AVIATION INVESTIGATION REPORT
A00A0051

COLLISION WITH TREES

JETPORT INC.
ISRAEL AIRCRAFT INDUSTRIES ASTRA SPX
FOX HARBOUR, NOVA SCOTIA
22 MARCH 2000

Aviation Investigation Report

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Summary

The Israel Aircraft Industries Astra SPX, serial number 087, registration C-FRJZ, was on a night visual approach to a private aerodrome at Fox Harbour, Nova Scotia. When on short final, the aircraft struck the tops of trees. The crew had initiated an overshoot just before hitting the trees, and the aircraft was able to climb away successfully. The flight diverted to Charlottetown, Prince Edward Island, approximately 30 nautical miles from Fox Harbour, and carried out an uneventful landing. The aircraft sustained substantial damage; the passengers and the crew were not injured.

Ce rapport est également disponible en français.

Other Factual Information

The aircraft was relatively new, and records indicated that it had been maintained in accordance with regulations. There were no pre-occurrence deficiencies identified. The aircraft had a flight management system capable of providing accurate point-to-point navigation and providing vertical guidance in certain circumstances. However, the crew was not trained or sufficiently familiar with the vertical guidance capability to have confidence in its use for approaches.

Fox Harbour is a privately owned, uncertified, single-runway aerodrome and was unregistered at the time of the accident. The runway (33/15) is paved, 4885 feet long, 75 feet wide, and equipped with runway edge lights. The runway elevation is approximately 50 feet above sea level. The approach end of Runway 33 had been cleared to a tree line approximately 1150 feet from the threshold. The average treetop height along the approach path about 60 feet. No approach lighting or visual approach slope indicating system (VASIS) was installed.

The captain, who was also the operations manager, was flying the aircraft from the left seat. The co-pilot, who was also the chief pilot, was in the right seat and was responsible for the pilot-not-flying duties. The captain had flown into Fox Harbour twice before, but never at night. The co-pilot had landed there about ten times, but only once before at night. The co-pilot's other night flight was in a Learjet, using Runway 15.

The departure and en route portions of the flight to Fox Harbour were unremarkable until preparation for the descent. The owner had made it clear to this crew, and to other crews on previous occasions, that he expected arrivals and approaches to be flown in minimum time. The operating crew and other employees confirmed this pressure, and aircrew therefore planned and conducted their operations accordingly. In preparation for the arrival and the approach to Fox Harbour, the crew inserted a series of waypoints in the flight management system to guide them for a straight-in approach and landing on Runway 33.

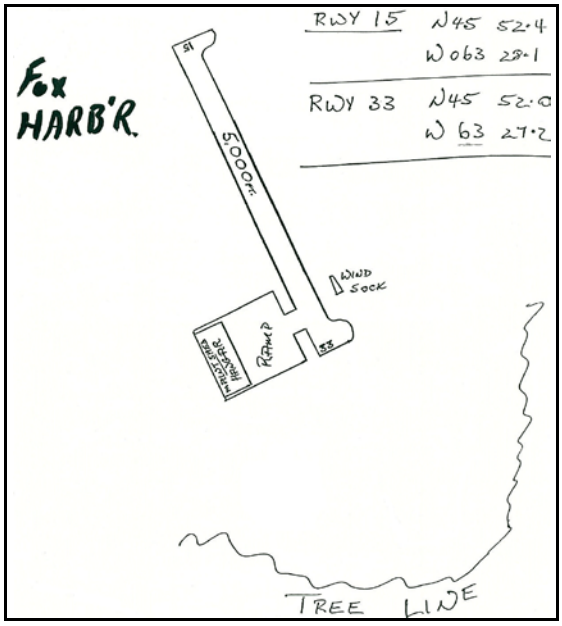
The weather for the arrival was good and consistent with the official forecasts and reports. The night was clear and starlit. The 90% illuminated moon was 24° above the horizon and almost directly behind the crew on approach to Runway 33. No restrictions to visibility were present. The aerodrome is on a peninsula along the Northumberland Strait shore in a sparsely settled area of relatively featureless terrain. Only the runway lights were clearly visible to the crew. These conditions are conducive to a black-hole illusion. Transport Canada's *Instrument Flight Procedures* manual discusses this phenomenon as follows:

> During night visual approaches to runways in dark, featureless areas ... the lack of ambient clues to orientation interferes with depth perception. Under these conditions, pilots often overestimate their altitude and, while concentrating on maintaining a constant visual angle of approach, ... [will fly along a descending] ... arc which results in premature contact with the ground.

