Transportation Safety Board of Canada | Bureau de la sécurité des transports du Canada

Air Transportation Safety Investigation Report A17Q0162

IN-FLIGHT COLLISION WITH DRONE

Sky Jet M.G. Inc.
Beechcraft King Air A100 C-GJBV
Québec/Jean-Lesage International Airport, Quebec
12 October 2017

About the investigation

The Transportation Safety Board of Canada (TSB) conducted a limited-scope, fact-gathering investigation into this occurrence to advance transportation safety through greater awareness of potential safety issues. It is not the function of the Board to assign fault or determine civil or criminal liability.

This is a new type of report that is part of a TSB pilot project to modernize its investigation processes and products.

History of the flight

A Beechcraft King Air A100 (registration C-GJBV, serial number B 100) (Figure 1), operated by Sky Jet M.G. Inc. as Flight SJ512, was on an instrument flight rules flight from Rouyn-Noranda Airport (CYUY) (Quebec) to Québec/Jean-Lesage International Airport (CYQB) (Quebec) with 2 pilots and 6 passengers on board.

Figure 1. C-GJBV (Source: Sky Jet M.G. Inc.)

As the aircraft approached CYQB, the aircraft was cleared for a visual approach to Runway 24. On final approach, the flight crew observed a drone, about the size of a dinner plate, in front of the left wing. The pilot had no time to take evasive action. The impact was unavoidable, and the drone disintegrated.

The collision took place at 1802 Eastern Daylight Time,[1] at an altitude of 2500 feet above sea level (ASL),[2] and approximately 7 nautical miles from the midpoint of Runway 24.

At 1804, the crew declared an emergency, then completed the landing without further incident. There were no injuries.

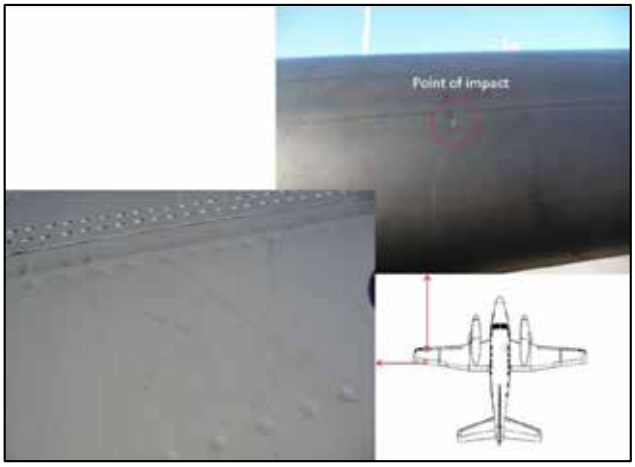
Meteorological information

Weather conditions at the time of the collision were favourable for visual flight, with clear skies and calm winds.

Damage to the aircraft

The damage was limited to a dent at the point of impact on the left wing de-icing boot, as well as scratches on the upper surface of the left wing (Figure 2). The damage was minor and had no effect on the airworthiness of the aircraft. The aircraft was returned to service the same day.

Figure 2. Damage to the aircraft (Source: Transport Canada, with photo montage by the TSB)



Canadian airspace

Canadian airspace is divided into 7 classes designated by letters A to G.[3] Each class is governed by its own regulations.

CYQB is located within Class C controlled airspace, which means that all aircraft must obtain authorization from air traffic control (ATC) before entering this airspace. Class G airspace is an airspace within which ATC has neither the authority nor the responsibility to exercise control over air traffic. The collision took place within the Class C control zone (Figure 3).

