



Aviation and Railway Accident Investigation Board

Report No. ARAIB/AAR-1003

AIRCRAFT ACCIDENT REPORT

HULL LOSS DURING FORCED LANDING

DONG SEO GNI CO. LTD.

CESSNA T206H, HL1094

15 NM WEST OF THE DAEGU INTERNATIONAL AIRPORT

26 MARCH 2010



10 FEBRUARY 2011

**AVIATION AND RAILWAY ACCIDENT INVESTIGATION BOARD
MINISTRY OF LAND, TRANSPORT AND MARITIME AFFAIRS
REPUBLIC OF KOREA**

According to the provisions of the Article 30 of the Aviation and Railway Accident Investigation Act of the Republic of Korea, it is stipulated;

The accident investigation shall be conducted separately from any judicial, administrative disposition or administrative lawsuit proceedings associated with civil or criminal liability.

And in the Annex 13 to the Convention on International Civil Aviation, Paragraphs 3.1 and 5.4.1, it is stipulated and recommended as follows;

The sole objective of the investigation of an accident or incident shall be the prevention of accidents and incidents, and it is not the purpose of the activity to apportion blame or liability. Any judicial or administrative proceedings to apportion blame or liability should be separate from any investigation conducted under the provisions of this Annex.

Thus, this investigation report issued as the result of the investigation on the basis of the Aviation and Railway Accident Investigation Act of the Republic of Korea and the Annex 13 to the Convention on International Civil Aviation, shall not be used for any other purpose than to improve aviation safety.

In case of divergent interpretation of this report between the Korean and English languages, the Korean text shall prevail.

Aircraft Accident Report

Aviation and Railway Accident Investigation Board. Hull loss during forced landing with no engine power, Dong Seo GNI Co. Ltd., Cessna T206H, HL1094, 15 NM West of the Daegu International Airport, 26 March 2010. Aircraft Accident Report ARAIB/AAR-1003. Seoul, Republic of Korea

The Aviation and Railway Accident Investigation Board (ARAIB) is a government organization for independent investigation of aviation and railway accident, and the accident investigation shall be carried out based on the Aviation and Railway Accident Investigation Law of the Republic of Korea and Annex 13 of the Convention on International Civil Aviation.

The objective of accident or incident investigation of the Korea Aviation and Railway Accident Investigation Board is not to apportion blame or liability but to prevent accidents and incidents.

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Hull loss during forced landing with no engine power

Dong Seo GNI Co. Ltd., Republic of Korea

Cessna T206H, HL1094

15 NM west of the Daegu International Airport

Latitude: N 35° 50 ' 15 " , longitude: E 128° 20 ' 11 "

26 March 2010, about 10:49 (01:49 UTC)¹⁾

Synopsis

On 26 March 2010, a Cessna aircraft (T206H, HL1094, hereinafter referred to as "HL1094") of the Dong Seo GNI Co. Ltd., which took off the Daegu International Airport at about 09:58 for the purpose of taking aerial photographs and was going to the Muju area²⁾ of Jeollabuk-do, was flying about 40 NM west of the Daegu International Airport at an altitude of 7,500 feet, when engine oil leaked out and covered the cockpit windshield to completely obstruct the pilots' forward view.

Avoiding the mountainous areas in anticipation of the engine stop, they were returning to the Daegu International Airport, when the engine stopped eventually. So they made a forced landing on a free space located in Sangon-ri³⁾, Yongam-myeon, Seongju-gun, Gyeongsangbuk-do at about 10:49. During the forced landing, the HL1094 overturned to be hull loss, but the pilots on board were not injured at all.

The Aviation and Railway Accident Investigation Board (hereinafter referred to as "ARAIB") dispatched accident investigators to the scene to institute an investigation and notified the NTSB of the accident. After gathering the factual information relevant to this accident, the ARAIB made a concentrated analysis on the result of the engine teardown inspection and the pilots performance.