The article "The Black Hole Approach: Don't Get Sucked In!" by Linda D. Pendleton in the online aviation periodical *AVWEB* states:

> When an approach is flown to an airport located on a coast in sparsely settled terrain on a night when the air is extremely clear and there is excellent visibility, the phenomenon of "black-hole illusion" is more pronounced.[1]

Black-hole illusion has been determined to be a factor in at least two accidents investigated by the TSB (TSB Reports A90H0002 and A96O0034). The crew was not aware of the black-hole illusion.



The company standard operating procedures (SOPs) require that "prior to each approach and landing, the flight crew shall be briefed on the critical aspects of the procedure." The company had not developed a formal arrival procedure into Fox Harbour, and an approach briefing was not conducted. It is probable that the good weather and the absence of a formal approach procedure for Fox Harbour contributed to this omission.

The aerodrome information available to the crew for the approach was a hand-drawn sketch of the aerodrome layout, with the latitude and longitude coordinates noted (Figure 1). The crew could not obtain current runway condition or wind information because the VHF radio at the aerodrome was not staffed.

Air traffic control radar data provided good information about the aircraft descent track, altitudes, and approach speeds. In general, the descent was flown at high speed on a track following the navigation waypoints programmed in the flight management system by the crew. Speed brakes were required to slow the aircraft during the descent. Example speeds show that the aircraft was at 340 knots indicated airspeed (KIAS) at 10 000 feet, 310 KIAS at 5000 feet, and 250 KIAS at 1000 feet. At 1000 feet, the aircraft was levelled and decelerated to configure for approach and landing. About this time, there was a slight quartering tailwind component, estimated to be about six knots. Because the speed was high throughout the descent, flaps and landing gear selections were delayed and, consequently, not fully extended until about three miles from the runway. At this time, the co-pilot went "heads down" to ensure that all checklist items were complete and to confirm that the aircraft was properly configured to land. When he next looked up, he observed that the aircraft was low in relationship to the runway and advised the captain, who corrected by levelling the aircraft. The aircraft altitude was recorded on radar to be between 200 and 300 feet above sea level while tracking inbound to the airport. A short distance before the tree line (Figure 1) the aircraft began descending again. The co-pilot saw trees between the aircraft and the runway and called for an overshoot. The captain had begun the overshoot on the co-pilot's call; however, the action was not taken in time to avoid striking the trees. There were no SOP calls relating to altitude during the approach.

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[1] http://www.avweb.com/articles/blackhole/

About 50 feet above ground level and 1300 feet from the threshold of Runway 33, the aircraft struck the trees and descended 10 feet into the treetops, then climbed away. Damage to the aircraft comprised wing leading-edge dents, minor fuselage perforations, leading- and trailing-edge flap dents and perforations, nose and landing-gear door damage, and foreign object damage to both engines. Tree debris was entangled in the landing gear; some of this debris fell from the aircraft during the overshoot. Debris that entered the engines subsequently resulted in an odour of burning wood and some smoke in the cabin.

Once the aircraft began climbing on the overshoot, the crew raised the landing gear and the trailing-edge flaps. Both systems functioned normally. The initial decision to raise the landing gear and the flaps was reexamined during the overshoot climb, resulting in the leading-edge flaps being left extended. The crew contacted air traffic control on the overshoot, declared an emergency, and requested clearance to Charlottetown. Charlottetown was chosen because it was nearby and clearly visible from Fox Harbour, had landing aids, and had airport emergency response services. The aircraft continued to Charlottetown for a straight-in approach and an uneventful landing and shutdown. Because of the flight time for the diversion to Charlottetown, the cockpit voice recorder only captured the last seven minutes of the approach information into Fox Harbour. A flight data recorder was not on board, nor was one required by regulation.

Jetport Inc. is a privately held charter company based in Hamilton, Ontario. At the time of the accident, the company was operating one Israel Aircraft Industries Astra SPX, one Learjet 31, and two Cessna Caravan aircraft. The company was approved to conduct Astra operations under *Canadian Aviation Regulations* (CARs) sections 604 and 704. The accident flight was being operated as a private flight for the owner of Jetport under section 604; however, three of the passengers were from a separate company travelling in support of another business project belonging to the owner at Fox Harbour. Because these passengers were not under contract to the operator, Transport Canada policy would have deemed the flight to be commercial and, consequently, required it to be operated under CARs section 704. The significant difference between CAR 604 and CAR 704 operations is that the runway length required for CAR 704 operations is greater. The runway length at Fox Harbour was sufficient for the flight to have been operated under CAR 704.

