FLIGHT SAFETY FOUNDATION
Accident Prevention
Vol. 62 No. 8 *For Everyone Concerned With the Safety of Flight* August 2005

DC-10 Overruns Runway in Tahiti While Being Landed in a Storm

The flight crew encountered showers, turbulence and a strong, gusting crosswind on final approach. The airplane touched down about midpoint on the wet runway, overran the runway, struck localizer antennas and came to a stop with the forward section of the fuselage in a lagoon.

FSF Editorial Staff

At 2353 local time Dec. 24, 2000, a McDonnell Douglas DC-10-10 operated by Hawaiian Airlines overran the runway during a landing at Tahiti Faaa Airport in French Polynesia. There were no injuries among the 15 crewmembers and 139 passengers. The extent of damage to the airplane was not specified in the final report on the accident, which was issued in February 2005.

In the report, the French Bureau d'Enquêtes et d'Analyses Pour la Sécurité de l'Aviation Civile (BEA) said, "The accident was caused by the failure, during the preparation for the approach, to take into account the risk of a storm passing over the airfield at the time of landing."

The report said that the following factors contributed to the accident:

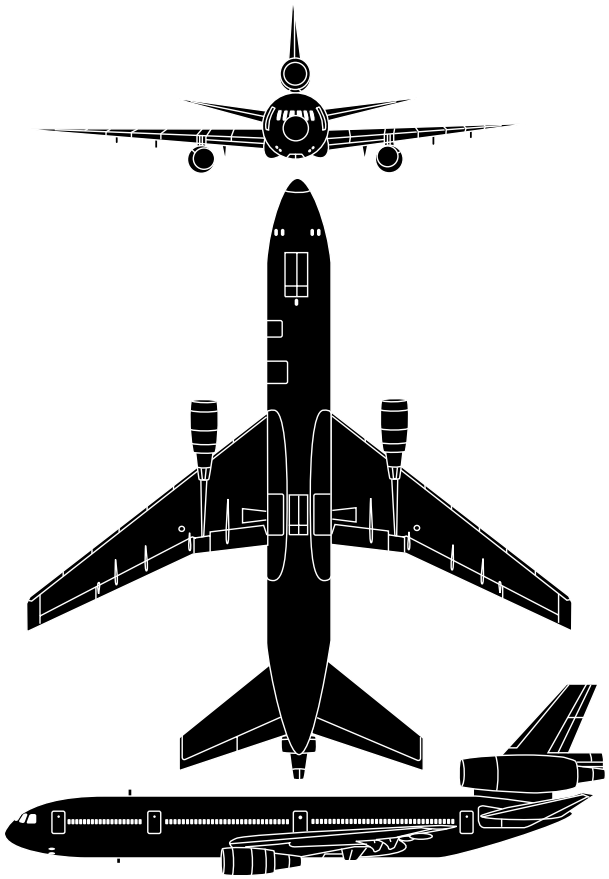
- "The crew focusing on lateral control of the airplane's track, due to a strong crosswind that was changing in strength and direction, and [their] late thrust reduction, resulting in a glide and a long touchdown;
- "The late manual extension of the spoilers, which increased the length of the landing roll; [and,]
- "The presence of water on the runway, the [airplane's] low vertical speed during contact with the ground and, perhaps, the slipperiness of the runway, which made the airplane slide."

The airplane was being operated on a scheduled flight to Tahiti from Honolulu, Hawaii, U.S.

The captain (the pilot flying), 56, had 18,905 flight hours, including 4,860 flight hours as a DC-10 captain. He held type ratings in the DC-9, DC-10, de Havilland Dash 7 and Lockheed L-1011.

"Before joining Hawaiian Airlines in 1977, the pilot had been employed by the U.S. Navy until 1975, by Panorama Air Tours and by Royal Hawaiian Air Service," the report said.

The copilot, 35, had 7,142 flight hours, including 526 flight hours in DC-10s. He held a DC-10 flight engineer certificate and a Dash 8 type rating.



McDonnell Douglas DC-10-10

The McDonnell Douglas DC-10-10 was the first model in the DC-10 series, a long-range, high-capacity transport airplane. It first flew in August 1970.