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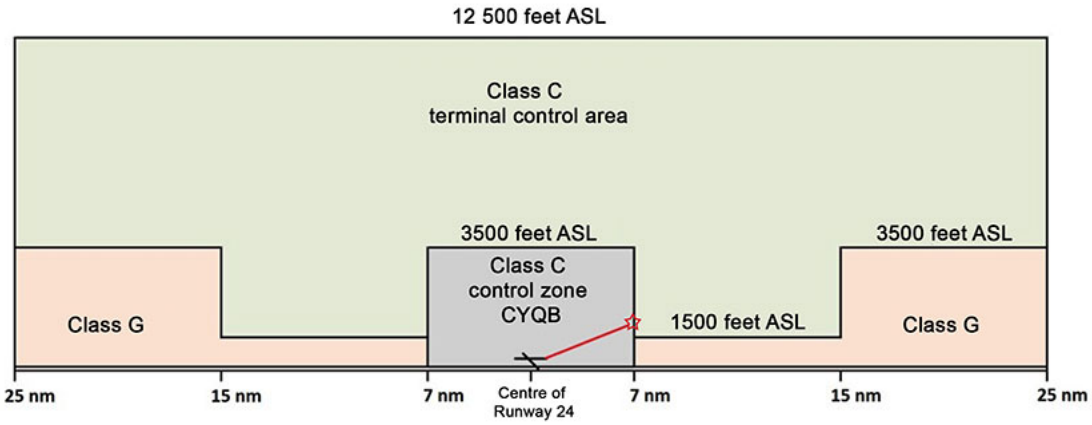
1 All times are Eastern Daylight Time (Coordinated Universal Time minus 4 hours).

2 About 2100 feet above ground level.

3 Transport Canada, TP 14371E, *Aeronautical Information Manual* (effective 12 October 2017 to 29 March, 2018), RAC – Rules of the Air and Air Traffic Services, section 2.8: Airspace Classification, p. 196.

Figure 3. Airspace classification of Québec/Jean-Lesage International Airport. The red star indicates the location of the collision.



Radar systems used by air traffic control

Radar systems are used to display data, such as an aircraft's position, speed and altitude, provided it is equipped with a transponder. A primary surveillance radar can detect an aircraft above a certain mass, even if it does not have a transponder. Generally speaking, drones cannot be detected by the primary surveillance radar because they are too small and made primarily of plastic.

Rules for drone operations

Consumers who want to buy a drone must understand that drones are considered aircraft under the *Aeronautics Act*.[4] Any civil aircraft flying in Canada is governed by the *Canadian Aviation Regulations* (CARs).

Transport Canada (TC) categorizes drones according to their use:

- Recreational purposes
- Non-recreational purposes

However, the CARs do not use the term "drone." The term "model aircraft"[5] is used for a drone operated for recreational purposes, and the term "unmanned air vehicle" (UAV)[6] is used for a drone operated for non-recreational purposes.

Model aircraft

There is currently only 1 provision governing the recreational use of drones in the CARs:

> No person shall fly a model aircraft or a kite or launch a model rocket or a rocket of a type used in a fireworks display into cloud or in a manner that is or is likely to be hazardous to aviation safety.[7]

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[4] An aircraft is defined as "any machine capable of deriving support in the atmosphere from reactions of the air, and includes a rocket" (Source: Government of Canada, *Aeronautics Act* [R.S.C. (1985), c. A-2], Definitions).

[5] A model aircraft is an aircraft weighing at most "35 kg (77.2 pounds) that is mechanically driven or launched into flight for recreational purposes and that is not designed to carry persons or other living creatures" (Source: Transport Canada, *Canadian Aviation Regulations*, SOR/96-433, subsection 101.01(1), Definitions).

[6] An unmanned air vehicle "means a power-driven aircraft, other than a model aircraft, that is designed to fly without a human operator on board" (Source: ibid.).

[7] Transport Canada, *Canadian Aviation Regulations*, SOR/96-433, section 602.45.

However, this provision was suspended following the issuance of *Interim Order No. 8 Respecting the Use of Model Aircraft* on 16 June 2017, except for models weighing 250 g or less. TC issued Interim Order No. 8 in response to the increased reporting of incidents involving drones. This interim order outlines the provisions that define limits on the use of drones, such as not operating a drone within a controlled airspace and the requirement to operate within line of sight. It also outlines the applicable fines in the event of misuse.

It is important to note that a Special Flight Operations Certificate (SFOC) is required when operating a drone outside of Interim Order No 8.

Although there is no specific guidance for operators who wish to obtain an SFOC, information regarding SFOCs can be found in Staff Instruction No. 623-001, which is used by TC to process applications and is available on TC's website.

Unmanned air vehicles

Drones used for non-recreational purposes, as well as drones over 35 kg used for recreational purposes, are governed by sections 602.41 and 603.66 of the CARs, which state that users must obtain an SFOC from TC before operating the UAV.

Under certain conditions, TC has granted exemptions that allow users to operate a UAV weighing up to 25 kg without an SFOC. Users wishing to obtain an exemption to operate a UAV without an SFOC are to consult Advisory Circular 600-004,[8] also available on TC's website.

