

AA2013-1

AIRCRAFT ACCIDENT INVESTIGATION REPORT

PRIVATELY OWNED

J A 4 1 2 3

January 25, 2013

 **JTTSB** *Japan Transport Safety Board*

The objective of the investigation conducted by the Japan Transport Safety Board in accordance with the Act for Establishment of the Japan Transport Safety Board and with Annex 13 to the Convention on International Civil Aviation is to determine the causes of an accident and damage incidental to such an accident, thereby preventing future accidents and reducing damage. It is not the purpose of the investigation to apportion blame or liability.

Norihiro Goto
Chairman,
Japan Transport Safety Board

Note:

This report is a translation of the Japanese original investigation report. The text in Japanese shall prevail in the interpretation of the report.

AIRCRAFT ACCIDENT INVESTIGATION REPORT

**PRIVATELY OWNED
SOCATA TB21, JA4123
DAMAGE OF LEFT WING DURING TAXIING (GROUND CONTACT)
ON AN APRON AT TAJIMA AIRFIELD
ABOUT 15:27 JST, JULY 24, 2011**

December 7, 2012

Adopted by the Japan Transport Safety Board

Chairman	Norihiro Goto
Member	Shinsuke Endoh
Member	Toshiyuki Ishikawa
Member	Sadao Tamura
Member	Yuki Shuto
Member	Toshiaki Shinagawa

SYNOPSIS

< Summary of the Accident >

When a privately owned SOCATA TB21, registered JA4123, was taxiing on an apron for flying from Tajima Airfield to Nagoya Airport on July 24 (Sunday), 2011, its left-hand main landing gear (L/H MLG) was retracted and the left wing contacted with the ground surface and sustained damage at about 15:27 Japan Standard Time.

< Probable Causes >

It is considered highly probable that this accident occurred because the captain and the owner started taxiing the Aircraft without its landing gears down locked, causing the mutual load balance between the landing gear actuators to be loosened and as a result, the L/H MLG to be retracted and the left main wing contacted with the ground surface and sustain damage.

As to the fact that the taxiing was started without the landing gears down locked, it is considered that the captain and the owner have not taken the proper measures for maintenance while being aware that the landing gear system did not work properly in the flight just before the accident, and that they had not properly understood the meaning of the situation despite the landing gear position indicator lights were showing the landing gears out of the down lock position in a subsequent pre-flight check,.

1. PROCESS AND PROGRESS OF THE INVESTIGATION

1.1 Summary of the Accident

When a privately owned SOCATA TB21, registered JA4123, was taxiing on an apron for flying from Tajima Airfield to Nagoya Airfield on July 24 (Sunday), 2011, its left-hand main landing gear (L/H MLG) was retracted and the left wing contacted with the ground surface and sustained damage at about 15:27 Japan Standard Time (JST: UTC+9hr, unless otherwise stated all times are indicated in JST based on a 24-hour clock).

The captain and the owner of the aircraft had been on board the aircraft, but no one was injured,

The aircraft sustained substantial damage, but there was no outbreak of fire.

1.2 Outline of the Accident Investigation

1.2.1 Investigation Organization

On July 26, 2011, the Japan Transport Safety Board received an accident notification, and then designated an investigator-in-charge and another investigator to investigate this accident.

1.2.2 Representatives of the Relevant States

An accredited representative of France, as the State of Design and Manufacture of the aircraft involved in this accident, participated in the investigation.

1.2.3 Implementation of the Investigation

July 27, 2011 On-site investigation, Aircraft examination and Interviews

August 8, 2011 Aircraft examination

September 5, 2011 Teardown examination of components

1.2.4 Comments from Parties Relevant to the Cause of the Accident

Comments were invited from parties relevant to the cause of the accident.

1.2.5 Comments from the Relevant State

Comments on the draft report were invited from the relevant State.

2. FACTUAL INFORMATION

2.1 History of the Flight

When a privately owned SOCATA TB21, registered JA4123 (hereinafter referred to as “the Aircraft”), was taxiing on the apron for flying from Tajima Airfield to Nagoya Airfield with the captain and the owner aboard, its L/H MLG was retracted and the left wing contacted with the ground surface and sustained damage at about 15:27 on July 24, 2011.

The history of the Aircraft’s behavior up to the time of the accident was summarized as below, according to the statements of the captain and the owner.

(1) The captain

On the day of the accident, the Aircraft, with the captain sitting on the right seat and the owner on the left seat, departed from Nagoya Airfield with the owner piloting and the

Aircraft arrived at Tajima Airfield at about 13:30. But when an operation to extend the landing gears for landing was performed, the owner found that the circuit breaker for the landing gear system (hereinafter referred to as “the Gear CB”) had been popped up. He tried to reset it several times, but it popped up each time. He could not extend the landing gears with a normal procedure; therefore, lowered them using the emergency landing gear knob. After that, they confirmed that the three green indicating lights for the down locked mode (the 3 Greens) had been illuminated, and the Aircraft landed on the airfield.

Past 15:00, before the Aircraft’s departure from Tajima Airfield for Nagoya Airport, the captain carried out the exterior preflight check of the Aircraft with the owner. Then, the captain sat on the right seat and the owner on the left seat again. The owner carried out the interior preflight check, and the Gear CB had been popped up. When the landing gear test switch was pushed, the 3 Greens were illuminated. Therefore, the owner concluded that the landing gears have been down locked. The captain had no doubt about the owner’s judgment because the Aircraft has been owned and used by him. All operations were performed by the owner until the time when the accident occurred.