Two engines are mounted on underwing pylons, with a third installed in the vertical stabilizer above the aft fuselage. The airplane is powered by General Electric CF6-6D or CF6-6D1 turbofan engines, each rated at 40,000 pounds (18,144 kilograms) thrust. The first version had a maximum takeoff weight of 410,000 pounds (185,970 kilograms), and a range of 3,128 nautical miles (5,793 kilometers).

A later version, with increased center-wing fuel capacity, has a maximum takeoff weight of 455,000 pounds (206,385 kilograms) and a range of 3,654 nautical miles (6,767 kilometers). Normal cruising speed is Mach 0.82; maximum cruising speed at 30,000 feet is 500 knots.

The service ceiling is 34,800 feet with CF6-6D engines or 35,200 feet with CF6-6D1 engines. Landing speed with a full load of passengers and baggage is 128 knots.♦

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

"Before being employed by Hawaiian Airlines as a flight engineer in 1998, this pilot had been employed by Island Air, then by the [U.S.] Air National Guard," the report said.

The flight engineer, 37, had 4,133 flight hours, including 613 flight hours as a DC-10 flight engineer.

"Before being employed in 1999 by Hawaiian Airlines, the flight engineer had worked for Corporate Air," the report said.

The report said that no notable events occurred during the five-hour en route portion of the flight from Honolulu.

At 2324, the captain conducted an arrival briefing that included the runway in use, top of descent, the published instrument approach procedure and the published missed approach procedure. The crew did not discuss the cumulonimbus clouds that had been reported in the vicinity of the airport or the atmospheric instability that had been forecast for the area.

At 2327, the copilot asked the center controller for information on weather conditions at the airport.

The controller said that an aviation routine weather report (METAR) issued at 2300 indicated that the surface winds were from 080 degrees at five knots, visibility was greater than 10 kilometers (six statute miles), scattered clouds were at 1,600 feet and cumulonimbus clouds were in the vicinity of the airport. The controller said that the METAR indicated that temporary weather conditions included surface winds from 340 degrees at 15 knots with gusts to 25 knots, visibility of 4,000 meters (three statute miles) in rain and a 3,500-foot overcast. The controller also told the crew that the runway was wet.

The report said that the METAR information essentially was the same as the weather information that the crew had received earlier via the airplane's aircraft communications addressing and reporting system (ACARS).

At 2332, the crew requested and received clearance to begin a descent from Flight Level 370 (approximately 37,000 feet). During the descent, the crew observed weather-radar displays of several areas of heavy precipitation on the airport and near the airport.

"The crew should have considered holding … so as to allow the stormy weather to pass over the aerodrome, especially since the diversion airfields for Tahiti Faaa are a long way away," the report said.

The nearest diversion airport adequate for a DC-10 landing was in Rarotonga, Cook Islands, New Zealand, 1,037 kilometers (560 nautical miles) southwest of Tahiti.

"Performing an approach in meteorological conditions with local tropical storms over the aerodrome guarantees neither the

landing nor a go-around," the report said. "Once the decision is taken to perform the approach, however, it is difficult for a crew to reconsider — in this case, as a result of deteriorating meteorological conditions — if they have not planned to do so when they develop their landing strategy during the arrival briefing."

At 2346, the tower controller told the crew to descend to 2,500 feet and to report crossing OVINI, which is the initial approach fix for the VOR/DME–ILS (very-high-frequency omnidirectional radio/distance measuring equipment–instrument landing system) approach to Runway 04. OVINI is 24 kilometers (13 nautical miles) from the VOR, which is near the departure end of Runway 04. The controller also told the crew that there were showers at the airport.

The copilot then told the controller that they were crossing OVINI. The controller cleared the crew to conduct the VOR/DME–ILS approach and told them to report when the airplane was established on the ILS localizer and glideslope.

The airplane, which was being flown on autopilot in instrument meteorological conditions, was established on the glideslope at 2348. The crew extended the landing gear and began to conduct the "Landing" checklist. They armed the spoilers and extended the flaps to 22 degrees, then to 35 degrees.

The report said that the company's operations manual specified that flaps should be extended to 50 degrees when the runway is wet or slippery.

