



# A Matter of METERS

**The Falcon 900 did not overrun by much, but the damage was serious.**

BY MARK LACAGNINA

As with most aircraft accidents, there were several “ifs” that might seem relatively benign when taken separately but together conspired to inflict substantial damage to a Dassault Falcon 900EX and present a hazard to the eight people aboard.

If the approach speed had been a few knots lower, if the touchdown had been a few meters

shorter, if the runway had been dry and just a bit longer, if the pilots had considered a go-around a few seconds earlier, if the thrust reverser system had not malfunctioned, or if the concrete base for an approach light had not protruded from the ground off the end of the runway, the overrun accident at Germany’s Emden Aerodrome the morning of Nov. 18, 2009, might not have happened.

But it did happen, and the events leading to the accident are discussed in the English version of the final report released in February 2012 by the German Federal Bureau of Aircraft Accident Investigation (BFU).

There were no injuries in the accident, which occurred during a business flight from Braunschweig, in north central Germany, to Emden, which is about 140 nm (259 km) northwest, near the coast of the North Sea.

The pilot-in-command (PIC), 55, had 18,500 flight hours, including about 8,500 hours in type, and held an airline transport pilot license and certification as a Falcon 900EX type rating instructor. “His most recent simulator training had taken place in June 2009,” the report said.

The copilot, 27, held a commercial pilot’s license and had about 3,500 flight hours, including about 420 hours in type. “His most recent simulator training had taken place in August 2009,” the report said.

The flight attendant, 33, had 1,523 flight hours, all in type. “Her responsibilities were those of so-called in-flight service personnel,” the report said.

### Strong Gusts

Before departing from Braunschweig at 1048 local time, the flight crew received a comprehensive weather briefing. Conditions at Emden were influenced by a strong low-pressure area over the North Sea, causing “hurricane-like” gusts in the area, the report said. A warm front also had brought heavy rain to the Emden area earlier that morning.

“The weather information available was both sufficient and accurate for the flight in question and did not flag up a need for any limitations,” the report said. “The weather information implied that the landing would be gusty and the runway probably wet.”

As the aircraft neared Emden, the crew was told by an air traffic controller that the surface winds at the airport were from 200 degrees at 15 to 20 kt with gusts at 25 to 30 kt, visibility was 9 km (6 mi), the ceilings were broken at 1,800 ft

and overcast at 2,400 ft, and Runway 25 was in use. The crew then was given radar vectors and was cleared to conduct the NDB (nondirectional beacon) approach to Runway 25.

After establishing radio contact with Emden Flight Information Service, the crew was told that the winds were from 200 degrees at 25 kt.

The airport at Emden is uncontrolled and has a single asphalt runway, 07/25, which is 1,300 m (4,265 ft) long and 30 m (98 ft) wide. “The threshold to Runway 25 is displaced by 100 m [328 ft], leaving a usable runway length of 1,200 m [3,937 ft],” the report said.

Emden Aerodrome was certified for aircraft with maximum weights below 14,000 kg (30,864 lb), but the company that operated the Falcon — which has a maximum takeoff weight of 22,226 kg (49,000 lb) and a maximum landing weight of 20,185 kg (44,500 lb) — had received an exemption from the local transportation authority to operate at the airport.

### Familiar With the Field

“Both pilots had previously flown to the Emden airfield and were familiar with the local infrastructure and the relatively short runway,” the report said. “There were no local limitations in force, and the full 1,200 m of runway were available for the landing.”

The Falcon’s actual landing weight was about 14,420 kg (31,790 lb), and the calculated landing reference speed ( $V_{REF}$ ) was 116 kt. The crew added 12 kt to  $V_{REF}$  for the wind conditions, resulting in a planned approach speed of 128 kt with full flaps and slats.

The airplane flight manual indicated that, for the aircraft weight and configuration, the required dry-runway landing distance was 745 m (2,444 ft) and the required wet-runway distance was 857 m (2,812 ft).

The report noted, however, that because

The nose landing gear struck the concrete base of an approach light.



## Falcon 900EX



Jet fighter manufacturer Avions Marcel Dassault in 1963 introduced its first business jet, the Mystère 20, later marketed as the Fan Jet Falcon and then as simply the Falcon 20. Smaller versions dubbed the Falcon 10 and 100 followed in 1973 and 1981, respectively.

The long-range, three-engine Falcon 50 was introduced in 1976, with the larger Falcon 900 and 900B models appearing in 1984 and 1991, respectively. Range was increased further when the Falcon 900EX was introduced in 1995.

Compared with previous models, the 900EX has more powerful Honeywell TFE731-60 engines, rated at 22.24 kN (5,000 lb) thrust. An additional fuel tank in the rear fuselage and a larger tank in the center fuselage increased fuel capacity to 9,526 kg (21,000 lb).

Maximum weights are 22,226 kg (49,000 lb) for takeoff and 20,185 kg (44,500 lb) for landing. At 0.8 Mach, the normal cruising speed, maximum range with reserves is 8,028 km (4,335 nm). Stall speed in landing configuration is 85 kt.