(2) The owner

Before the Aircraft’s departure from Tajima Airfield, the owner carried out the exterior preflight check as usual and while sitting on the left seat, he carried out the interior preflight check. The owner found that all the 3 Greens, which must have been illuminated, had been extinguished when he had turned the main switch on. When he tried to reset the Gear CB, the motor buzzed and the Gear CB immediately popped up. He tried to reset the Gear CB once again, but it popped up again. When the owner pushed the landing gear test switch, the 3 Greens were illuminated. Therefore, he judged that the landing gears have been down locked. After starting and warming up the engine, he tried to reset the Gear CB again, but it popped up just the same. He remembered that when the emergency landing gear knob was reset to the normal position, the aural warning sounded, and when the throttle lever was pushed forward, the warning sound came to a halt. But he had no clear memories about whether the emergency landing gear knob had been reset before starting the engine or after that. After warming up the engine, he started taxiing. And then, he taxied it straight and checked its brake system. Then he taxied the Aircraft straight again, and turned it to the left. While paying attention to keeping the Aircraft along the yellow line, he had the Aircraft taxied on the apron. After he performed an operation to direct the Aircraft slightly to the left, the Aircraft gradually leaned to the left; then, the left wing contacted with the ground surface and the Aircraft came to a stop.

The owner stopped the engine and turned off the main switch, then got out of the Aircraft. The left wing tip cover had been broken and areas around the flap fitting structure had been deformed.

This accident occurred at about 15:27 on the apron at Tajima Airfield (Latitude 35°30'58" N, Longitude 134°47'18" E).

(See Figure 1 Estimate Taxi route, Photo 1 The accident aircraft and its damages, Photo 2 The gear retract mechanism of L/H MLG)

2.2 Injuries to Persons

There were no injuries to those aboard the Aircraft.

2.3 Information on Damage to the Aircraft

2.3.1 Extent of Damage

Substantial

2.3.2. Damage to the Aircraft Components

Left wing Damaged

2.4 Personnel Information

(1) Captain	Male, Age 55	
Private pilot certificate (Airplane)		January 6, 1995
Rating for single-engine (land)		January 6, 1995
Multi-engine (land)		July 6, 2001
Class 2 aviation medical certificate		
Validity		June 9, 2012
Total flight time		832 h 44 min
Flight time in the last 30 days		1 h 48 min
Total flight time on the type of aircraft		10 h 00 min
Flight time in the last 30 days		1 h 00 min
(2) Owner	Male, Age 67	
Private pilot certificate (Airplane)		November 30, 1998
Rating for single-engine (land)		November 30, 1998
Class 2 aviation medical certificate		Expired
Total flight time		1,036 h 11 min
Flight time in the last 30 days		0 h 00 min
Total flight time on the type of aircraft		179 h 25 min
Flight time in the last 30 days		0 h 00 min

2.5 Aircraft Information

2.5.1 Aircraft

Type	SOCATA TB21
Serial number	1055
Date of manufacture	April 23, 1990
Certificate of airworthiness	DAF-2010-266
Validity	July 29, 2011
Category of airworthiness	Airplane, Normal
Total flight time	1,592 h 18 min
Flight time since last periodical check (50h Check on January 20, 2011)	7 h 49 min
(See Figure 2, Three Dimension View of SOCATA TB21)	

2.5.2 Weight and Balance

When the accident occurred, the Aircraft's weight was estimated to have been 1,223 kg and the center of gravity (CG) was estimated to have been 103.5 cm aft of the reference line, both of which were estimated to have been within the allowable ranges (the maximum takeoff weight of 1,400 kg and the CG range of 101.6 to 129.5 cm corresponding to the weight at the time of the

accident).

2.6 Meteorological Information

Aviation special weather observations recorded at the Tajima Airfield Administration Office around the time of the accident were as follows:

15:40	Wind direction	360° to 010°	Wind velocity	8 kt		
	Visibility	20 km				
	Clouds Amount	1/8	Type	Cumulus	Cloud base	2,500 ft
	Temperature	26 °C	Dew point	20 °C		
	Altimeter setting (QNH)	29.81 inHg				

2.7 Accident Site and Wreckage Information

2.7.1 Condition of Accident Site

The Aircraft came to a halt at a place about 51 meters northwest of Spot 11 on the apron at Tajima Airfield with its L/H MLG retracted and the tip of the left wing contacted with the ground surface and with its nose directed to the west-northwest.

Scratch marks caused by the tip of the left wing and a flap hinge, each with a length of about four meters, had been left on the apron.

(See Figure 1 Estimate taxi route, Photo 1 The accident aircraft and its damaged)

2.7.2 Details of Damages

(1) Fuselage

The footsteps installed on the left side of the fuselage had been fractured.

(2) Left Wing

There were cracks in the wing tip cover made by the plastic.

Scratch marks were found on the lower surface of the wing tip and the lower surface of the aileron.

There were scratch marks on the lower end of the outer flap hinge.

The wing structure in the area with the outer flap hinge installed had been deformed.

2.8 Fact Finding Tests

2.8.1 Functional Test of the Landing Gear Extension and Retraction System

To test the performance of the landing gear extension and retraction system, the Aircraft was jacked up with its three landing gears down locked. The main switch was turned on after returning the emergency landing gear knob and resetting the Gear CB which had been popped up and then, after confirming that the landing gear lever was in the down position. Just then, all landing gears moved to the up position and the motor continued to buzz. When the landing gears started moving from the down lock position, the 3 Greens were all gone out and the red light was illuminated. And, the landing gear aural warning continued to sound because the thrust lever remained in the pulled position.

After that, the landing gear UP relay, which feeds electricity to the electro-hydraulic pump, was removed from the fuselage to confirm whether it had any abnormalities, such as partial melting and adhesion in the contact points. When the terminal-to-terminal continuity check was verified, the relay worked properly.

Therefore, the landing gear UP relay was reinstalled, and the functional test of the system was made again. The landing gears moved properly and their retraction and extension movements in response to the position of the landing gear lever were confirmed. The functional tests were repeated later, but the condition in which the landing gears move to the UP position even with the landing gear lever in the DOWN position, a symptom which was confirmed when the main switch was turned on at the beginning, did not reappear.