"Landing on a wet runway and hydroplaning are covered by Hawaiian Airlines during the pilots' line-oriented flight training," the report said. "Use of the flaps at 50 degrees is dealt with during regular simulator training, but the operator's common practice is to use them only at 35 degrees. The operator justified this practice by citing the lower stresses on the airplane structure. However, the choice of the landing configuration remains at the captain's discretion."

At 2349, the copilot told the controller that the airplane was established on the ILS. The controller cleared the crew to land on Runway 04 and said that the surface winds were from 060 degrees at 10 knots, gusting to 14 knots.

Over the next few minutes, wind direction changed rapidly from southeast to northwest.

At 2350, the captain told the copilot, "[There is] quite a bit of crab in this thing."

The copilot said that the flight management system indicated that the wind was from 280 degrees at 28 knots.

The report said that the charts used by the flight crew incorrectly indicated available landing distance. Past the displaced threshold of Runway 04, the length of runway available for landing was 3,110 meters (10,204 feet). The report said that the *Aeronautical Information Publication* (*AIP*)*—Pacific Region* published in September 2000 erroneously indicated that available landing distance was 3,310 meters (10,860 feet). A notice to airmen (NOTAM) was issued on Sept. 28, 2000, to correct the error, and correct information was published in the *AIP* in November.

"The crew was using Jeppesen charts that did not take into account the various amendments published in September and November," the report said. "On these charts, the displaced threshold did not appear, and the [published available landing distance], 3,310 meters, did not take into account the displaced threshold. This distance thus was 200 meters [656 feet] longer than the distance really available."

Nevertheless, the report said, "The precision approach path indicator (PAPI) was correctly calibrated and positioned at the displaced Runway 04 threshold."

The runway did not have centerline lights. International Civil Aviation Organization Annex 14, *Aerodromes*, recommends centerline lights on runways for which a precision instrument approach procedure is published. The report said that the coloring of centerline lights helps flight crews estimate distance to the end of the runway. [Centerline lights typically are white until the last 915 meters (3,000 feet) of the runway; the lights then alternate between red and white for 610 meters (2,000 feet) before changing to red for the last 305 meters (1,000 feet) of the runway.]

Over the next few minutes, wind direction changed rapidly from southeast to northwest.

Annex 14 also recommends periodic measurement of runway surface-friction characteristics.

"This information is not available at Faaa aerodrome, which has no measuring equipment," the report said. "Testimony from aircrew that regularly use the aerodrome and have had experience of it in rainy conditions indicates that the runway's [surface shape] is not favorable for adequate water run-off during heavy showers. In addition, the flare height can sometimes be difficult to evaluate at night due to a layer of fog that forms through evaporation."

During the last nine minutes of the approach, meteorological data recorded by the airport weather station showed that wind velocities at the Runway 04 threshold increased rapidly from 5.8 meters per second (11.3 knots) to 16.3 meters per second (31.7 knots).

"The variations in wind speed and direction indicate the presence of turbulent wind and wind shear characteristic of a storm," the report said. "[The recorded meteorological data] also indicate that the storm period lasted about 15 minutes."

At 2351, the controller said that the winds were from 330 degrees at 18 knots, gusting to 28 knots, and told the crew to report when they had the airport in sight.

The airplane was about 600 feet above the ground when the copilot told the controller that the airport was in sight. The controller said that the winds were from 330 degrees at 18 knots, gusting to 29 knots.

The copilot called out radio altitude in 100-foot decrements from 500 feet to 100 feet.

The airplane was 328 feet above the ground at 2352:11 when the autopilot was disengaged. Airspeed was 155 knots, one knot slower than the target approach speed that had been calculated by the flight engineer.

"Arriving on short final, [the airplane] entered an area of rain and turbulence associated with the passage of a storm over the airfield," the report said.

Rapid changes in aileron-control position and elevator-control position recorded by the flight data recorder (FDR) after the autopilot was disconnected indicated that significant control inputs were made, the report said.

"The recordings of the intensity and direction of the wind along the runway show variations in all directions over time," the report said. "The turbulent nature of the wind explains the captain's significant inputs on the flight controls in order to maintain lateral control of the airplane's track, perhaps at the expense of control of the descent path on short final."

