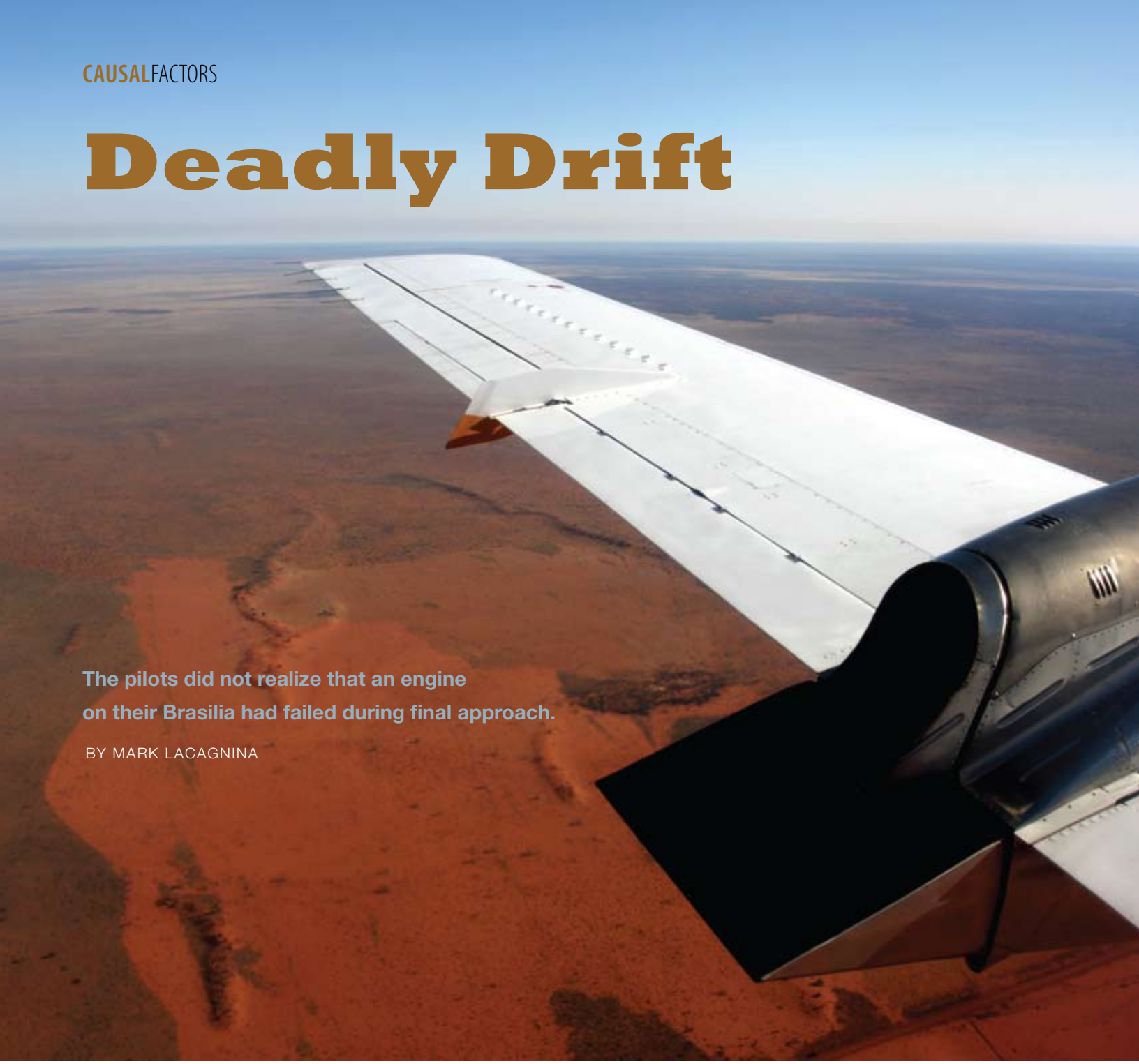
Deadly Drift



The pilots did not realize that an engine on their Brasilia had failed during final approach.

BY MARK LACAGNINA

Deficiencies in procedures for verifying fuel quantity and the absence in Australia of a flight simulator for emergency procedures training were among the safety issues identified by the investigation of a serious incident in which the flight crew nearly lost control of their Embraer EMB-120ER Brasilia following an engine failure on final approach.

The incident occurred the morning of June 26, 2007, during a charter flight from Perth, Western Australia, to Jundee, a gold-mining community about 780 km (421 nm) northeast.

The fuel quantity indicators showed that there was 1,190 kg (2,623 lb) of fuel aboard the aircraft when it departed from Perth with 28 passengers and three crewmembers at 0639 local time.

"Normal fuel consumption for the flight from Perth to Jundee was in the range of 750–900 kg [1,653–1,984 lb]," said the report by the Australian Transport Safety Bureau (ATSB).