2.8.2 Teardown Examination of the Landing Gear UP Relay

In order to confirm the condition of the contact points of the landing gear UP relay (whether the trace of partial melting and adhesion, and other abnormalities can be found) based on the results of the functional tests of the landing gear extension and retraction system, a teardown examination was performed with the cooperation of the Japan Aerospace Exploration Agency, and the following findings were obtained:

- (1) The mark “12V 50A Ref. 03393” was found on the side of the relay, while the stamp mark “2459” was seen on the topside.
 - (2) The surface of the contact points both on the fixed and movable sides had been degraded (with compounds accumulated) and there were traces of partial melting and adhesion.
 - (3) The surface of the wires for the coils inside had been partially discolored.
- (See Photo 5 Gear UP Relay)

2.9 Flight Manual

In the flight manual for the Aircraft, there are the following descriptions in Section 4 “NORMAL PROCEDURES”:

4-4 Before Starting Engine

(Omitted)

<i>Circuit-breakers (side panel)</i> <i>In</i>
<i>Magneto switch</i> <i>OFF</i>
<i>Emergency landing gear control (Emergency landing gear down knob)</i>	•••• <i>PUSHED</i>

(The rest is omitted)

2.10 Other Information

2.10.1 Outline of Landing Gear System

The landing gear system of the Aircraft moves the landing gear mechanism with an electrically driven hydraulic power pack; electro-hydraulic pump. An electrical circuit for controlling its action consists of three parts—the electro-hydraulic pump (motor) control, the landing gear position indicator light control and the landing gear warning control. The system which drives and controls the electro-hydraulic pump uses a 28V DC power source for the Aircraft. In a normal condition, the landing gears move up and down as hydraulic pressure is applied, by controlling the direction of the motor’s rotation, to the hydraulic circuits on the UP and DOWN sides connected to the hydraulic cylinders of the actuators installed for each of the landing gears. The landing gears are held in the retracted position during flight by maintaining the hydraulic pressure for the UP side circuit, while when the landing gears are in the extended position, they held the down lock mechanically with the power of the springs.

The emergency landing gear extension system is so designed as to apply no hydraulic pressure on either side, with both the UP side and DOWN side hydraulic circuits connected to the

RETURN circuits by switching the hydraulic circuit valve. In this case, the landing gears are designed to move to the down lock position with their dead weight and the power of the springs.

2.10.2 Control of the Landing Gear Extension and Retraction System

(1) Electro-Hydraulic Pump Control

The hydraulic pump control supplies electricity to the DOWN side of the electro-hydraulic pump, when the landing gear knob is shifted to the DOWN position, as the landing gear DOWN relay is activated. When the landing gears move to the down lock position, the DOWN LIMIT switch becomes OPEN and the electricity supply is cut off; as a result, the electro-hydraulic pump comes to a stop.

When the landing gear knob is shifted to the UP position during flight, the landing gear UP relay is activated and supplies electricity to the UP side of the electro-hydraulic pump. If the landing gears move to the UP position and further pressure is applied to the hydraulic circuit, the pressure switch becomes OPEN and the electricity supply is cut off and then, the electro-hydraulic pump comes to a stop.

When hydraulic pressure for holding the landing gears in the UP position drops during flight, the pressure switch becomes CLOSE and electricity is supplied to the electro-hydraulic pump and pressure continues to be applied to the hydraulic circuit until the pressure switch becomes OPEN again.

(2) Landing Gear Position Indicator Lights Control

As to the system for indicating the landing gear positions for the Aircraft, when the landing gears come to the down lock position, the switch for each landing gear is activated and the green position indicator lights showing the down lock position for each of the landing gears are illuminated. If the selected position of landing gear lever (UP or DOWN) and their actual position do not correspond to each other, the red landing gear position indicator light showing the landing gears are in operation is illuminated.

The test switch is designed only to check if the bulbs for the red light and the three green lights have not burned out.

(See Figure 3 Landing gear control system, Photo 3 The equipment for the gear control)

(3) Landing Gear Warning Control

The landing gear warning system for the Aircraft sounds an alarm, when either (or all) of the landing gears comes out of the down lock and when the throttle lever is retarded below approximately 1/2 inch of the aft stop or the flaps are extended more than 10° .

2.10.3 Installment Condition of the Landing Gear UP and DOWN Relays

The Aircraft had been installed the landing gear UP and DOWN relays with the mark “12V 50A Ref. 03393,” but the manual for the Aircraft had designated the model “03395 – 24V 50A” as a device which must be installed as a standard for its landing gear UP and DOWN relays. According to the manufacturer, if a 12V type relay was installed for the Aircraft, an insulated substance would melt with heat caused by excessive electricity.

The Aircraft was imported into Japan as a brand-new aircraft when its total flight time was two hours and 40 minutes and there were no records that the relays involved had been replaced after its import.

According to explanations by the manufacturer, it had been producing TB20 and TB21

aircrafts with a 14V DC power system (with 12V system landing gear relays installed) until 1989, but the Aircraft was manufactured in 1991 and it had been installed 24V system landing gear relays. But as described in 2.5.1, the Aircraft was manufactured in 1990, so that the manufacturer was asked to reconfirm the related records. As a result, it was confirmed that the Aircraft was manufactured in 1990 with a 28V DC power system.

3. ANALYSIS

3.1 Qualification of Personnel

The captain has held a valid airman competence certificate and a valid aviation medical certificate.

The owner has held a valid airman competence certificate, but his aviation medical certificate has expired.

3.2 Airworthiness Certificate of the Aircraft

The Aircraft had a valid airworthiness certificate and had been maintained and inspected as prescribed. But, as described in 2.1, its main landing gears had not been properly retracted in the flight just before the accident. The Aircraft landed at that time by activating the emergency landing gear system, but it continued to be used after that, with no measures for maintenance despite its failure to properly extend the landing gears.

3.3 Relations to Meteorological Phenomena

It is considered highly probable that the weather condition at the time of the accident had no relations with the occurrence of this accident.

3.4 Circumstances at the Time of the Accident

3.4.1 Condition of the Landing Gear Extension and Retraction System

As described in 2.1 (1) and (2), the Aircraft could not extend its landing gears with a normal procedure in the flight just before the accident. Therefore, it is considered highly probable that the landing gears had been extended by activating the emergency landing gear extension system.

