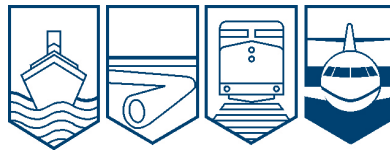


Transportation Safety Board
of Canada



Bureau de la sécurité des transports
du Canada

**AVIATION INVESTIGATION REPORT
A10O0125**



STALL AND SPIN AND COLLISION WITH TERRAIN

**TORRES AVIATION INCORPORATED (DOING BUSINESS AS
SKYWORDS AERIAL ADVERTISING)**

CESSNA 172K C-GQOR

TORONTO/BUTTONVILLE MUNICIPAL AIRPORT, ONTARIO

20 JUNE 2010

Canada

The Transportation Safety Board of Canada (TSB) investigated this occurrence for the purpose of advancing transportation safety. It is not the function of the Board to assign fault or determine civil or criminal liability.

Aviation Investigation Report

Stall and Spin and Collision with Terrain

Torres Aviation Incorporated (doing business as
Skywords Aerial Advertising)

Cessna 172K C-GQOR

Toronto/Buttonville Municipal Airport, Ontario

20 June 2010

Report Number A10O0125

Summary

The Cessna 172K (registration C-GQOR, serial number 17259052), operated by Torres Aviation Incorporated (doing business as Skywords Aerial Advertising), was returning to the Toronto/Buttonville Municipal Airport after an aerial advertising, banner-towing flight. It flew a low approach parallel to Runway 33, dropped the banner in the grass and commenced an overshoot for landing on Runway 33. Shortly thereafter, the aircraft stalled and spun to the ground. The pilot was fatally injured and the aircraft was destroyed by the impact and a post-crash fire. The emergency locator transmitter functioned until it was consumed by fire. The accident occurred at 1728 Eastern Daylight Time.

Other Factual Information

History of Flight

The aircraft had flown earlier that day between 1138 and 1336 ¹ without incident.

The accident flight took off from Toronto/Buttonville Municipal Airport (Buttonville) at 1526, picked up the banner 5 minutes later, proceeded via the Don Valley Parkway through the Toronto/Billy Bishop Toronto City Airport control zone, then along the lakeshore to Port Credit where it flew a planned orbit from 1559 until 1700.

Upon its return to the Buttonville Municipal Airport, the aircraft was cleared for a low approach, parallel to Runway 33, to drop the banner in the grass to the west. After the banner was released, engine power was increased and the aircraft began a normal overshoot to join the left-hand circuit to land on Runway 33.

After passing abeam the departure end of runway 33, approximately 800 feet beyond the banner release point, the aircraft assumed an unusually nose-high pitch attitude, estimated to be as much as 45°, and banked slightly (less than 10°) to the left. It reached an estimated height of 250 feet above ground level and stalled aerodynamically. The left wing dropped to near 90° bank and the aircraft entered an incipient spin to the left. After turning through about 210°, it struck the ground in a 45° nose-down pitch attitude. The impact was not survivable.

Leaking fuel ignited and an intense fire ensued.

Wreckage

The left wingtip struck the ground first, followed by the nose. The ground scar was less than 50 feet long and all components, except fragments of glass and similar light materials were confined within that area. Damage to the wing leading edge and the propeller spinner was consistent with an impact in a 45° nose-down pitch attitude. There was no contact with the nearby building, lamp standard or tree, further confirming the 45° nose-down flight path. Apart from scars on a parking lot surface, there was no property damage.

The fuel system was compromised on impact. The fire was likely the result of fuel being ignited by hot exhaust components. The fire consumed the right wing fuel tank and most of the cockpit. The left wing fuel tank did not burn and was found to contain fuel; the quantity could not be determined due to spillage from compromised lines.

Flight control cables were found intact. Control surfaces were free to move. Pitch trim was deflected less than 1/8 of an inch trailing up, essentially neutral. Flaps were fully retracted. The track of the aircraft from the point at which the banner was dropped to the point at which the aircraft stalled was consistent with the aircraft flying as trimmed, in a 5° to 10° left bank.

¹ All times are Eastern Daylight Time (coordinated universal time minus 4 hours).

Engine controls were intact but their pre-impact settings could not be determined. Cockpit instruments were removed and examined at the TSB Laboratory but fire damage precluded any useful information.

The pilot seat frame was composed mainly of magnesium material which was completely consumed by the fire. Only parts of the frames, rails, and locking mechanisms were found. These were all proper components for this model of aircraft. There was no indication of pre-impact damage. Their condition, however, precluded determination of the seat position at impact.