1) Unless otherwise indicated, all times in this report are Korea Standard Time (KST, UTC+9)

2) Mountainous area located about 50 NM west of the Daegu International Airport

3) Located about 15 NM west of the Daegu International Airport

The ARAIB determines that the cause of this accident was that 「During the flight, all of the engine oil leaked out through a gap that was made as the crankshaft oil seal located between the engine crankshaft and the propeller hub, was pushed out, and due to this the engine ceased.」

Contributing to this accident was that 「① The engine was not installed with a retaining plate that physically supports the crankshaft oil seal to prevent it from being pushed out. ② Because the crankshaft oil seal is not a check item besides overhaul check, the crankshaft oil seal has never been checked since the engine was manufactured.」

As a result of this accident investigation, the ARAIB makes safety recommendations to the Lycoming Ltd. and to the Dong Seo GNI Co. Ltd.

1. Factual Information

1.1 History of Flight

The HL1094 took off the Daegu International Airport at about 09:58 for the purpose of taking aerial photographs of the Muju area of Jeollabuk-do located about 40 NM west of the Daegu International Airport, and was approaching the aerial photographing area at an altitude of 7,500 ft.



[Fig. 1] photographing area and flight path of HL1094

But immediately before the entry into the photographing mission area, engine oil leaked out suddenly to completely cover the windshield, and the oil pressure started to drop rapidly. In anticipation of an engine cease situation, the pilots decided to get away from mountainous areas and changed the flight direction toward the Daegu International Airport.

The pilots reduced the throttle lever to the idle position, and maintained a glide speed while looking for a suitable place for landing when the engine stopped at an altitude of around 3,000 feet about 15 NM west⁴⁾ of the Daegu International Airport.

4) About 20 NM from the point of return

Judging it impossible to glide to the Daegu International Airport at such an altitude, the pilots decided to make a forced landing nearby, declared an emergency to the Daegu Approach Control making one turn in the air and made a forced landing after executing the procedures of "Emergency Landing without Engine Power".

The place where the HL1094 made a forced landing was a free space of 70 meters long and 50 meters wide, surrounded by buildings and agricultural hotbeds. After touchdown, the HL1094 advanced about 40 meters with a heap of the cloth cover for the heat conservation of the hotbed caught by the nose gear until the nose slipped to the left to be capsized to the right.

1.2 Injuries to Persons

Injury	Pilot	Passenger	Total	Other
Fatal	0	0	0	0
Serious	0	0	0	0
Minor / No injury	2	0	2	0
Total	2	0	2	0

1.3 Damage to Aircraft

The HL1094 sustained substantial damage by the overturn after a forced landing, incurring damage of about 300 million won⁵⁾.

1.4 Other Damage

There was no other damage due to this accident.

1.5 Personnel Information

1.5.1 The Captain

The captain (age 35, male) held a valid Commercial Pilot License⁶⁾ and Class 1

5) The price at the time of introduction in 2001

Airman Medical Certificate⁷⁾. His total flying time was 511 including 209 hours on the T206 aircraft, 42 hours for the latest three months and 35 hours for the latest one month, and was waiting the flight schedule in the hotel with no flight in the latest 72 hours before the accident flight.

1.5.2 The Co-pilot

The copilot (age 29, male) held a valid Commercial Pilot License⁸⁾ and Class 1 Airman Medical Certificate⁹⁾. His total flying time was 381 hours including 62 hours on the T206 aircraft, 43 hours for the latest three months and 35 hours for the latest one month, and was waiting in the hotel without the flight in the latest 72 hours before flight.

1.6 Aircraft Information

1.6.1 Aircraft History

The HL1094 was manufactured¹⁰⁾ by the Cessna Company in January 2001 and was introduced and registered¹¹⁾ by the Dong Seo GNI Co. Ltd. on 27 September 2005, and held a valid Certificate of Airworthiness¹²⁾, an Operating Limitation Specification¹³⁾, and a Radio Station Certificate¹⁴⁾.