As to the condition of the landing gear system at that time, because the contact points of the landing gear UP relay had become partially melted and adhesive at the CLOSE position due to degradation, as described in 2.8, it is considered highly probable that the system had been in a situation where the electrical power was supplied to the UP side of the electro-hydraulic pump. Regarding the fact that the Gear CB had popped up and, when it was reset, immediately popped up again, it is considered highly probable that the phenomenon had occurred due to an overcurrent because electrical supply could not be stopped even after the pressure switch was activated, as the landing gears were in the UP position.

When the landing gear UP relay was dismantled to confirm whether it had any abnormalities in this investigation, no problems were found and when the functional test for the landing gears was repeated after reinstalling the relay, a discrepancy which the position of the landing gear lever and the actual position of the landing gears differed was not reproduced. Therefore, it is considered highly probable that the partial melting and adhesion part of the contact points of the landing gear UP relay had come off in the course of the work to remove the part.

3.4.2 Judgment on Departure

As described in 2.1 (1) and (2), it is considered highly probable that, even while being aware that the Aircraft was unable to extend its landing gears with a normal procedure in the flight just before the accident, the captain and the owner continued to operate the Aircraft without taking the proper measures for maintenance.

When there are any doubts about the maintenance condition of aircraft, an aircraft operator must take action for maintenance for the suspected problem before the start of the next flight. Until the proper measures for maintenance are performed, further flight shall not be planned.

3.4.3 Condition at the Time of Departure

As described in 2.1 (1) and (2), the owner came to realize in the preflight check and the start-up of the engine that the 3 Greens showing the landing gears are in the down locked mode had gone out and the Gear CB had popped up, and he tried to reset it. But it immediately popped up again and the warning tone also sounded, but when he pushed the throttle lever forward, the warning tone stopped. When this phenomenon occurred, the Aircraft had problems with its landing gear system and it was necessary for the owner to take measures for maintenance after discontinuing the operation at that time.

The fact that the 3 Greens had gone out can be taken to mean that the down lock system for each of the three landing gears had been released simultaneously to counter the power of the springs. Therefore, it is considered probable that the electro-hydraulic pump had been activated toward the UP side. Judging from the descriptions in 2.1 (1) and (2), the captain and the owner carried out preflight check of the Aircraft as usual, but they had no clear memories about the procedure at that time. It is considered probable that the landing gear system had been in a condition in which, with the emergency landing gear knob reset and the Gear CB reset, as described in 2.8.1, the main switch can be turned on. Therefore, it is considered probable that the electro-hydraulic pump had applied pressure to the UP side hydraulic circuit; as a result, the down locked mode for the landing gears had been released.

Regarding the fact that when the electro-hydraulic pump for the Aircraft applied pressure to the UP side hydraulic circuit, only the down locked mode for the landing gears had been released, it is considered highly probable that as the weight of the Aircraft had come on the landing gears, the electro-hydraulic pump had no enough power to move the struts of the landing gears. Further, it is considered highly probable that as electrical power continued to be supplied to the Aircraft with a large load left at that time, then, the Gear CB popped up because the electrical circuit became an overcurrent condition.

In the pre-flight check, the owner pushed the landing gear test switch and illuminated on the 3 Greens, and the captain and he understood that the landing gears were in the down locked mode. As described in 2.10.2 (2), the confirmation procedure for the landing gear position indicator lights with this test switch is simply aimed at checking whether the bulbs for the lights have not burned out. In the test with the condition that the 3 Greens showing the gear down locked all extinguished, when the 3 Greens are illuminated, this shows that the bulbs of the indicator lights have not burned out and that the landing gears are not in the down lock position. Accordingly, it is considered highly probable that the captain and the owner had not properly understood the function of the landing gear test switch and the meaning of the landing gear position indicator lights.

It is considered highly probable that the landing gear down locked mode was released with the throttle lever pulled, causing the warning tone began to sound, but the sound stopped as the throttle lever was pushed forward by over 1/2 inch ahead from aft end position.

3.4.4 Situation of Taxiing

According to the captain and the owner, as described in 2.1 (1) and (2), when the Aircraft started taxiing, the emergency landing gear knob remained to be reset and the 3 Greens had been off, while the popped up Gear CB was unable to be reset. The Aircraft started taxiing, the owner checked its break system and running straight again and after turning to the left, the Aircraft began leaning to the left.

Based on these findings, it is considered highly probable that when the Aircraft started taxiing, the actuators for all the three landing gears had stopped at the place to the UP side where the down locked mode was released and the hydraulic circuit on the UP side had been closed. At that time, it is considered highly probable that all landing gear actuators had stopped in the middle of the up and down positions and in a situation where they weres able to be moved in either direction. It is considered highly probable that the Aircraft had started taxiing in this situation and the landing gears were about to move to the down lock position with the power of the springs. But, because the hydraulic circuit on the UP side had been closed, it is considered highly probable that the actuators for the three landing gears connected to the hydraulic circuits could not move simultaneously in the same direction; as a result, the mutual loads for the landing gear actuators became unbalanced when the Aircraft was taxiing, causing only the L/H MLG to move in the UP direction. As a result, it is considered highly probable that the Aircraft leaned to the left with the L/H MLG retracted and the left wing contacted with the ground surface and sustained damage.

3.4.5 Landing Gear UP and DOWN Relays

As described in 2.8.2 and 2.10.2, the Aircraft had been installed the landing gear UP and DOWN relays with the mark “12V 50A Ref. 03393”, but their specification had been mentioned as “03395 – 24V 50A” on the component list in the flight manual. In addition, the Aircraft had a 28V power supply system, as described in 2.10.1.

This means that electrical power with 28V for the power supply system had been supplied as against the voltage rating of 12V and the current rating of 50A for the installed landing gear relays. In this situation, an electric current which is more than double the current rating flows to the coils. Therefore, it is considered highly probable that the coils had got overheated and the temperature increased, causing heat that discolored the coating of the coils.