Because of the airplane's low vertical speed during touchdown on the wet runway, the spoilers did not deploy automatically.

At 2352:20, the ground-proximity warning system generated an aural "sink rate" warning. The captain observed that the airplane was slightly below the PAPI glide path.

"The [captain] rejoined the descent path with the aid of the PAPI and continued his approach using external visual references," the report said. "At that time, the airplane was following a track parallel and to the right of the approach path."

Between 2352:32 and 2352:38, the cockpit voice recorder recorded automated radio-altitude callouts in 10-foot decrements from 50 feet to 10 feet. A power reduction began seven seconds after the last radio-altitude callout. FDR data indicated that airspeed remained about 150 knots until touchdown. The calculated landing reference speed (V_{REF}) was 137 knots.

"Thrust reduction was late [and] may be explained by the captain's focusing on lateral control … as a high thrust level allows for better control of the track," the report said. "In any event, the high thrust led to an increase in glide distance [that] was accentuated by a sudden head wind component, as is shown by an increase in airspeed four seconds before touchdown of the main landing gear [at 2352:45]."

The main landing gear touched down to the right of the runway centerline, 1,300 meters (4,265 feet) from the displaced threshold. Because of the airplane's low vertical speed during touchdown on the wet runway, the spoilers did not deploy automatically.

"Without the spoilers, deceleration during the landing roll is not in accordance with performance as stated in the manufacturer's documentation," the report said. "In case of a known unavailability of the system, an additional 200 meters must be allowed for [in landing-distance calculations]."

The nose landing gear touched down three seconds after the main landing gear touched down. Two seconds later, the thrust reversers were deployed.

"The [recorded FDR] parameters indicate that reverse thrust on each of the engines was adjusted and regulated without it ever reaching its maximum value," the report said.

The captain told investigators that he did not use full reverse thrust because of a published noise-abatement procedure that prohibited use of reverse thrust between 1700 and 0600.

"He [also said that he] thought that, by using too much thrust-reverser power, he would have more difficulty in keeping the airplane on the runway," the report said.

The airplane was not equipped with an autobrake system. The operations manual recommended that if directional control is affected by a crosswind, the crew should release pressure on the wheel brakes and should not use reverse thrust.

"On a wet runway and with a crosswind, the wind's effect on the fuselage and the tail tends to align the airplane into the face of the wind," the report said. "This tendency of the airplane to align itself into the face of the wind and to be pushed off the centerline is increased by the application of reverse thrust."

The report said that the captain likely did not notice that the spoilers had not deployed automatically because his attention was focused on maintaining directional control of the airplane. At 2352:53, eight seconds after the main landing gear touched down on the runway, the flight engineer noticed that the spoilers had not deployed automatically; he manually deployed the spoilers.

The airplane veered left because of the crosswind, the wet runway and the use of the thrust reversers, the report said.

At 2352:59, the copilot said "centerline."

"The captain then corrected to align the airplane on the centerline while continuing to brake and to use the thrust reversers," the report said.

The airplane was about 300 meters (984 feet) from the end of the runway when the captain observed the localizer antennas beyond the end of the runway.

"He selected more thrust-reverser power and increased pressure on the brakes," the report said. "[He told investigators that] it seemed to him that he was on an ice-covered runway."

The report said that braking action likely was nil near the end of Runway 04 because of tire rubber deposited by airplanes that had been landed on Runway 22.

The airplane was on the centerline when it overran the runway 36 seconds after the main landing gear touched down. The copilot told the controller, "Hawaiian four eight one is right on the end, going off the runway, going off the end of the runway. Send the equipment. Send the equipment."

At 2353:21, the airplane struck the localizer antennas 72 meters (236 feet) beyond the end of the runway. The airplane came to a stop with the underwing-mounted engines resting on a rock seawall 80 meters (262 feet) beyond the end of the runway.

"The captain, after checking on the safety situation around the airplane, ordered the evacuation via [the right center door]," the report said.

The crew did not use the aft cabin doors for evacuation because the airplane's tail section was too high off the ground.

Because the evacuation slide was deployed in shallow water, the passengers were told to don their life vests. Some passengers had difficulty donning their life vests, and some passengers were not able to don their life vests. Postaccident tests of unused life vests aboard the airplane indicated that the elastic bands used during the packing of some life vests prevented the straps from being buckled properly.