The banner tow hook was found to function properly. The banner was found in the intended drop location and was free of any damage, tangles, or other indication of abnormal operation during the release.

Damage to the propeller indicated low rpm at impact. The engine was examined and no indication was found of pre-impact damage or mechanical failure. The fuel system and carburetor were free of contamination. There was no indication that the engine would not have produced power were it commanded.

The fuel selector was found selected to the RIGHT tank. In accordance with company policy and the Cessna 172 *Aircraft Flight Manual*, Normal Procedures, the fuel selector switch should be positioned to BOTH tanks for take-off and landing. Its use in the RIGHT only position, however, does not affect fuel flow to the engine.

Company Information

Torres Aviation Incorporated (doing business as Skywords Aerial Advertising) holds an Air Operator Certificate for aerial work issued under Subpart 702 of the *Canadian Aviation Regulations* (CARs). It operated 2 Cessna 172 type aircraft. Nothing was found to indicate that company procedures were inappropriate for the operation or that they had not been complied with.

Aircraft Information

Records indicate that the aircraft was certified, equipped and maintained in accordance with existing regulations and approved procedures. Weight and balance were within limits. There were no loose articles in the aircraft that could have shifted the centre of gravity aft, resulting in the nose pitching up.

Airworthiness Directive CF-87-15R2 - Seat Rail and Locking Mechanism Inspection was complied with. Though not mandatory, secondary seat stops were installed in accordance with Cessna Service Bulletin SEB07-5. The tow hook was installed in accordance with Limited Supplemental Type Certificate O-LSA96-047.

The secondary seat stops referred to in Cessna Service Bulletin SEB07-5 are different from an earlier secondary seat stop (Cessna Service Bulletin SEB89-2) and from other aftermarket seat stops. This stop incorporates a spring-loaded reel mechanism mounted to the seat frame, from which a nylon webbing strap extends forward and is secured to a fixed point on the cabin floor. The reel retracts the strap through spring tension as the seat moves forward along the seat rails. The reel is positively locked to prevent the strap from extending unless the seat position

adjustment handle is raised, providing an independent defence against aft seat movement in the event that the primary latching pins are improperly engaged or inadvertently become disengaged.

Pilot Information

Records indicate that the pilot was certified and qualified for the flight in accordance with existing regulations. The pilot held a valid Commercial Pilot Licence for single and multi-engine land aeroplanes and a valid Category 1 medical certificate, as well as a class 1 instrument rating. The pilot had trained at Buttonville. The pilot was hired by the operator one month prior to the accident and had completed all required company training. The pilot had flown 4 banner-towing flights during the 2 days prior to the accident without incident. The pilot had accumulated approximately 260 hours of total flight time, of which an estimated 190 hours were on the Cessna 172 type. In the 30 days prior to the accident, the pilot had flown 22 hours, all on type.

There was no indication that incapacitation or physiological factors affected the pilot's performance. Fatigue was not an issue.

Weather Information

The weather was suitable for the flight and was not considered to have been a factor in the accident.

ATC and Recorder Information

The aircraft was not equipped with any flight or cockpit data recording devices; none was required by regulation. Air traffic control radar and communication data were reviewed for both flights. The tracks were consistent with the intended missions. No altitude deviations or other indications of abnormal performance were found.

Radio communications between the pilot and air traffic controllers were consistent with normal practice. Upon its return to Buttonville, the aircraft gave no indication of a malfunction or any requirement for special handling. After the banner was dropped, there was no communication or indication of attempted communication from the aircraft.

Seat-slip Accidents/Incidents

Several general aviation aircraft types, including but not limited to the Cessna 172, have been involved in accidents and incidents in which it was established or suspected that the pilot's seat dislodged from its desired position and slid backwards. In Canada, 5 accidents involving aircraft damage are recorded in the past 20 years, none of which resulted in more than minor injury. As none of the occurrences were investigated beyond data gathering, a limited amount of information as to cause and circumstance is available.

In all cases, the seat slid back during the take-off acceleration or immediately after rotation. Four resulted in runway excursions without the aircraft taking off. In one instance, the aircraft became airborne and the nose pitched down, resulting in a collision with the ground. There was insufficient data to determine if the aircraft had stalled. In another instance, the pilot pulled both the control column and the throttle back, resulting in the aircraft losing power and pitching up. The pilot released the control column, repositioned the seat, regained control of the aircraft, and landed safely without damage.