As to the fact that the contact points of the landing gear UP relay had been deteriorated and become partially melted and adhesive, as described in 2.10.3, it is considered somewhat likely that the relay which was not confirmed to the specification of the Aircraft was installed, and was using with the overload condition for it, then the determination of the contact point of it had become faster. Not only weight of the landing gears but also the power of the springs works to the landing gear mechanism for the Aircraft in the downward direction. Therefore, the load for the electro-hydraulic pump is larger in the upward direction than in the downward direction. Further, the landing gears are retracted and extended one time each on every flight, in addition, the landing gear system operates in the upward direction also when the pressure switch is activated. So that, the landing gear UP relay works more frequently than the landing gear DOWN relay; as a result, it is considered highly probable that the contact points of the UP relay had become deteriorated more

quickly.

About the history of installation of the landing gear UP and Down relays involved, because the Aircraft had been imported as a newly manufactured aircraft when its total flight time was two hours and 40 minutes, and also because there had been no replacement record for the relays involved after it was imported, it is considered probable that the relays had already been installed on the Aircraft when it was manufactured.

3.4.6 Quality Assurance in Aircraft Manufacturing

When it can be assumed, as described in the above paragraph, that the Aircraft had been installed the landing gear UP and DOWN relays which are not conformed to the specification when it was manufactured, it is considered probable that the manufacturer should confirm whether the aircraft built in the same period of time as the Aircraft (the aircraft of the same type) had not been installed incompatible electrical components.

3.5 Implementation of Appropriate Maintenance Measures

As described in 3.4, it is considered highly probable that this accident occurred because the captain and the owner, while being aware that the landing gear system did not work properly in the flight just before the accident and the emergency landing gear extension system was used, and they started operations for the next flight without taking proper measures of maintenance.

For the purpose to ensure safe flights, individual aircraft operators should always be prepared to receive advice from maintenance personnel and other related persons. The captain and the owner, while considering maintenance and other measures when the Aircraft develops problems, should have decided beforehand the maintenance method including how to contact the related parties to obtain advice.

4. CONCLUSIONS

4.1 Probable Causes

It is considered highly probable that this accident occurred because the captain and the owner started taxiing the Aircraft without its landing gears down locked, causing the mutual load balance between the landing gear actuators to be loosened and as a result, the L/H MLG to be retracted and the left main wing contacted with the ground surface and sustain damage.

As to the fact that the taxiing was started without the landing gears down locked, it is considered highly probable that the captain and the owner had not taken the proper measures for maintenance while being aware that the landing gear system did not work properly in the flight just before the accident, and that they had not properly understood the meaning of the situation despite the landing gear position indicator lights were showing the landing gears out of the down lock position in a subsequent preflight check,.

4.2 Other Findings Related to Safety

It is considered probable that the Aircraft had been installed the electrical components (landing gear UP and DOWN relays) which were not conformed to its specifications, when it was manufactured. It is considered probable that the manufacturer's quality assurance system was not working properly when the Aircraft was manufactured.

5. PREVENTIVE ACTIONS

Actions for Accident Prevention Taken after the Accident

After the accident, the aircraft manufacturer of the Aircraft performed a check on TB20 and TB21 aircrafts, which is close to the serial number of the Aircraft, namely which had been manufactured in the transition period in which the power system changed from 14V to 28V DC.

