

**ACCIDENT**

<b>Aircraft Type and Registration:</b>	EADS Socata TBM 700C1, N700GY	
<b>No &amp; Type of Engines:</b>	1 Pratt & Whitney Canada PT6A-64 turboprop	
<b>Year of Manufacture:</b>	2004	
<b>Date &amp; Time (UTC):</b>	27 March 2008 at 1039 hrs	
<b>Location:</b>	Alderney Airport, Channel Islands	
<b>Type of Flight:</b>	Private	
<b>Persons on Board:</b>	Crew - 1	Passengers - None
<b>Injuries:</b>	Crew - None	Passengers - N/A
<b>Nature of Damage:</b>	Major damage to propeller, engine and aircraft nose	
<b>Commander's Licence:</b>	Airline Transport Pilot's Licence	
<b>Commander's Age:</b>	54 years	
<b>Commander's Flying Experience:</b>	17,400 hours (of which approximately 150 were on type) Last 90 days - 240 hours Last 28 days - 90 hours	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot and subsequent enquiries by the AAIB	

**Synopsis**

The pilot of a TBM 700 landed with three green lights and a red light showing on the landing gear control and indication panel; the nose gear subsequently collapsed during the rollout. The pilot had interpreted the three greens as indicating that the landing gear was locked down, however the red light signifies that the gear is unlocked and takes precedence over the three greens. Although the correct procedure required the landing gear to be operated manually using the hand pump, it was dependent on the pilot recognising that a red warning light signifies that the landing gear is unlocked, even if three greens are displayed concurrently. The lack of clarity in the TBM 700 Pilot's Operating Handbook (POH) regarding the

significance of the red warning light was considered to be a causal factor in this accident.

One Safety Recommendation is made to improve the clarity of the Emergency Procedures in the TBM 700 POH.

**History of the flight**

The aircraft, with one person on board, took off from Biggin Hill bound for Alderney. When the pilot selected the landing gear up, the green nose gear light did not extinguish and the red landing gear warning light remained on. The pilot, who was an ATPL holder and experienced on large commercial jet transport aircraft,

made a number of unsuccessful attempts to retract the gear before consulting the POH. He elected to continue the flight with the gear down, observing the airspeed limitation in the POH. He considered that the three green lights signified that all three gears were locked down and therefore no further action was required.

The aircraft landed at Alderney with three greens and a continuous red light still showing on the landing gear control and indication panel. At approximately 40 kt during the rollout, the nose gear leg collapsed, causing the propeller and nose to strike the paved runway surface. The aircraft then departed the runway, coming to a stop on a taxiway. The pilot shut down the aircraft and evacuated via the main door.

The aircraft was subsequently lifted using airbags. An engineer was unable to pull the nose gear to lock down, but was able to lock the nose gear down after one and a half pumps on the landing gear hand pump.

### Pilot's Operating Handbook

The following description of the TBM 700 landing gear indication system (Figure 1) is provided in Section 7.5 of Revision 0 of the TBM 700 POH:

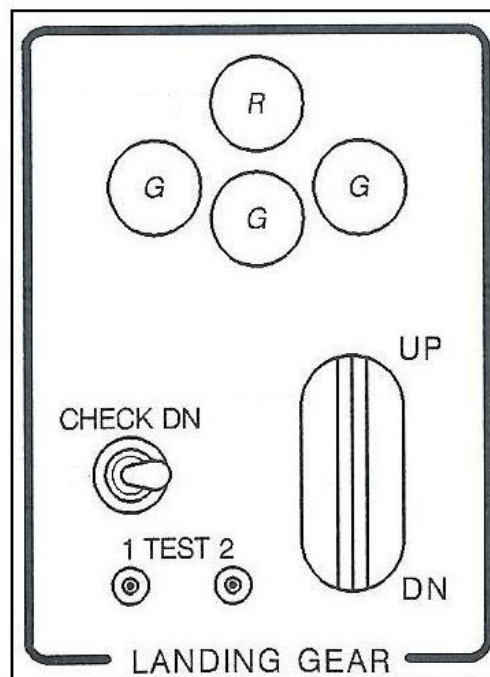
#### ***LANDING GEAR INDICATOR***

*Landing gear position indication is accomplished by 4 warning lights:*

- 3 green indicator lights (one per landing gear) indicate that each landing gear is down-locked,
- 1 red warning light indicates that landing gears are operating, or not locked down or up

#### **NOTE:**

*The red warning light flashes as soon as landing gears are operating and remains continuously on in case of locking problem.'*



**Figure 1**

TBM 700 - Landing gear control and indication panel

Extracts of the relevant Emergency Procedures, contained in Section 3 of the POH, are included in the attached Appendix.