The report said that the public-address system was not operational. Some passengers, for whom French was their native language, had difficulty understanding instructions communicated by cabin crewmembers in English.

The flight crew told investigators that the evacuation, which was assisted by airport firefighters, was conducted calmly and rapidly.

"The end of the [evacuation] slide was tied up to the seawall … to give passengers the shortest walk possible through the water," the report said. "The passengers were greeted by firefighters, who had taken care to remove the barbed wire coils that were protecting the aerodrome against intruders."

During the accident investigation, difficulties were encountered in conducting the FDR readout.

"Hawaiian Airlines did not possess any conversion documents allowing the raw binary data to be transformed into engineering values," the report said. "American Airlines, the airplane's owner, provided two different conversion documents, not knowing which of the two corresponded to the airplane. After having selected the most likely document, the investigators met with conversion problems, and validation of certain parameter values (radio altitude, acceleration and glideslope and localizer deviations) had to be done based on recordings of previous flights.

"In addition, the operator was unable to provide up-to-date and exact documentation on the evolution of the parameter acquisition and recording system. Thus, the FDR readout was slowed down, and some lack of precision may remain."

Based on the findings of the accident investigation, BEA recommended that:

- "Operators ensure that crews are made aware of the importance of specifically planning, during the arrival briefing, for circumstances that would lead to a modification in the approach strategy, where the meteorological situation warrants it;
- "The DGAC [French Direction Générale de l'Aviation Civile] measure the [surface-friction] characteristics of the runway at Tahiti Faaa Aerodrome;
- "The DGAC study the possibility of equipping all aerodromes on French territory used for public transport with runway-centerline lighting;
- "Operators systematically ensure that the documentation used by aircrew is in accordance with the relevant national regulatory documentation; [and,]
- "The FAA [U.S. Federal Aviation Administration] ensure that American operators possess up-to-date conversion tables for on-board data for airplanes used for public transport."♦

[FSF editorial note: This article, except where specifically noted, is based on the English translation of French Bureau d'Enquêtes et d'Analyses Pour la Sécurité de l'Aviation Civile (BEA) Report n-aa01224a, *Accident on 24 December 2000 at Tahiti Faaa Airport to the DC-10-10 Registered N132AA Operated by Hawaiian Airlines*. The 68-page report contains illustrations and appendixes. In a foreword to the English edition, BEA said, "As accurate as the translation may be, the original text in French should be considered as the work of reference."]

Want more information about Flight Safety Foundation?

Contact Ann Hill, director, membership and development,
by e-mail: hill@flightsafety.org or by telephone: +1 (703) 739-6700, ext. 105.

Visit our Internet site at <www.flightsafety.org>.

We Encourage Reprints

What's Your Input?

In keeping with the Foundation's independent and nonpartisan mission to disseminate objective safety information, FSF publications solicit credible contributions that foster thought-provoking discussion of aviation safety issues. If you have an article proposal, a completed manuscript or a technical paper that may be appropriate for *Accident Prevention*, please contact the director of publications. Reasonable care will be taken in handling a manuscript, but Flight Safety Foundation assumes no responsibility for material submitted. The publications staff reserves the right to edit all published submissions. The Foundation buys all rights to manuscripts and payment is made to authors upon publication. Contact the Publications Department for more information.

Accident Prevention

Staff: Mark Lacagnina, senior editor; Wayne Rosenkrans, senior editor; Linda Werfelman, senior editor; Rick Darby, associate editor; Karen K. Ehrlich, web and print production coordinator; Ann L. Mullikin, production designer; Susan D. Reed, production specialist; and Patricia Setze, librarian, Jerry Lederer Aviation Safety Library

Subscriptions: One year subscription for six issues includes postage and handling: US$160 for members/US$280 for nonmembers. Include old and new addresses when requesting address change. • Attention: Ahlam Wahdan, membership services coordinator, Flight Safety Foundation, Suite 300, 601 Madison Street, Alexandria, VA 22314 U.S. • Telephone: +1 (703) 739-6700 • Fax: +1 (703) 739-6708.