Figure 1 Estimated Taxi Route

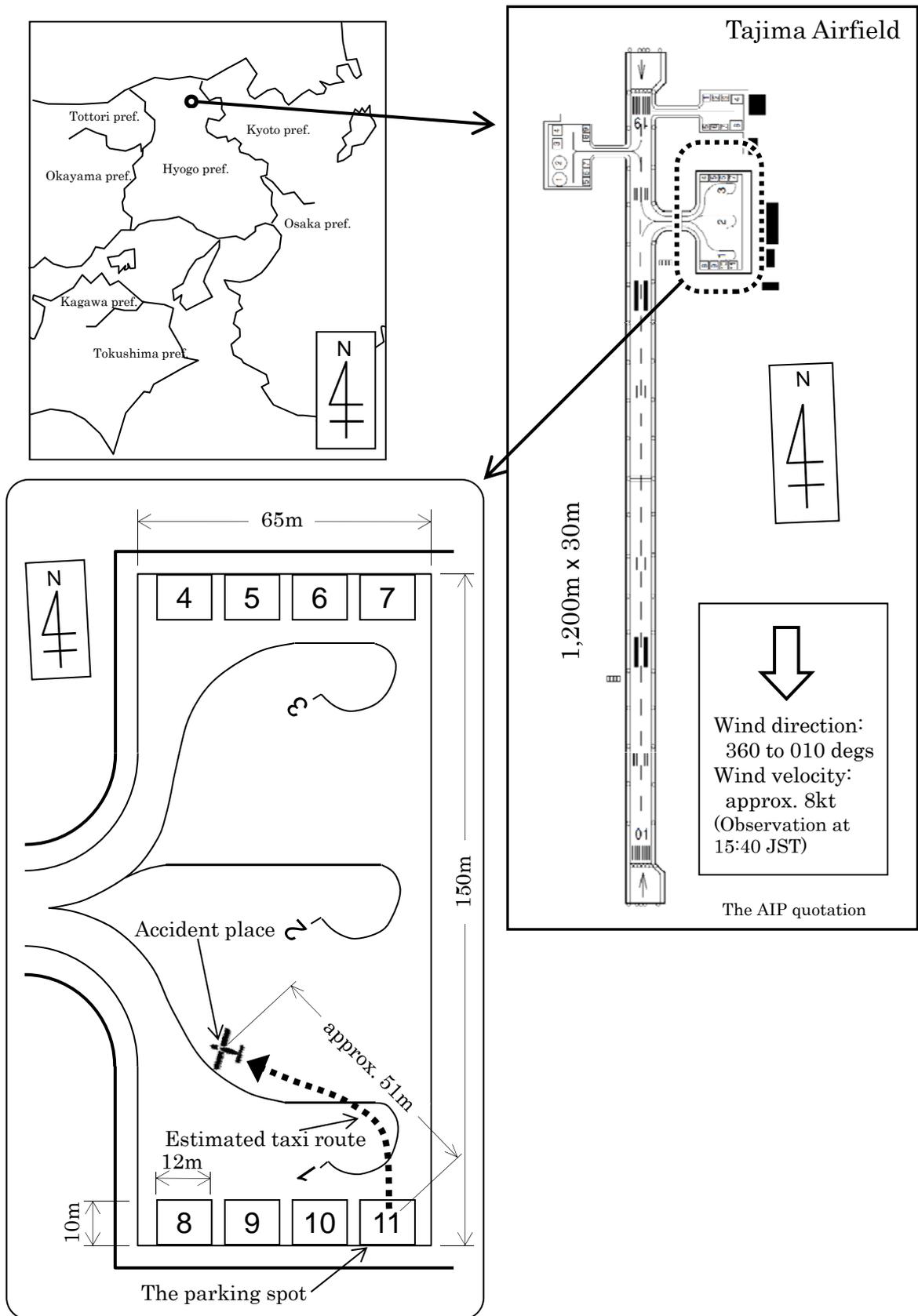


Figure 2 Three Dimension View of SOCATA TB21

Unit : m

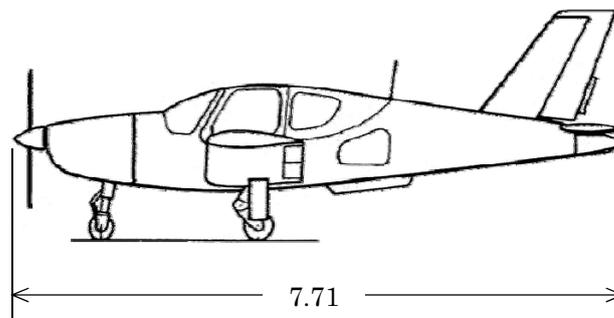
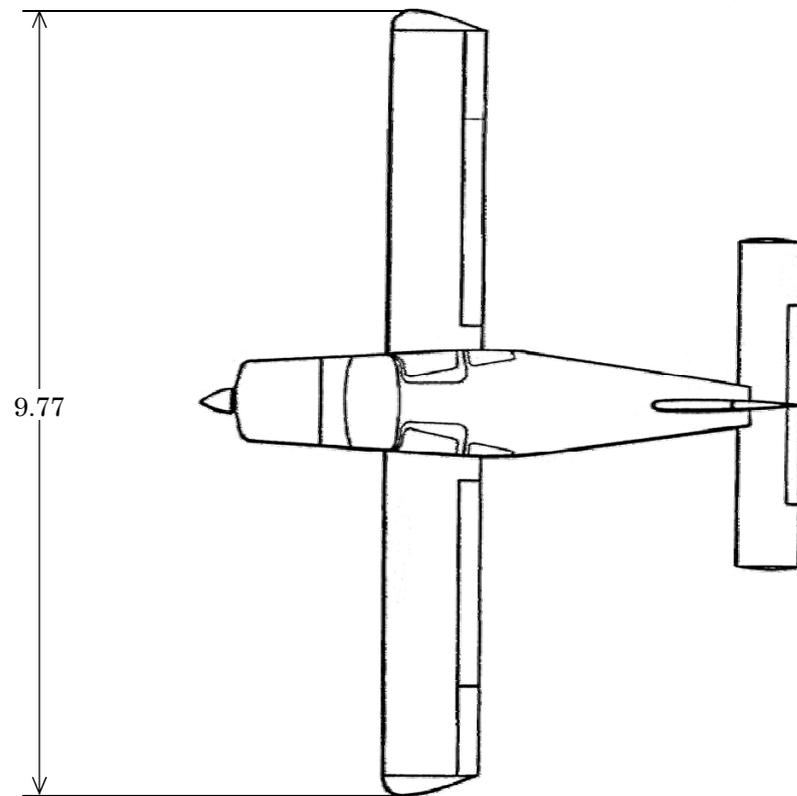
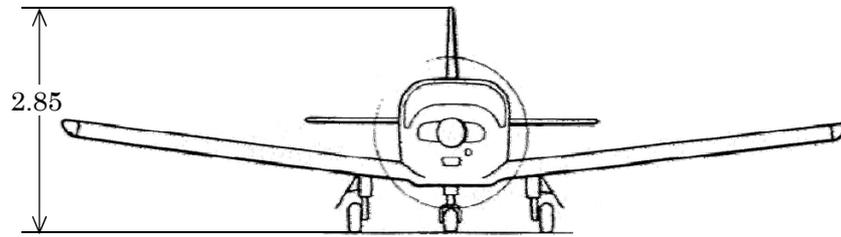
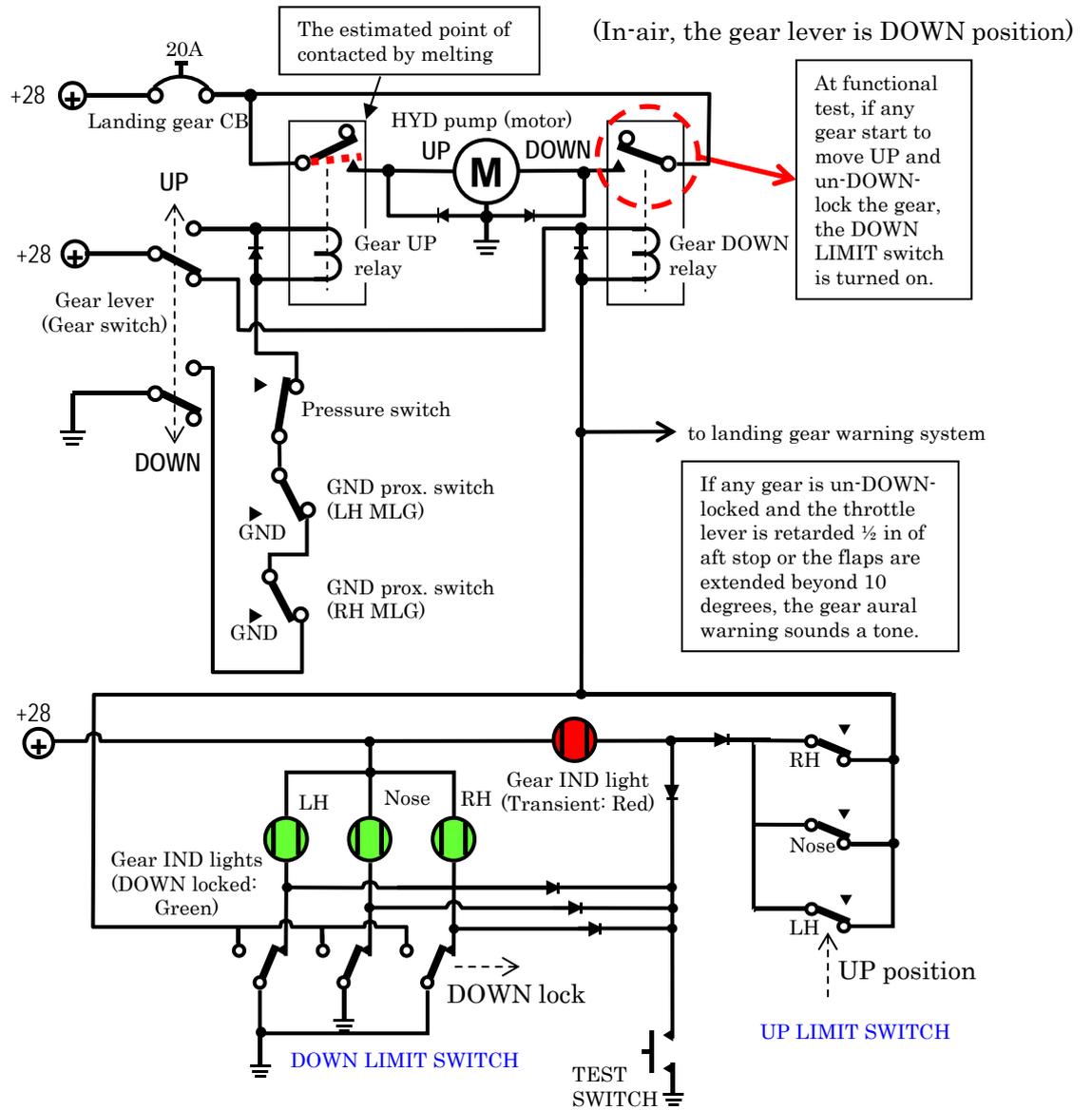


