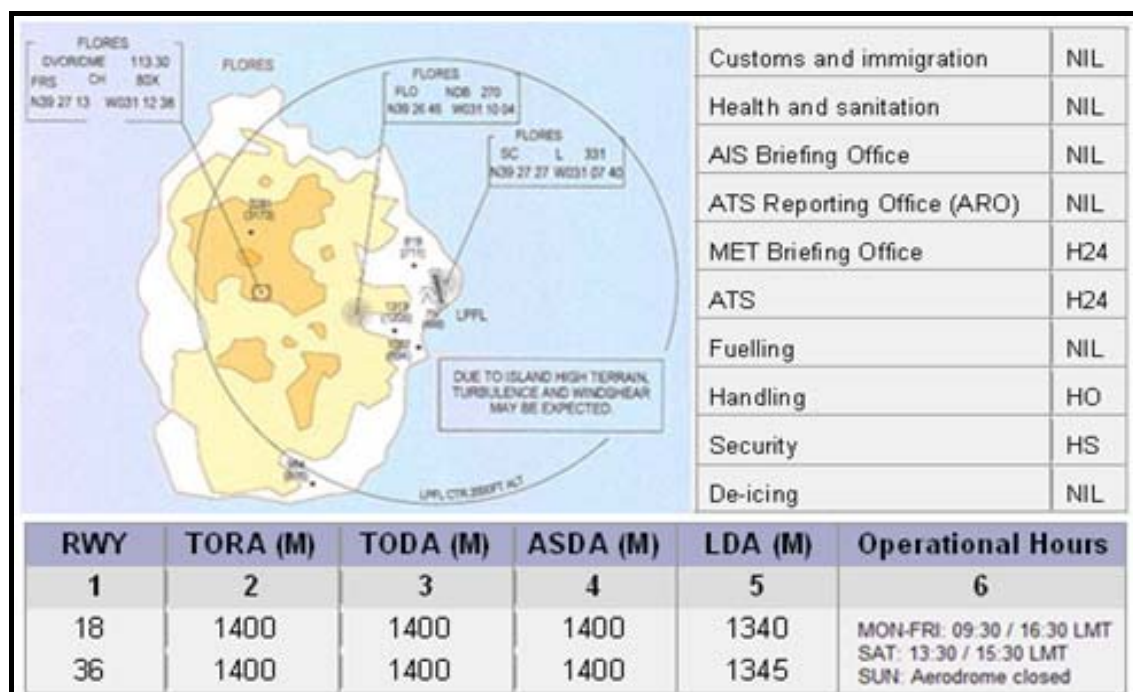
1.9 Communications

The aircraft was equipped with standard communication equipment for that route, including transponder and Sat phone.

1.10 Aerodrome

Flores aerodrome is located on the east side of the island and, as per AIP Portugal chapter AD 2, it is classified as a domestic aerodrome receiving VFR & IFR scheduled, non-schedule and private traffic during normal daylight operational hours.

Location, facilities and runway dimensions are shown below (*picture nr. 5*).



Picture Nr: 5

Having no customs & immigration services available, the aerodrome can't receive international traffic, but in emergency situations.

1.11 Flight Recorders

The aircraft was not equipped with flight recorders.

1.12 Wreckage & Impact

Not applicable.

1.13 Medical or Pathological

Not applicable.

1.14 Fire

There was no fire.

1.15 Survival Aspects

Not applicable.

1.16 Tests & Research

Next morning, after the incident, the pilot checked fuel system for any electric fault and found it was operating properly and fuel was flowing from auxiliary tanks, so he continued the flight to final destination. Considering the extreme meteorological condition the aircraft had been exposed to, it was supposed the fuel vents became obstructed with ice and, as soon as it entered a warmer area the ice melted and vents became unobstructed.

No other tests have been performed.

1.17 Organizational & Management

There's nothing special to refer on this chapter.

1.18 Additional Information

There's no other relevant information to refer.

2. ANALYSIS

2.1 Flight Preparation

On the eve of the flight, pilot contacted Halifax FIC, by phone, in order to request meteorological information package for next morning to be delivered to its FBO (*Shell Aerocentre*).

A NavCanada Flight Service Specialist provided the pilot with forecasted weather for the route to be flown, emphasizing how the wind would be pushing the aircraft and shortening flight time. She explained where clouds and precipitation would be encountered, ice forming probability and expected freezing zone and level. Apparently the weather would be fine for the trip, leaving a very cold place for another much warmer, especially after crossing a cold front that was expected near Flores. By that time an ATC Flight Plan has been filled, with departure at 10:30 (07:00 local) next morning.

The aircraft had been refuelled in the afternoon of December the 21st (19:30 UTC), with 1828ltr of fuel, being all tanks full for departure on the 23rd. Departure was postponed due ice formation on the aircraft and de-icing facilities not available, even with aircraft hangared until that morning, when it was parked outside.

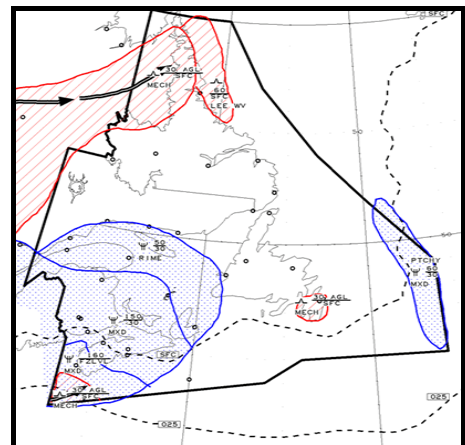
There was no evidence of the aircraft being de-iced before departure, next day, but it's supposed that, at least, it was clean from ice accretion when taking off.