Previous reports of incidents involving unmanned aerial vehicles

In Canada, between 2014 and 2017, the TSB received 30 reports of incidents in which pilots observed a drone on their flight path but no collision occurred. As well, between 2010 and 2017, the TSB received 8 reports of incidents that involved a drone but not an aircraft. In one of these incidents, a drone being operated for recreational purposes flew over a crowd at an outdoor event in Beloeil, Quebec. It fell from a height of 25 to 50 feet, and struck and injured a spectator.[9]

Highlights

The investigation was unable to identify the operator of the drone involved in the collision with the Sky Jet M.G. Inc. aircraft. No debris from the drone could be found, and it could not be determined with certainty whether it was used for recreational or non-recreational purposes.

The CYQB control tower had not been informed of any UAV activity in the Class C control zone under its jurisdiction, no SFOC had been issued, and no Notices to Airmen had reported any such activity on 12 October 2017. The presence of a drone within controlled airspace had not been detected by the radar in the CYQB control tower. Because neither TC nor NAV CANADA was aware of this drone operation in the control zone, the investigation concluded that the regulations governing the operation of drones were not followed.

Depending on the type of offence and its severity, a drone operator who contravenes the CARs or Interim Order No. 8 may be subject to an administrative monetary penalty (a fine up to $25,000)

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[8] Transport Canada, Advisory Circular (AC) 600-004: Guidance Material for Operating Unmanned Air Vehicle Systems under an Exemption, (Issue 02, 22 December 2016), at https://www.tc.gc.ca/eng/civilaviation/opssvs/ac-600-004-2136.html (last accessed on 09 February 2018).

[9] TSB Aviation Occurrence A16Q0063.

imposed by TC, and in some cases, may be found guilty of an indictable offence or an offence punishable on summary conviction.

It is easy for any consumer to purchase a drone without being informed of any regulations governing its use; retailers are under no obligation to inform consumers of the regulations in force.

In 2016, TC issued 4381 SFOCs for UAVs, as compared to 66 in 2010. Given this increase in the use of UAVs and in SFOC applications, TC's administrative system is no longer able to meet the usual 20-day service standard for processing and issuing SFOCs. As a result, there have been negative effects for UAV operators, such as delays to business operations and industry's ability to plan activities.[10]

Amendments to the current regulations governing the operation of drones

TC has proposed amendments to the current regulations governing the operation of drones for both recreational and non-recreational purposes. The recommended changes are described in Part I of the *Canada Gazette*. The regulatory proposal is primarily aimed at reducing the potential risks that unmanned aircraft systems (UAS)[11] pose to the safety of manned aircraft and to people and property on the ground.

In its rationale for the *Regulations Amending the Canadian Aviation Regulations (Unmanned Aircraft Systems)*, TC stated the following:

> The likelihood of further incidents was further analyzed by Transport Canada and based on Air Occurrence Report (AOR) incidents collected since January 2014. In 2014, there were 41 incidents of non-compliance reported. In 2015, the number of reported incidents more than doubled to 86, and a total of 148 incidents near aerodromes were reported in 2016. A few of the reports include flights near people or vehicles, but the existing AOR system tends to rely on pilot and air traffic controller reports, therefore incidents near people, vehicles, or property on the ground tend to be underrepresented in the data.[12]

Safety measures

In this incident, there were no injuries and only minor damage to the aircraft. However, the use of drones near an aerodrome or within controlled airspace poses a serious risk to aviation safety. For this reason, all recreational and non-recreational drone users must be knowledgeable about and comply with the regulations, including the requirement to operate within line of sight. Users must also familiarize themselves with the different classes of airspace to ensure they comply with the regulations and avoid conflicts with aircraft. In addition, it is important for the public to notify TC when observing the use of a drone near an aerodrome so that TC can take appropriate action.

This concludes the TSB's limited-scope investigation into this occurrence. The Board authorized the release of this investigation report on 06 February 2018. It was officially released on 14 February 2018.

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[10] Government of Canada, *Canada Gazette*, Part I, Vol. 151, No. 28 (15 July 2017).

[11] The terms "model aircraft" and "UAV" as currently found in the CARs are to be replaced with "unmanned aircraft systems," according to the proposed amendments.

[12] Government of Canada, *Canada Gazette*, Part I, Vol. 151, No. 28 (15 July 2017).

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Le présent rapport est également disponible en français.