Figure 3 Landing Gear Control System

Outline of the landing gear electrical system



Outline of the landing gear HYD system

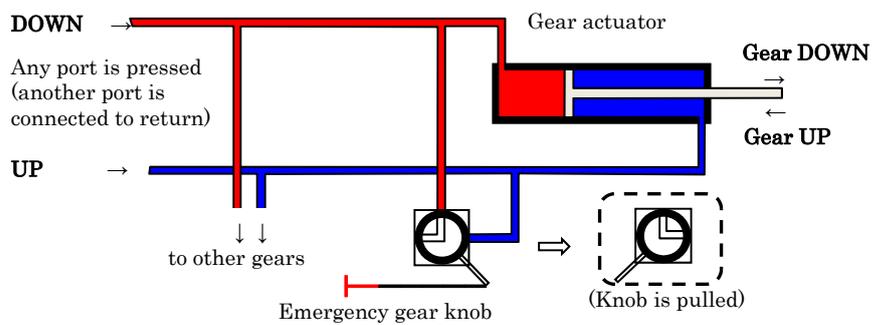
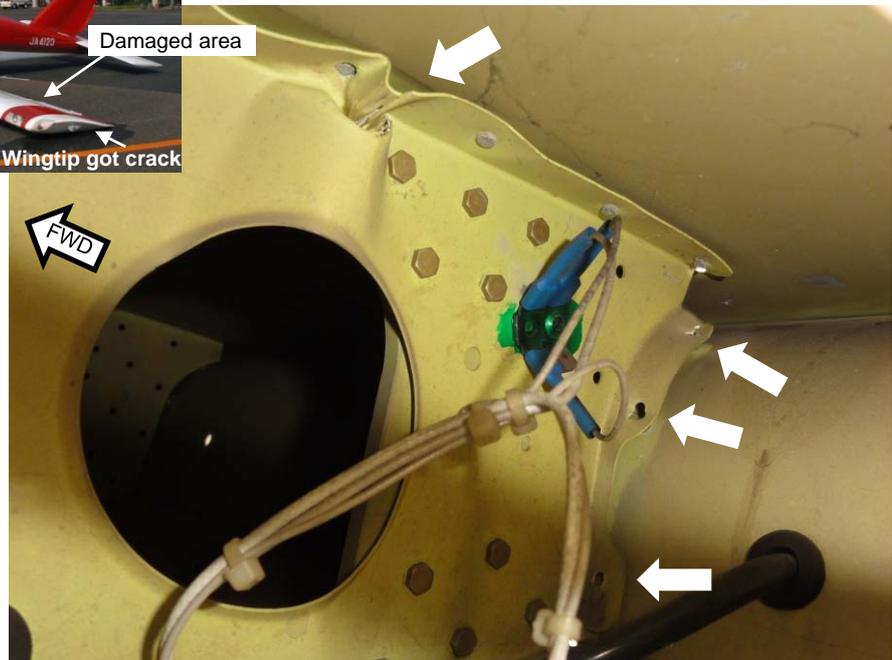


