

## SEA07LA152

## HISTORY OF FLIGHT

On June 10, 2007, about 1415 Pacific daylight time, N914DD, registered as a Dassault-Breguet Mystere Falcon 900, was substantially damaged when it overran the departure end of Runway 25 following an aborted take-off at the Santa Barbara Municipal Airport, Santa Barbara, California. The airplane was registered to Kerry Acquisitions LLC, of Concord, Massachusetts, and operated by Trishan Air, of Santa Barbara. The airline transport rated captain, airline transport rated pilot acting as first officer/co-pilot (FO), and 13 passengers were not injured. Visual meteorological conditions prevailed for the 14 Code of Federal Regulations (CFR) Part 91 business flight, and an instrument flight rules (IFR) flight plan was filed. The flight was originating at the time of the accident, and the intended destination was Tampa, Florida.

In a statement submitted on June 11, 2007, and in a personal interview with a Federal Aviation Administration (FAA) Aviation Operations Safety Inspector, the captain reported that a normal preflight was conducted, and that the fuel load was brought up to 18,400 pounds for the [transcontinental] flight. The captain stated that the calculated weight of the aircraft was 45,400 pounds, with the following takeoff speeds being noted: takeoff decision speed (V1) - 116 knots, rotation speed (Vr) - 129 knots, and take-off safety speed (V2) - 154 knots. The captain further stated that based on the speeds previously noted, the balanced field length for a Runway 25 takeoff was 5,000 feet; according to the Airport Facility Directory, the length of Runway 25 is 6,055 feet. The captain reported that he did not perform a center of gravity (CG) computation. The captain revealed that all checklists were completed prior to reaching the runway, at which time the flight was cleared for takeoff. The captain reported that as power was applied normal acceleration was felt for a heavy weight takeoff, and all engine indications were normal. The captain stated that V1 speed was called, followed by Vr speed being called, at which time he pulled back on the yoke, but with no response. The captain further stated that when the speed was well into the upper 130 knot range he relaxed the yoke, then pulled aft again, and again there was no response from the airplane; "...it did not even try to lift off." The captain reported that with the end of the runway fast approaching he determined "...the odds of a possible airborne crash were greater than a runway/clearway type of incursion." The captain stated that power was then immediately reduced to the stops, full nose forward pressure was applied to the yoke, and maximum braking effort was applied. The captain further stated that because of the high speed minimal braking effectiveness, the airplane departed the end of Runway 25 just to the right of centerline, coming to a stop about 100 yards off the end of the runway into the dirt.

In a statement submitted on June 11, 2007, the first officer reported that prior to taking off the captain supervised the fueling and the weight and balance, while he calculated and filled out the takeoff and landing distance card (TOLD card). The first officer further reported that after the engines were started, all checklists were completed prior to reaching Runway 25. The first officer stated that during the takeoff roll acceleration seemed normal, and that he called out "speed alive," "80 knots," "V1" and "Vr" speeds. "I then transitioned to the outside of the aircraft, expecting to see the aircraft lift off the ground. Shortly thereafter [the captain] called out something to the effect that nothing was happening. He then initiated the runway abort procedure, and that when it was apparent the airplane was not going to stop on the runway, the captain called out for everyone to brace themselves." The first officer stated that the airplane's nose gear sheared off when going over a berm, and that the airplane came to rest with its nose on the ground.

## PERSONNEL INFORMATION

### The Captain

The captain, age 53, held an airline transport pilot certificate with a rating for airplane multi-engine land, and commercial privileges for airplane single-engine land. At the time of the accident the captain reported a total time of 14,000 hours, with 400 hours in make and model. The captain received his Dassault DA-50 type rating at the Flight Safety International Training Center, Teterboro, New Jersey, on June 24, 2006. The captain's most recent FAA first-class medical certificate was issued on February 1, 2007, with no limitations.

### The First Officer

The first officer, age 66, held an airline transport pilot certificate with a rating for airplane multi-engine land, and commercial privileges for airplane single-engine land. At the time of the accident the first officer reported a total time of 15,000 hours, with 10 hours in make and model. The first officer received training in the DA-50 airplane from the accident captain in accordance with Federal Aviation Regulation (FAR) 61.55. The first officer's most recent FAA first-class medical certificate was issued on March 9, 2007, with the limitation "must wear corrective lenses."