The 900EX was succeeded by the winglet-equipped 900LX in 2010.

Sources: Dassault Aviation, *Jane's All the World's Aircraft*

the approach was flown faster than planned, the required landing distance actually was 986 m (3,235 ft).

The crew told investigators that despite the strong and gusty winds, the approach was stable, and they established visual contact with the runway while descending through 1,700 ft about 6 nm (11 km) from the airport. They completed the “Final” checklist, which

included a test of the anti-skid braking system and hydraulic indicators. “The crew said that both were normal,” the report said. They selected autobrake position 1, which corresponds to normal anti-skid braking.

“Witnesses stated that the runway was wet [and that] there were a number of large puddles on the left and right outer margins in the final quarter of the runway,” the report said. “The last 200 m [656 ft] of the runway had a large puddle left of the centerline.”

### ‘Very Late’ Touchdown

Calibrated airspeed was about 132 kt when the aircraft crossed the runway threshold, and the report noted that the PIC did not reduce thrust to idle to reduce the touchdown speed.

The Falcon touched down about 214 m (702 ft) from the threshold at 1126. “Given that the runway is short ... even under ideal conditions, this was very late to brake the aircraft to a full stop on the runway,” the report said.

Recorded flight data indicated that calibrated airspeed was 124 kt and groundspeed was 115 kt on touchdown. The copilot engaged the airbrake while the PIC reduced thrust on all three engines to idle and then advanced the thrust reverse lever. The report noted that the latter action was not in keeping with standard operating procedure, which requires the pilot to ensure that the “DEPLOYED” annunciator has illuminated before applying maximum reverse thrust.

Moreover, the thrust reverse system, which is on the center engine, did not function normally. With all three wheels on the ground and the thrust levers at idle, the thrust reverse lever should remain locked, keeping thrust at idle, until the reverser doors on the center engine deploy fully; then, the reverse lever is unlocked and can be advanced to increase the exhaust flow impacting the doors and being redirected forward for reverse thrust.

Investigators found that the mechanical lock was substantially worn, allowing the thrust reverse lever to be advanced before the reverser doors were fully deployed. “During the landing,

the thrust reverser doors remained in a partway position between stowed and deployed,” the report said. “Since the engine was already delivering high power, the doors were unable to attain the deployed condition.”

Thus, the thrust reverse “DEPLOYED” annunciator never illuminated; instead, a master caution was generated to warn that the doors had not fully deployed.

### ‘No, Too Late’

About eight seconds after touchdown, the PIC called for a go-around. “This call came too late for a safe go-around,” the report said. “At this time, there was about 550 m [1,804 ft] of runway remaining, the flaps were set to 40 degrees, and the reverse thrust was delivering full power.”

The pilots recognized this. Shortly after calling for a go-around, the PIC said, “No, too late.” The copilot agreed, saying, “No, no more.”

The aircraft was about 320 m (1,050 ft) from the departure end of the runway when the PIC disengaged the thrust reverse system. The report said that although maximum reverse thrust normally can be used until the aircraft is at a standstill, the PIC’s decision to disengage the system was correct because the malfunction actually had resulted in some forward thrust being produced by the center engine. “During the investigation, it was not possible to determine the strength of the respective thrust component in each direction,” the report said.

After the PIC disengaged the thrust reverse system, three seconds elapsed as the thrust produced by the center engine decreased from 82 percent to 36 percent  $N_1$  (fan speed). The aircraft then began to decelerate more rapidly.

“During the following seconds, the flight crew attempted to brake the aircraft to a stop from a [calibrated airspeed] of about 95 kt (80 kt groundspeed),” the report said. “After having traveled about 900 m [2,953 ft] along the runway, the crew steered the aircraft toward the right. They said it was their intention to avoid a

collision with the runway lights located on the grass just after the hard runway.”

Groundspeed was about 15 kt when the Falcon overran the runway. The nose landing gear collapsed and separated from the airframe after striking the base of the approach light, the farthest to the right among seven lights located 2.4 m (7.9 ft) from the end of the runway. “Both main landing gear were still on the runway, the left gear about 1.5 m [4.9 ft] in front of the runway end,” the report said.

After the Falcon came to a stop, the PIC told the flight attendant, “Open the door. Open the door. Get everyone out.” The flight attendant unlatched the cabin door and lowered it, but the door opened only about halfway before coming into contact with the ground. “In this position, the stairs were presented as a line of triangles with the apex directed upward,” the report said, noting that although this likely hindered the evacuation, everyone was able to exit quickly through the opening.

The report concluded that the causal factors of the accident were:

- “The extended landing distance due to the [fact that the] increased approach speed was not taken into account;
- “The aircraft touched down too late on the runway;
- “Consideration of a go-around came too late for action;
- “The go-around was not carried out;
- “The engine thrust was reduced too late; [and,]
- “A faulty reverse thrust mechanism partly negated the effect of wheel brake operation, thereby extending the landing distance.”

*This article is based on the English translation of Investigation Report BFU CX015-09. The report is available in German and English at <[www.bfu-web.de](http://www.bfu-web.de)>.*

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