The HL1094 was equipped with one engine of TIO-540-AJ1A type manufactured by the Lycoming Ltd. and with one aerial photographing camera¹⁵⁾.

The total service time of the HL1094 was 1,113 hours, the number of takeoff and landing was 328 cycles, the service time of the engine was 1,113 hours, and the service time of the propeller was 629 hours. According to the Maintenance Manual, the engine was to have the overhaul check every 2,000 hours.

6) Number: 6512 (passed on 24 April 2007, issued on 16 March 2009)

7) Number: 025-7696 (Expiry: 31 December 2010)

8) Number: 6707 (Passed on 29 November 2007, issued on 26 May 2008)

9) Number: 110-0182 (Expiry: 31 December 2010)

10) Serial Number: T20608259

11) Registration Number: 2009-016

12) Number: AS08079 (issued on 10 October 2008)

13) Number: ASOL08079 (issued on 10 October 2008)

14) Number: 46-2005-40-0000001 (permitted on 8 November 2005)

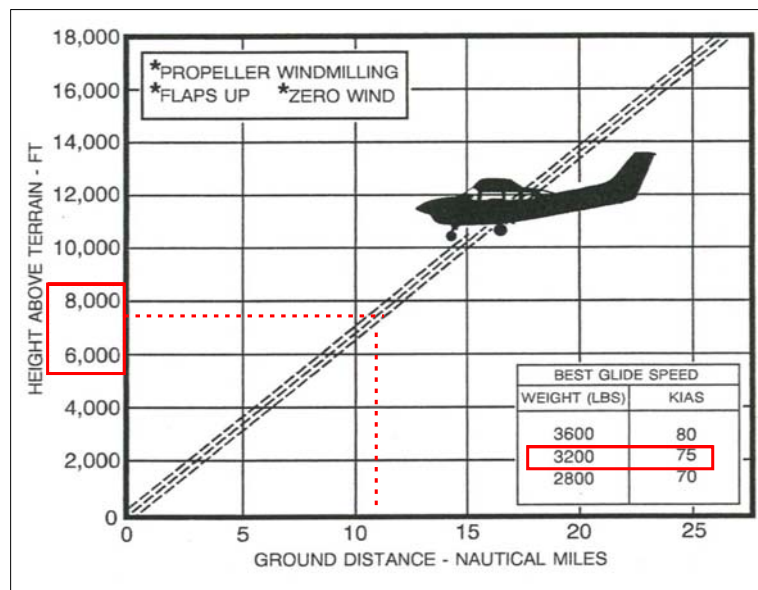
15) ULTRA CAM X (Manufacturer: Vexcel)

1.6.2 Weight and Balance

- Takeoff weight¹⁶⁾: 1,601 kg (Maximum takeoff weight: 1,633 kg)
- Weight at the time of air return: 1,579 kg (Fuel consumption: 22 kg)
- Weight at time of a forced landing: 1,571 kg (Fuel consumption during returning: 8 kg)

1.6.3 Emergency Landing Procedures

According to the T206H Flight Manual Chapter 3. Emergency Procedures, if engine ceased in the air, gliding speed should be maintained as soon as possible, and the cause of failure should be confirmed while gliding to a suitable landing place. The gliding speed and distance by altitude are as shown in [Fig. 2].



[Fig. 2] Gliding speed and distance

If time allows, an engine restart should be attempted; if it is not possible to restart, procedures of "the Emergency Landing without Engine Power" should be executed as shown in [Fig. 3].

16) Airframe (including pilots): 1,175 kg, fuel: 240 kg, photographing equipment: 186 kg

FORCED LANDINGS**EMERGENCY LANDING WITHOUT ENGINE POWER**

1. Passenger Seats -- AS FAR FORWARD AS PRACTICAL.
2. Passenger Seat Backs -- MOST UPRIGHT POSITION.
3. Seats and Seat Belts -- SECURE.
4. Airspeed -- 85 KIAS (flaps UP).
75 KIAS (flaps DOWN).
5. Mixture -- IDLE CUT OFF.
6. Fuel Selector Valve -- PUSH DOWN and ROTATE to OFF.
7. Ignition Switch -- OFF.
8. Wing Flaps -- AS REQUIRED (40° recommended).
9. Master Switch -- OFF when landing is assured.
10. Doors -- UNLATCH PRIOR TO TOUCHDOWN.
11. Touchdown -- SLIGHTLY TAIL LOW.
12. Brakes -- APPLY HEAVILY.