Photo 1 The Accident Aircraft and its Damages

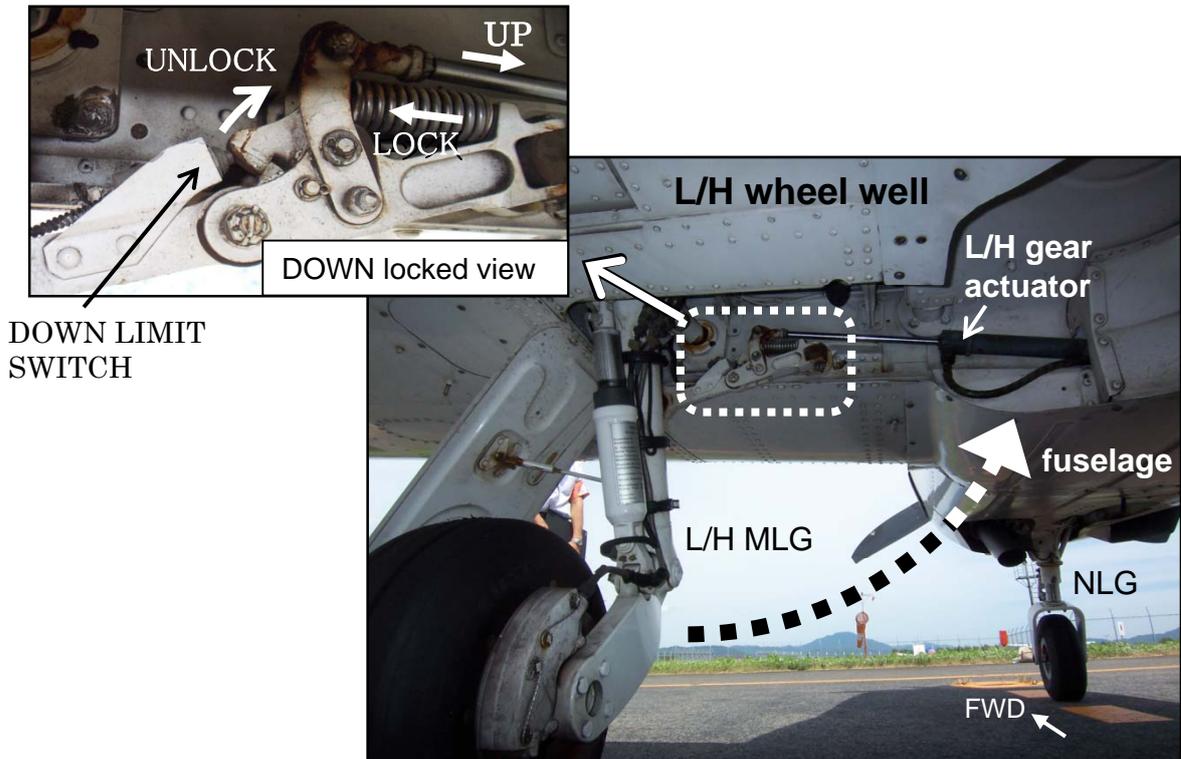


The accident aircraft



The damages and deform of the LH wing-structure around the fitting of outboard flap hinge.

Photo2 The Gear Retract Mechanism of L/H MLG



DOWN LIMIT SWITCH

Photo 3 The Equipment for the Gear Control



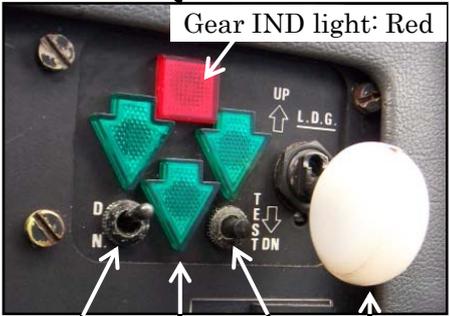
Cockpit



Landing Gear CB (popped up)



Emergency gear knob (pulled)



Dimmer switch
 Gear IND lights: Green
 Gear lever (DOWN)
 Test switch

Photo 4 Gear Relays and HYD Pump

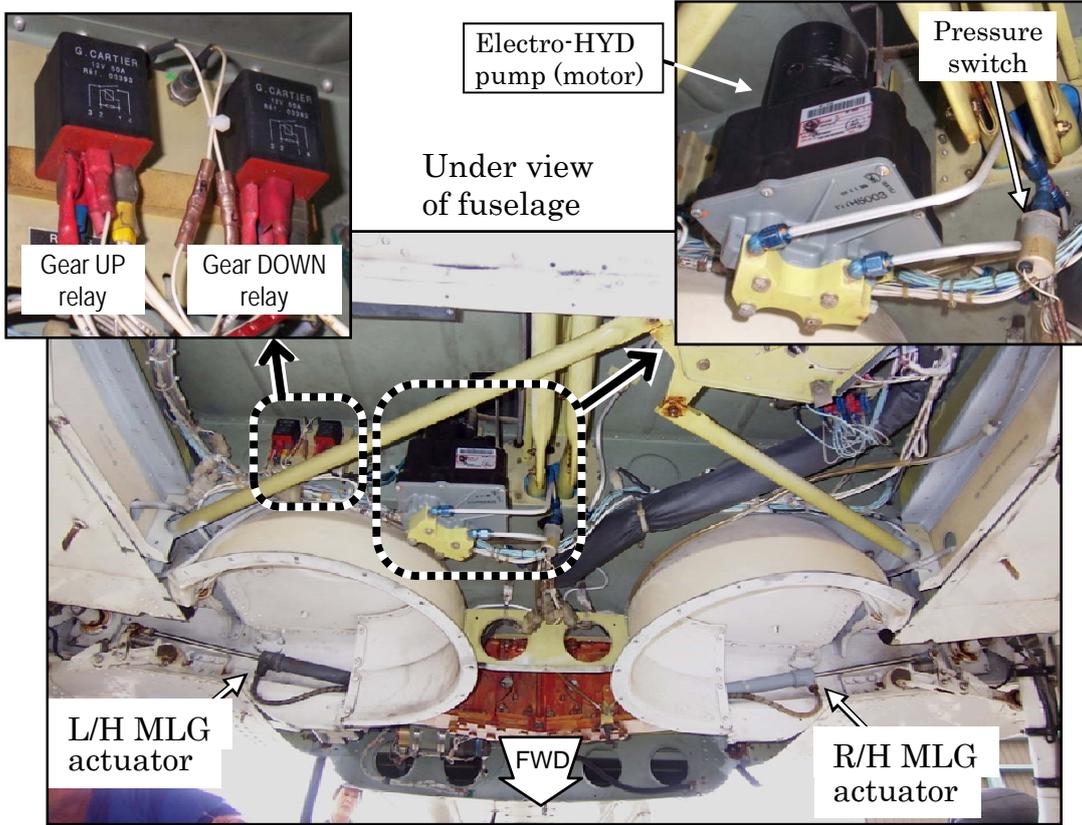


Photo 5 Gear UP Relay