Several foreign occurrences involving Cessna aircrafts with similar seat rails and locking mechanisms were also studied. Most occurred during the take-off run or shortly after rotation and most resulted in runway excursions. Two accidents occurred during go-around, and both cases involved an aircraft configured with full flap. In this configuration, substantial forward force is required on the yoke to overcome the nose-up trim change that occurs when go-around power is applied. After the seat slid back, the pilot was unable to control the nose-up aircraft, the nose rose to an excessively high pitch attitude and the aircraft stalled.

Airworthiness directive CF-87-15R2 requires repeated inspections of the seat rails and locking mechanisms for various Cessna aircraft models to prevent such occurrences. In most of the occurrences involving Cessna aircraft, the airworthiness directive had been complied with and seat rail wear was not a factor. These occurrences were attributed to improper installation of the seat or a failure of the pilot to properly adjust and lock the seat. Cessna Service Bulletin SEB07-5 requires the installation of the 2007 secondary seat stops. No reports were found of unintentional seat movement with the 2007 stop installed.

After this accident, but not directly related to it, the Federal Aviation Administration issued a Safety Alert for Operators advising that missing or improper seat stop installations had been found on some aircraft and that they should be inspected regularly for proper airworthy condition.

The following TSB Laboratory reports were completed:

- LP091/2010 – Instrument Analysis
- LP134/2010 – Analysis of Piston Deposit

Analysis

Airport operations, air traffic control services and weather did not contribute to this accident. There was no indication of any difficulty in handling the aircraft with the banner in tow and it disengaged cleanly.

Records indicate that the aircraft was certified, equipped, and maintained in accordance with existing regulations and approved procedures. There was no communication from the pilot indicating any difficulty. The pilot was certified and qualified for the flight in accordance with existing regulations. Fatigue was not considered a contributing factor.

In attempting to find a reasonable explanation as to why the aircraft stalled and spun to the ground, a number of plausible scenarios were considered:

- the controls were fouled or jammed;
- the aircraft was improperly configured;
- the pilot became incapacitated or otherwise unable to control the aircraft;
- the pilot's seat was not locked in position and slid on the rail;
- the pilot attempted an emergency return to the runway; or
- the pilot induced the pitch-up for some other reason.

The control cables were found intact and control surfaces were free to move. Aircraft manoeuvres throughout the low approach, banner drop and initial overshoot were all normal. Nothing was found to indicate the controls were fouled or jammed in such a way to induce an abrupt pitch-up or prevent recovery.

The flaps were up and the pitch trim was found in the neutral position, a normal position for take-off and consistent with the banner drop sequence and subsequent climb at normal climb airspeed. In this configuration, in the absence of any pilot input, the aircraft could not autonomously achieve the pitch attitude or angle-of-attack that occurred in this accident.

If not properly secured, the seats of some aircraft, including Cessna types, have been known to slide backwards unintentionally on their rails, due to acceleration forces on the initial take-off or the pilot pushing on the controls to counter the trim change when power is applied on a go-around in the flap-down configuration. There is no known instance of seats sliding back in Cessna aircraft equipped with the 2007 secondary seat stop. Impact and fire damage made it impossible to determine with certainty whether or not the seat had been properly locked in position before impact or to determine its position at impact.

The investigation considered the possibility of an engine failure or other malfunction that would lead the pilot to attempt an immediate return to the field. It was determined that the propeller was turning at impact but not at full power. Examination of the engine, its components and ancillary controls did not reveal any anomalies that would preclude normal operation. An engine failure from fuel starvation due to the non-standard selection of the right tank was considered unlikely.

On the go-around, the aircraft was to the left of the runway. Had the aircraft experienced an engine power loss, it is doubtful that the pilot would have turned to the left, away from the field; rather, the more logical action would have been to turn right. Moreover, having been trained at Buttonville, in the event of an emergency landing, the pilot would likely have been aware of suitable landing sites in the vicinity of the departure area of Runway 33.

After dropping the banner, the pilot may have attempted to check the drop area by looking through the rear window. This would require pitching up deliberately and twisting the torso. With the left hand on the yoke and the right hand on the throttle, the twisting motion could have induced an inadvertent reduction in power and downward pressure on the left side of the yoke resulting in a left bank. It is unclear how this would have resulted in a sustained power reduction and sustained application of aft elevator without the pilot taking notice and making corrections.

None of these scenarios could be validated.

Findings as to Causes and Contributing Factors

1. For undetermined reasons, during an intentional overshoot, the aircraft climbed, pitched up steeply, stalled and entered a spin from which it did not recover.
2. The impact was not survivable.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 13 April 2011.

Visit the Transportation Safety Board's website (www.bst-tsb.gc.ca) for information about the Transportation Safety Board and its products and services. There you will also find links to other safety organizations and related sites.