The copilot was the pilot flying. He had 1,618 flight hours, including 1,356 hours in type. The pilot-in-command (PIC) had 3,040 flight hours, including 649 hours in type. Neither pilot had

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flown turbine aircraft before they began training in the Brasilia.

The weather at Jundee was clear with light northerly winds. Jundee Airstrip was privately operated and had a 2,095-m (6,873-ft) gravel runway oriented east-west. The crew began a straight-in visual approach to the airstrip at about 0800.

The Brasilia was in landing configuration and about 400 ft above the ground when the left engine flamed out because of fuel starvation. The aircraft drifted left of the runway centerline, and the copilot applied normal yaw and roll corrections. The drift continued, and the copilot told the PIC that the aircraft was not responding to his control inputs. The PIC called for a go-around.

Neither pilot realized that the left engine had failed. "When the crew advanced the engine power levers to commence the go-around, they were startled when the aircraft yawed and rolled left aggressively in response to the engine power asymmetry," the report said.

'Significant Delay'

The copilot asked the PIC to assist him on the controls. "The crew experienced significant difficulty in controlling the aircraft's attitude and airspeed," the report said.

The stick shaker activated twice as airspeed decreased from 110 kt to 96 kt. The Brasilia turned 45 degrees left of runway heading, with bank angle increasing to a maximum of 40 degrees. Several enhanced ground-proximity warning system warnings were generated as the aircraft came within 50 ft of the ground.

"There was a significant delay before the crew configured the aircraft appropriately for one-engine-inoperative flight," the report said.

Nearly four and a half minutes elapsed between the crew's initiation of the go-around and their retraction of the flaps and landing gear, and feathering of the propeller. "They reported that there was an immediate and significant improvement in aircraft performance when the left engine condition lever was placed in the feather position," the report said.

After completing the go-around and the engine failure checklist, the crew diverted the flight to Wiluna, about 42 km [23 nm] southwest of Jundee. They landed the aircraft without further incident at 0818.

Empty Tank

Examination of the aircraft revealed that the fuel quantity indicators showed 300 kg (661 lb) remaining in the left tank and 150 kg (331 lb) in the right tank. "A physical check revealed that the right tank contained 150 kg of fuel and that the left tank was empty," the report said.

The inaccurate fuel indication was traced to the failure of a capacitance probe in the left outboard tank. The probe had been disabled by an electrical short in wiring that had been abraded from contact with the airframe.

No one had noticed that the left fuel quantity indicator was reading high. "There were clear indications that the operator's fuel quantity measurement procedures and practices were not sufficiently robust to ensure that a quantity indication error was detected," the report said.[1]

"There was evidence that flight crews did not have a proper understanding of the reasoning behind the fuel quantity check procedures and the necessity for an independent validation of the fuel quantity by a totally reliable method."

A "reliable method" existed in the form of *dripless measuring sticks*, also called *dripsticks* and *magna sticks*. They are calibrated fuel quantity measuring devices that can be manually lowered from the wing tanks. There are eight dripsticks in the Brasilia, one for each inboard tank and three for each outboard tank. Pilots must use a table to convert dripstick readings to fuel quantity in kilograms.

The report noted that the flight logs for the operator's six Brasilias showed that the dripsticks had been used to validate fuel quantities only twice — and by the same pilot — in the three months preceding the incident.

Vague Verification

The operator had established fuel quantity verification procedures based on information contained in Australian Civil Aviation Advisory

Embraer EMB-120ER Brasilia

The EMB-120ER is the extended-range version of the Brasilia, the twin-turboprop passenger and cargo aircraft that Empresa Brasileira de Aeronáutica (Embraer) began delivering in 1985. The ER was introduced in 1991 and was the standard version until production ceased in 2000.

With accommodations for 30 passengers, the ER's maximum weights are 11,990 kg (26,433 lb) for takeoff and 11,700 kg (25,794 lb) for landing. Powered by Pratt & Whitney Canada PW118 engines rated at 1,342 kW (1,800 shp), the aircraft's long-range cruise speed at 25,000 ft is 270 kt, and maximum range is 1,629 nm (3,017 km).

Source: *Jane's All the World's Aircraft*

Publication (CAAP) 234-1(1), *Guidelines for Aircraft Fuel Requirements*.

The report said that the guidelines "lacked clarity" and did not emphasize that one of the major purposes of an independent verification of fuel quantity before flight is to check the accuracy of the aircraft's gauges.

"In broad terms," the report said, "the CAAP allowed two options for establishing fuel on board:

- "Full tanks or 'a totally reliable and accurately graduated dipstick, sight gauge, drip gauge or tank tab reading,' or,
- "A cross-check by at least two different methods."

Neither option ensured an accurate verification of fuel quantity "in cases where a gauge was under- or over-reading by a constant amount or when there was a gradually increasing error," the report said.

Commercial aircraft rarely are operated with full tanks, as recommended by the first option, and the use of devices such as dripsticks is "not generally favored" by operators because it is time consuming and requires the aircraft to be on a level surface for accurate measurements, the report said.