[Fig. 3] Emergency landing procedures

1.7 Meteorological Information

According to the statements of the pilots, the visual meteorological condition was maintained during the flight and the meteorological factor did not impede the flight.

1.8 Aids to Navigation

Not applicable

1.9 Communications

There was no communications failure while the HL1094 was flying.

1.10 Aerodrome Information

Not applicable

1.11 Flight Recorders

No flight recorder was installed in the HL1094.

1.12 Wreckage and Impact Information

As shown in [Photo 1], the HL1094 touched down at the entry into a free space about 70 meters long and about 50 meters wide, and advanced about 40 meters with the nose gear caught by a heap of cover for the heat conservation of hotbed before it capsized to the right as the nose slipped to the left.



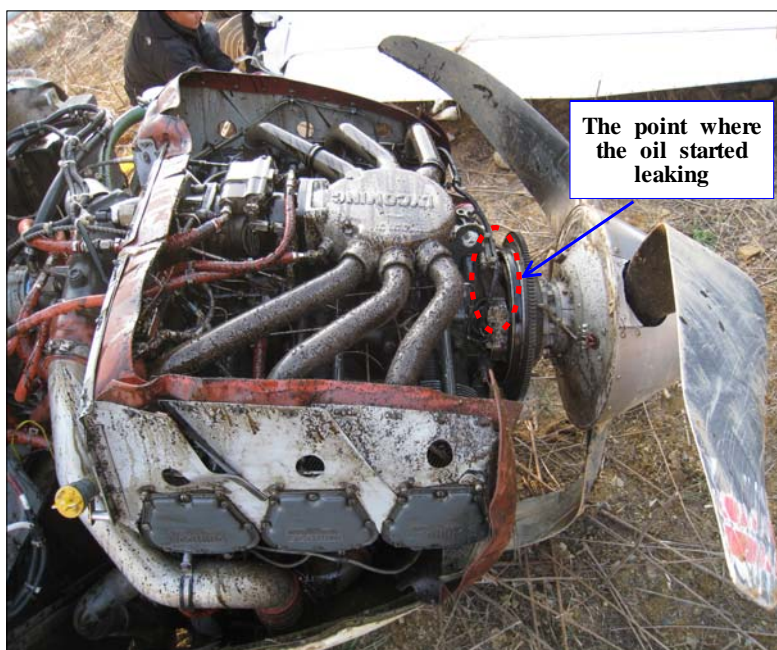
[Photo 1] Advance and stop directions after touchdown



[Photo 2] Damage of the aircraft after capsizing

As shown in [Photo 2], in the process of the HL1094 being overturned after a forced landing with the engine stopped, the 3-leaf propeller was all bent backward without any rotation damage, and the right wing and the nose gear were broken and fell off, and the hull was pressed and crushed.

The engine oil that leaked out from the back of the propeller hub as shown in [Photo 3], was sprayed on the engine, the windshield of the cockpit and the surface of the hull.



[Photo 3] Engine oil leakage

1.13 Medical and Pathological Information

The HL1094 pilots held valid Class 1 Airman Medical Certificates and testified that they had not taken any particular medication or alcoholic beverage before the flight.