2.2 Flight Progress

At 10.37 N21070 got its clearance from ATC, started the engine and by 10:43 it was airborne from St. Johns runway 34, with a 320° / 15 – 20kts wind and an OAT -10°C.

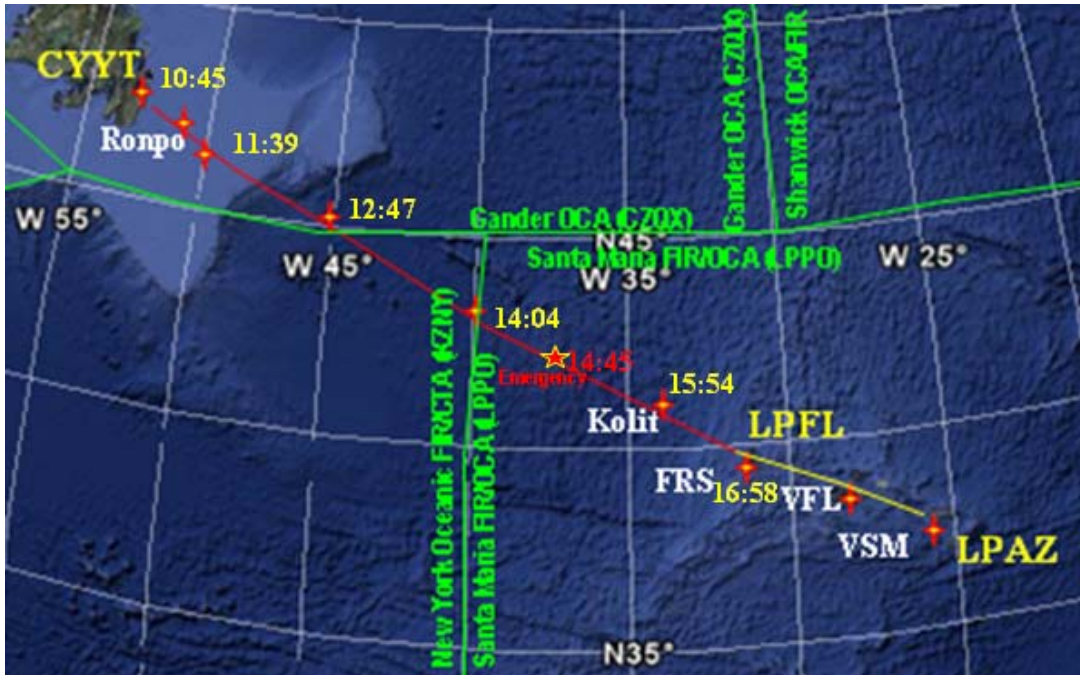
After departure, the flight was cleared to proceed direct to "Ronpo" and then to 46°N 050°W.

Environment Canada 12:00 chart (*picture nr. 6*) showed an area of moderate ice formation, which the aircraft should be passing through, when approaching 050°W. By that time the engine should be fed from main tank and extra tanks were not in use, having no air flowing through vents and facilitating ice formation. The cold front was extending from 47°N 036°W south-westerly (less than 100NM from Flores), so the aircraft was flying in cold weather and ice would stay in place, instead of melting.



Picture Nr: 6

Following extra tanks special operation procedures, the pilot had to deplete more than half right tank, prior to select extra tanks, which would occur not before passing 045°W.



Picture Nr: 7

Initially, fuel was flowing from extra tanks (visually checked by pilot) because fuel gases expansion was enough to fill the tank and allow pumps to be fed. As fuel was consumed, vacuum was created inside the tanks and it became more difficult for the pumps to suck the fuel. At that stage, more than three hours after departure (passing 040°W app), the pilot noticed that fuel was not flowing in extra tank line. He checked pump electrical connections but the problem persisted. He assessed the situation and by 14:45 (037°W app), in contact with Sta Maria, declared fuel emergency and requested permission to divert to Flores aerodrome.

Permission was granted and Flores advised of incoming traffic.

N21070 landed in Flores (LPFL) at 16:58, uneventfully, and made a night stop there.

The following morning, after some checks have been performed, fuel system was confirmed operating normally and the flight continued to its final destination.

3. CONCLUSIONS

3.1 Findings

Based on what has been exposed, we may conclude that:

- 1st The pilot was duly qualified for the operation to be carried and took all intended measures to perform it safely;
- 2nd The aircraft was certified and prepared for the crossing, having an approved extra fuel system installed;
- 3rd The weather, at departure aerodrome, was extremely cold and there was ice formation on aircraft structure;
- 4th Weather en route was favourable to ice formation, especially at intended flight levels to be flown;
- 5th The pilot followed recommended procedures for extra fuel tanks operation and confirmed system initial normal operation;
- 6th Later, during flight, the pilot noticed a fault on fuel system operation and was unsuccessful in recovering normal operation;
- 7th In such conditions remaining fuel was not enough to continue the flight to destination and it was not feasible to return to departure aerodrome;
- 8th Flores aerodrome was well in range for the aircraft to reach it safely, but was not available for international regular operation;
- 9th The pilot declared fuel emergency and requested permission to divert to Flores aerodrome;
- 10th Permission was granted and the flight landed uneventfully at Flores;
- 11th Next morning extra fuel system was tested and normal operation was confirmed;
- 12th Further investigation concluded for a possible blockage of fuel vents, by ice accretion.

3.2 Causes of the Incident

This incident was caused by a probable ice blockage of fuel tank vents, after the aircraft has been exposed to extremely cold conditions, which prevented the extra tank's fuel to be sucked from the tanks, causing a fuel shortage for the flight to reach safely its destination aerodrome, even with fuel enough onboard.

4. SAFETY RECOMMENDATIONS

No safety recommendations were issued.

Lisbon, 12th of June 2009

The Investigator In Charge,



António A. Alves