According to the aircraft manufacturer, the TBM 700 pilot training includes a review of landing gear emergency procedures. The significance of the red warning light is explained and the emergency procedures to be followed are highlighted. In December 2008, the aircraft manufacturer issued Service Letter SL 70-050, to remind pilots of the necessity to comply with the instructions in the Pilot's Operating Handbook.

### **Nose gear actuator examination**

The nose gear actuator was removed and examined at the manufacturer's facility in the presence of the AAIB and the aircraft manufacturer.

When the actuator was functionally tested on a rig, an anomaly was found. It successfully retracted, giving the correct UP lock indications, but almost simultaneously, the switch indications for DOWN lock were detected. This meant that the actuator would have sent an indication to the landing gear control unit that the nose gear leg was locked both UP and DOWN. This anomaly could have produced the continuous red light reported by the pilot.

When the actuator was disassembled, some faint witness marks were found in the internal mechanism. These could have been indicative of small fragments of material with the potential to cause a malfunction having been present at some stage, however, no contamination was found. The actuator operated normally when functionally tested again after reassembly.

### **Other incidents**

This aircraft had experienced two other similar events in the four months preceding the accident. In both cases the problem occurred during retraction. All post-incident maintenance tests were passed with no fault found. Although the hand pump was not used to manually lower the landing gear manually on those occasions, the nose gear did not collapse.

There have been other reported incidents of TBM 700 nose gear collapse on landing. It was not possible to obtain information on all such occurrences, but details of another similar accident<sup>1</sup> that occurred to a TBM 700

at Paris Le Bourget in September 2007 were available. As in this accident, a red light and a green light remained illuminated after gear-up selection, prompting the pilot to return to Le Bourget. The pilot observed that three greens and a constant red light were illuminated after selecting the gear down. The pilot consulted the ATC controller, who confirmed that all three gear legs appeared to be down. The POH procedure to operate the landing gear hand pump was not followed and the nose gear leg collapsed during the rollout.

### **Analysis**

Whilst it was possible during testing of the nose gear actuator to recreate an anomaly that would explain the red gear unlocked light indication observed by the pilot, it was not possible to establish what had caused this. The fact that the actuator worked satisfactorily on the rig after reassembly would suggest that contamination was the cause although none was found.

Section 7.5 of the TBM 700 POH states that a continuous red warning light indicates a landing gear locking problem, irrespective of the condition of the green lights and the significance of the red warning light should be explained during pilot training. Notwithstanding this, on this, and at least one other occasion, the three green lights led a pilot to believe that the gear was locked down, even though a red light was showing. On most other aircraft types the green lights will only illuminate when the landing gear is locked down and a locking problem is indicated by a failure of the green lights to illuminate. Pilots who fly other aircraft types in addition to the TBM 700 are therefore more likely to assume that three greens signify that the landing gear is locked down, when in fact it is not. If, as in this and the Le Bourget accident, the pilot has interpreted the three green lights to mean that the landing gear is locked down, despite the red warning light showing, then the pilot is likely to

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#### **Footnote**

<sup>1</sup> BEA report on accident to TBM 700 F-GTJM at Paris Le Bourget on 4 September 2007, published March 2008.

believe that the problem has been resolved and that no further corrective action is required.

Given this situation, and in order to prevent similar accidents from occurring in the future, the POH would benefit from being amended to explain more clearly the significance of a red light, particularly when three green lights are displayed concurrently. For example, the following sentence in Section 7.5 of the POH is potentially misleading because if there is a continuous red light showing together with three greens, the gear is not locked:

*'3 green indicator lights (one per landing gear) indicate that each landing gear is down-locked'*

The Emergency Procedures in the POH would also benefit from being more explicit with respect to the significance of the red light and that if this is displayed, manual operation of the landing gear is required.

The following Safety Recommendation is therefore made with the aim of clarifying the information contained in the TBM 700 POH:

**Safety Recommendation 2009-002**

It is recommended that EADS Socata amends the TBM 700 Pilot's Operating Handbook, to clarify the need for manual extension of the landing gear if a continuous red light is showing, even if the green gear lights on the landing gear control and indication panel are lit.

**TBM**

SECTION 3  
EMERGENCY PROCEDURES  
D.G.A.C. Approved

PILOT'S OPERATING HANDBOOK 700

**3.11 - LANDING GEAR AND FLAPS**

DISCREPANCY WHEN LANDING GEAR GOES UP (Cont'd)

*If the fixed red warning light is still on :*

Continue flight if necessary at a speed BELOW 178 KIAS, without icing conditions or land.

If landing gear does not lock (incorrect indication), refer to paragraph "DISCREPANCY WHEN LANDING GEAR GOES DOWN".