1.14 Fire

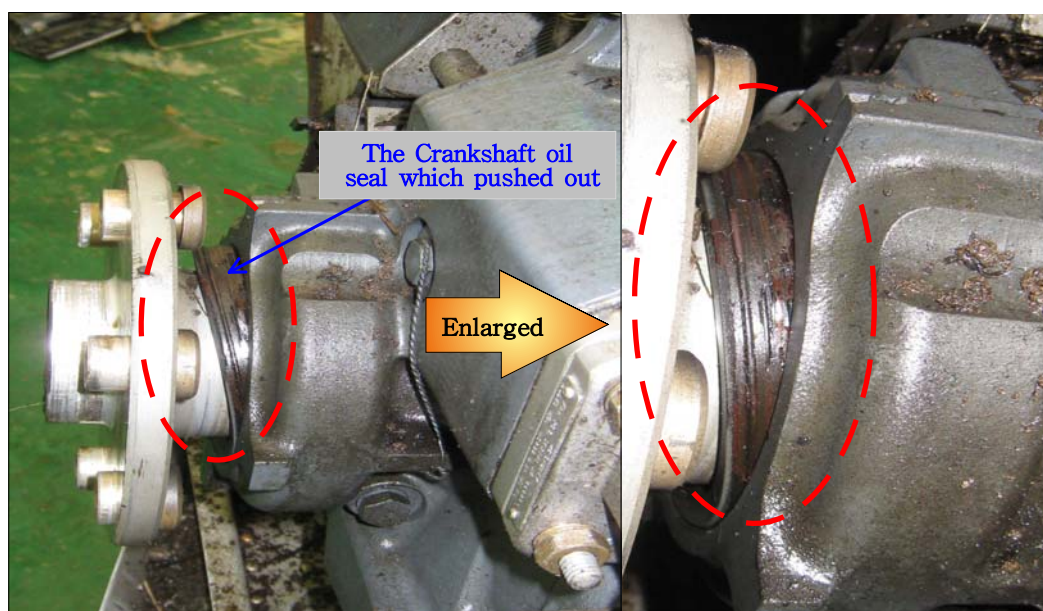
There was no fire in this accident.

1.15 Survival Aspects

Not applicable

1.16 Tests and Research

In the wreckage analysis room of the ARAIB on 28 March 2010, an engine teardown inspection was conducted in order to find out the cause of the oil leakage in the presence of the related persons of the ARAIB, Busan Regional Aviation Administration and the Dong Seo GNI Co. Ltd., and the following were confirmed.



[Photo 4] The Crankshaft oil seal which pushed out

- As shown in [Photo 4], it was found that the upper portion of the crankshaft oil seal which was located between engine crankshaft and propeller hub was pushed out.
- The retaining plate that supports the crankshaft oil seal to prevent it from being pushed out was not installed.

1.17 Organizational and Management Information

Not applicable

1.18 Additional Information

None

2. Analysis

2.1 General

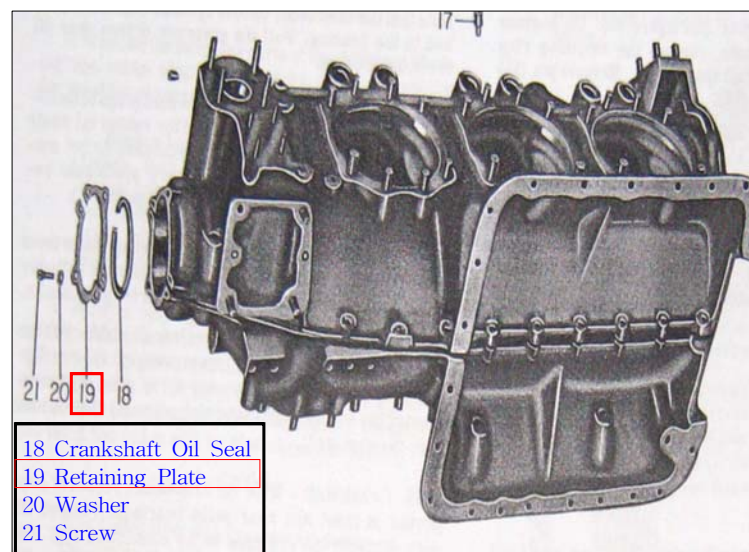
The pilots of the HL1094 were certified and qualified for the relevant flight, and the aircraft held valid Airworthiness Certificate and Operating Limitation Specification.