Analysis

The regular defences provided by complete aerodrome information, a comprehensive approach briefing, altitude call-outs, final approach monitoring, and adherence to SOPs were not present on this flight. Further, this was the crew's first night flight into Fox Harbour with this aircraft and their first night flight to this runway, and visual conditions were conducive to a black-hole illusion. Without previous experience or other information to alert them to the potential of a black-hole illusion on approach, the crew were not adequately prepared to operate in this higher risk environment. Consequently the crew, in the absence of these defences, were unable to detect their proximity to the terrain until just before the aircraft struck the trees.

The descent and the approach were flown in a manner to minimize flying time. This manner resulted in high descent and intermediate approach speeds and delayed the pre-landing checks and the configuration of the aircraft for landing. Consequently, the co-pilot's attention was diverted inside the cockpit when approach monitoring was required.

During the overshoot, the crew reverted to their training for a normal go-around and elected to raise the landing gear and the flaps. Under normal operating circumstances, this decision would have been appropriate; however, the decision created additional risk to safety because of the potential for an asymmetric flap or landing gear malfunction due to the damage to control surfaces and the landing gear. The extent of the damage was unknown to the crew.

The flight was conducted under CARs section 604, when CARs section 704 applied. Since the runway length at Fox Harbour was sufficient for the flight to operate under either section, this did not affect the outcome of the occurrence. However, the Board is concerned that the company was unaware of the regulatory requirement to operate under the appropriate regulation.

Findings as to Causes and Contributing Factors

1. Conditions conducive to black-hole illusion were present during the night approach to the runway.

2. In this situation, the crew did not recognize the potential hazard of the black-hole illusion and therefore did not compensate for it.

3. The crew did not adhere to the required standard operating procedures for the preparation and execution of the approach. Consequently, the crew were inadequately prepared for the visual conditions on final approach.

Findings as to Risk

1. The high descent and intermediate approach speeds caused cockpit pre-landing checks to be delayed. This delay resulted in the co-pilot's attention being diverted inside the cockpit when approach monitoring should have been done.

2. The crew's decision to raise the landing gear and the flaps on the overshoot after hitting the trees increased the risk to the flight.

Other Findings

1. The company was unaware that its operations into Fox Harbour were not done in accordance with the regulations.

Safety Action

The following changes have been made at Fox Harbour:

(a) The runway has been surveyed and centreline markings have been made in accordance with accepted standards.

(b) A PAPI (precision approach path indicator) has been installed at both ends of the runway, and the calibration is confirmed weekly.

(c) ARCAL (aircraft radio control of aerodrome lighting system) has been installed to control runway lighting and the PAPI.

(d) The trees on the Runway 33 approach have been cut back to comply with the approach standards set out by Transport Canada.

(e) A rotating beacon has been installed on the hangar and comes on when the ARCAL is activated.

(f) A global positioning system approach is being developed by Approach Navigations Systems Inc. and Transport Canada approval is expected in the near future.

(g) Standard operating procedures have been put in place for all company aircraft operating in and out of the Fox Harbour aerodrome.

(h) Fuel is available at Fox Harbour, facilitating lower aircraft landing weights.

Transport Canada has written a number of articles in its newsletter *Aviation Safety Letter* (ASL)—delivered to every valid Canadian licenced pilot—on night flying and the effects of black-hole illusion:

(a) "Understanding Night VFR and the CFIT Risk" (ASL 2/99);

(b) "Spatial Disorientation at Night" (ASL 3/2000);

(c) "Night VFR Part I—Do You See the Hazard?" (ASL 4/2000); and

(d) "Night VFR Part II—The Dark Side of Night Flying" (ASL 2/2001).

Additionally, as part of an ambitious night visual flight rules (VFR) awareness campaign, Transport Canada (TC) produced a night VFR awareness briefing package for use by the regional System Safety offices during safety awareness presentations. This package includes a new video titled "Black-holes and Little Grey Cells—Spatial Disorientation During Night VFR" (TP13838), a night VFR awareness poster titled "Hazards of Night Flying" (TP13717), a slide presentation, and a questionnaire for participants to complete during presentations.

In November 2001, the video was added to TC's Web site as a new item available for purchase. The poster was reproduced in ASL 3/2001 and has been listed on TC's Web site since July 2001. All these products have been made to raise pilots' awareness so as to prevent similar occurrences.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 20 February 2002.