**CAUTION**

**DO NOT ENTER ICING CONDITIONS (THIS COULD ADVERSELY INCREASE DRAG AND WEIGHT DUE TO ICE ACCUMULATION, AND LOCK WHEELS AND STRUTS).**

**CLIMB PERFORMANCE WILL BE DEGRADED BY 50 %.**

**INDICATED AIRSPEED AT CRUISE WILL BE DECREASED BY 50 KIAS.**

**THIS SHOULD BE TAKEN INTO ACCOUNT WHEN CALCULATING THE AIRCRAFT RANGE.**

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Appendix - Figure 2

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SECTION 3  
EMERGENCY PROCEDURES  
D.G.A.C. Approved

PILOT'S OPERATING HANDBOOK 700

**3.11 - LANDING GEAR AND FLAPS**

**DISCREPANCY WHEN LANDING GEAR GOES UP**

**- Red warning light on "LANDING GEAR" control panel remains flashing ON :**

The red warning light on the landing gear control panel flashing at the end of maneuver indicates that the landing gear electrohydraulic pump still operates.

1 - "LDG GR" circuit breaker ..... **PULL**  
*If the red warning light goes off :*

The flight may be continued without any restriction. The electrohydraulic pump starting will be manually controlled with the "LDG GR" circuit breaker for the landing gear extension.

*If the red warning light remains fixed ON, apply the following procedure :*

**- Red warning light on "LANDING GEAR" control panel remains fixed ON (whatever the condition of the green lights may be) :**

The red warning light on the landing gear control panel is fixed ON at the end of maneuver, the green indicator lights are ON or OFF :

1 - Keep IAS ≤ 128 KIAS.

2 - EXTEND the landing gear.

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Appendix - Figure 1

**Appendix**

TBM 700 POH Section 3.1.1 Emergency Procedures

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SECTION 3  
3.11 – LANDING GEAR AND FLAPS

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**DISCREPANCY WHEN LANDING GEAR GOES DOWN**

- **Red warning light on "LANDING GEAR" control panel remains flashing ON (whatever the condition of the green lights may be) :**  
The red warning light on the landing gear control panel flashing at the end of maneuver indicates that the landing gear electrohydraulic pump operates correctly.

- 1 - "LDG GR" circuit breaker ..... **PULL**  
*If the red warning light goes off :*
- 2 - LAND.

*If the red warning light remains fixed ON, apply the following procedure :*

- **Red warning light on "LANDING GEAR" control panel remains fixed ON (whatever the condition of the green lights may be) :**  
The red warning light on the landing gear control panel is fixed ON at the end of maneuver, the green indicator lights are ON or OFF, extend the landing gear manually.

- 1 - "LDG GR" circuit breaker ..... **PULL**
- 2 - Floor hatch ..... **OPEN**
- 3 - By-pass selector ..... **FULLY PULL / LOCK**
- 4 - Landing gear control ..... **DN**
- 5 - Hand pump ..... **ACTUATE**  
with maximum amplitude

**CAUTION**

**THE ENTIRE EXTENSION OF THE LANDING GEAR TAKES ABOUT 65 CYCLES. IT IS MANDATORY TO HAVE A CLEAN HARDENING OF THE MANUAL CONTROL AT THE END OF THE MANEUVER**

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SECTION 3  
3.11 – LANDING GEAR AND FLAPS

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DISCREPANCY WHEN LANDING GEAR GOES DOWN (Cont'd)

- 6 - "LDG GR" circuit breaker ..... **PUSH**
- 7 - "CHECK DN" inverter ..... **ACTUATE**  
*If the hardening of the manual control is marked and if the normal indicating shows 3 green indicator lights or the "CHECK DN" indicating shows 3 green indicator lights.*
- 8 - LAND.  
*If the manual control remains soft or if one (or several) green indicator light(s) miss(es) on the normal indicating and on the "CHECK DN" indicating, the bad locking of a landing gear in down position is confirmed. Recycle the landing gear as follows :*
- 9 - By-pass selector ..... **UNLOCK / PUSH**
- 10 - Wait a minute.
- 11 - Landing gear control (IAS ≤ 128 KIAS) ..... **UP**  
*Perform tests of landing gear extension in the NORMAL mode by applying positive load factors during the maneuver as well as skidding.*  
*In case of failure, refer to Chapter 3.7 "EMERGENCY LANDINGS", Paragraph "LANDING WITH UNLOCKED MAIN LANDING GEAR" or Paragraph "LANDING WITH DEFECTIVE NOSE LANDING GEAR".*

*Indication :*  
*If a main landing gear is not in the down position, it is preferable to land with landing gear up (Refer to Chapter 3.7, Paragraph "LANDING WITH GEAR UP").*