The pilots took a sufficient rest before the flight and no medical factor which might have adversely influenced their performance, was found.

2.2 Engine Teardown Inspection

The upper portion of the crankshaft oil seal which located between the engine crankshaft and the propeller hub was pushed out. This is judged to be because the oil seal could not overcome the oil pressure in the engine, so engine oil leaked out during the flight to make the engine cease eventually.

A retaining plate was not installed as like the number 19 of [Fig. 4] that supports the crankshaft oil seal to prevent it from being pushed out. Because of this, it is judged that it was not possible to physically prevent the force pushing the crankshaft oil seal out from acting when the oil pressure inside the engine increased.



[Fig. 4] Oil seal and retaining plate of other engine

The engine of HL1094 was to be overhauled every 2,000 hours, and for the other checks before and after flight or periodical checks, the crankshaft oil seal is not a check item. Thus, it is judged that the crankshaft oil seal has never been checked since the engine was manufactured.

2.3 Pilots Performance

At the time of oil leakage, the HL1094 was flying over mountainous area, and considering the gliding performance of the aircraft, it was not in a position sufficient to secure an emergency landing if the engine ceased at the oil leaking point. Because of this, it is judged to be an adequate action that the pilots maintained a gliding speed with the throttle reduced to idle without stopping engine right away to get away from the mountainous area although a lot of oil leaked.

And considering that they declared an emergency after engine ceased and took the emergency landing procedures according to the Manual relevant to the aircraft and that they tried to make an emergency landing while finding a suitable place although the forward view was obstructed because of the oil covering the windshield, it is judged that the pilots of the HL1094 were well aware of the situation and made a proper decision to take the emergency procedures.

3. Conclusions

3.1 Findings

1. The pilots of HL1094 were certified and qualified for the relevant flight and the aircraft held a valid certificate of airworthiness and operating limitation specification.
2. The pilots took a sufficient rest before the flight and no medical factor which might have adversely influenced their performance, was found.
3. The leaked engine oil covered the cockpit windshield and obstructed the forward view of the pilots, and impeded the pilots in making an emergency landing.
4. At the time, the HL1094 was flying over mountainous area, and it was not in a position sufficient to secure an emergency landing if the engine was stopped at the oil leaking point in view of the gliding performance of the aircraft.
5. At the time of the accident the engine service time of the HL1094 was 1,113 hours, and the engine was to have an overhaul check every 2,000 hours.

3.2 Causes

The Aviation and Railway Accident Investigation Board determines that the cause of the engine cease was that 「During the flight, all of the engine oil leaked out through a gap that was made as the crankshaft oil seal located between the engine crankshaft and the propeller hub, was pushed out, and due to this the engine ceased.」

Contributing to this accident was that 「① The engine was not installed with a retaining plate that physically supports the crankshaft oil seal to prevent it from being pushed out. ② Because the crankshaft oil seal is not a check item besides overhaul check, the crankshaft oil seal has never been checked since the engine was manufactured.」

4. Safety Recommendations

As a result of an investigation into the HL1094 accident occurred on 26 March 2010 at 15 NM west of the Daegu International Airport, the Aviation and Railway Accident Investigation Board makes the following safety recommendations;

To the engine manufacturer (Lycoming Ltd.)

1. Devise a scheme for mounting a retaining plate that physically supports the crankshaft oil seal to prevent it from being pushed out. (AAR1003-1)
2. Devise a scheme for specifying the check time and method in the maintenance manual so that the crankshaft oil seal can be checked more effectively. (AAR1003-2)

To the Dong Seo GNI Co. Ltd.

1. Provide a case study to its pilots and maintenance personnel and devise a scheme for checking an initial indication of the engine oil leakage from the crankshaft oil seal on the ground, if practicable. (AAR1003-3)