The operator of the Brasilia used the second option provided by the CAAP. Company pilots told investigators that they generally conducted preflight fuel checks by comparing the fuel-remaining indication on the totalizer — a gauge located on the fuel-management panel — with a calculation based on the fuel-remaining figure recorded in the flight log plus any fuel added since the previous flight.

"A discrepancy of 60 kg [132 lb] or more between the indicated total fuel and the calculated total fuel figures required resolution to the satisfaction of the crew," the report said. "If the discrepancy could not be resolved, then [the dripsticks] were used to confirm the quantity in the tanks."

The operator's procedures required pilots to record in the flight log the reason for any discrepancy of 60 kg or more. The flight logs for the company's six Brasilias showed that 68 such discrepancies were recorded during the three months preceding the incident. Pilots attributed 51 of them to "APU burn" — that is, fuel consumed during operation of the auxiliary power unit. No reasons were given for the remainder of the discrepancies.

Discovering technical failures such as malfunctions of fuel quantity indicating systems requires procedures for verifying fuel quantity that are "well designed, fully understood and properly conducted by the users," the report said. "In this occurrence, none of those criteria were present."

The report noted that after the incident, the Australian Civil Aviation Safety Authority (CASA) "initiated a project to amend the guidance [in the CAAP] to provide better clarity and emphasis."

Similar Incidents

The report discussed three other incidents in which similar fuel-related engine failures occurred recently in Australian-registered commercial aircraft.

On Oct. 18, 2007, a Cessna 404's right engine lost power during a charter flight with three passengers from Beverly to Adelaide. The pilot landed the aircraft at Adelaide without further incident. The ATSB investigation determined that faulty wiring had caused the fuel quantity indicator to over-read.[2]

On Feb. 5, 2007, the crew of a Boeing 747-300, en route on a positioning flight from Jakarta, Indonesia, to Melbourne shut down the no. 3 engine after noticing that the boost pump low-pressure warning light had illuminated and the fuel quantity indicator for the no. 3 tank was reading zero. The crew continued the flight to Melbourne and landed without further incident. Investigators determined that an electrical problem and/or water contamination had caused the fuel gauge to malfunction.[3]

On. Sept. 23, 2005, a low-fuel warning light for the left tanks in a Fairchild Metro III illuminated during a flight with 16 passengers from Thangool to Brisbane. The crew believed it was a false warning because the gauge showed sufficient fuel, but they diverted the flight to Bundaberg as a precaution. The left engine flamed out as the Metro neared the airport, but an uneventful landing was conducted. Investigators found that the fuel quantity indicating system had not been recalibrated properly during maintenance performed before the incident flight.[4]

"In each case, the practices used by the flight crew to establish fuel quantity before flight did not detect erroneous fuel quantity indications," the report said. "The operators involved subsequently amended their procedure to include physical (e.g., dripstick) checks as a mandatory part of the procedures for establishing the quantity of fuel on board the aircraft."

The report said that the incident at Jundee likely would not have occurred if the crew had used the dripsticks to verify fuel quantity before takeoff, or if the Brasilia had been equipped with an independent low-fuel-level warning system, which was not required by certification or operating standards.

The incident likely would have been avoided if the aircraft's dripsticks had been used to verify fuel gauge readings.

Australian Transport Safety Bureau

'Unable to Function'

Neither of the Brasilia pilots had previously experienced a power loss on short final approach. The aircraft's behavior after power was increased to initiate the go-around at Jundee likely appeared to be "abnormal and without reason," the report said.

"It was likely that the aircraft's behavior alarmed and focused each crewmember to the extent that they were unable to function effectively as a unit in the areas of decision making and task sharing. There was a delay in the crew's diagnosis of the situation. The aircraft was at or near the limits of its performance envelope for a significant period after the go-around was initiated."

A flight simulator is the only means of safely training for critical emergencies such as an engine failure on approach, the report said. "Importantly, in addition to being exposed to the full range of emergency situations, pilots are able to practice crew coordination in those situations."

However, there was no Brasilia flight simulator in the country when the pilots were in training, and CASA did not require simulator training. "At the time of the occurrence, there were 22 EMB-120 aircraft on the Australian civil aircraft register," the report said.

A Brasilia flight simulator was installed in the Ansett Aviation Training facility at Melbourne in March 2009. "Subsequently, under the guidance of CASA, all Australian EMB-120 operators began conducting flight crew endorsement [training] and some recurrent training in the simulator," the report said.

This article is based on ATSB Transport Safety Report AO-2007-017, "Fuel Starvation, Jundee Airstrip, WA — 26 June 2007, VH-XUE, Empresa Brasileira de Aeronáutica S.A., EMB-120ER."

Notes

1. Media reports identified the operator as Skippers Aviation.
2. ATSB Report AO-2007-049 (*ASW*, 6/09, p. 61).
3. ATSB Report BO/200700368 (*ASW*, 10/08, p. 57).
4. ATSB Report BO/200504768 (*ASW*, 1/08, p. 60).