## AIRCRAFT INFORMATION

The Dassault-Breguet Mystere Falcon 900, serial number 80, was issued an airworthiness certificate on January 9, 1990. The airplane was maintained in accordance with FAR Part 91.409 (f)(3) per the Dassault Falcon Jet recommended inspection program. The most recent inspection conducted prior to the accident was complied with on March 2, 2007, at a total airframe time of 5,473.1 hours. The airplane was equipped with three Garrett TFE 731-5BR turbofan engines, each rated at a maximum thrust of 4,750 pounds. The airplane was dispatched in accordance with the airplane's Minimum Equipment List (MEL) with the thrust reverser inoperative.

The airplane was configured to carry 12 passengers and two pilots. According to the airplane's type certificate data sheet, A46Eu, Revision 14, Mystere-Falcon 900, dated March 28, 2007, Crew Seats: The optional third crew seat may be occupied for takeoff and landing.

## METEOROLOGICAL INFORMATION

At 1353, the weather reporting facility located at SBA reported wind 250 degrees at 8 knots, visibility 6 miles, haze, scattered clouds at 1,500 feet, scattered clouds at 20,000 feet, temperature 18 degrees C, dew point 12 degrees C, and an altimeter setting of 29.89 inches of Mercury.

## FLIGHT RECORDERS

The airplane was equipped with a Fairchild model A-100-A cockpit voice recorder (CVR). The CVR was secured and subsequently forwarded to the Safety Board's Recorder Laboratory in Washington, DC for evaluation.

A transcript of the recording was prepared beginning at 13:51:27.9. The recording and transcript continued uninterrupted through the rejected takeoff and ended at 14:12:04.2. At 14:11:38.7, during the takeoff roll, the first officer called V1, and at 14:11:42.8 the first officer called Vr. At

14:11:51.8, 13.1 seconds after V1 was called by the first officer, the sound of decreasing engine RPM is heard. At 14:12:00.0 numerous impact sounds are heard, followed by the recorder ceasing to operate at 14:12:04.2.

A flight data recorder (FDR) was not installed on the airplane, nor was it required to be per FAR 91.609(c).

## WRECKAGE AND IMPACT INFORMATION

A post-accident investigation of the accident site revealed that the airplane came to rest in an upright position 580 feet past the departure end of Runway 25, and about 15 feet to the right of the runway's extended centerline. After exiting the end of the runway the airplane impacted a berm, which resulted in the nose landing gear collapsing rearward and the airplane sliding on its nose before coming to a stop. Maintenance personnel who examined the airplane shortly after the occurrence reported substantial damage to the forward section of the pressure vessel, just aft of where the nose landing gear is attached; the nose landing gear had separated during the overrun.

## TESTS AND RESEARCH

At the request of the NTSB investigator-in-charge (IIC), a FAA operations inspector conducted a DA-900 Level C flight simulator evaluation at the facilities of Flight Safety International's Wilmington, Delaware Learning Center. The evaluation was conducted in order to evaluate the airplane's rotation characteristics in various takeoff configurations. Seven takeoff scenarios were performed.

For scenario one, the simulator was configured at a gross takeoff weight of 46,480 pounds, slats and flaps set to S+20 degrees, stabilizer trim set at -5.5 degrees (mid range of the green band), and Vr -129 knots for 45,400 pounds. During the simulated takeoff, a delay of 2 to 4 seconds was noted from the time an up elevator input was made to the time the airplane reacted positively to rotation.

For scenario two, the simulator was configured at a gross takeoff weight of 46,480 pounds, slats and flaps set to S+20 degrees, stabilizer trim set at -7 degrees (aft range of the green band), and Vr - 129 knots for 45,400 pounds. During the simulated takeoff, a slight delay of 1 to 2 seconds was noted from the time an up elevator input was made to the time the airplane reacted positively to rotation.

For scenario three, the simulator was configured at a gross takeoff weight of 46,480 pounds, slats and flaps set to S+20 degrees, stabilizer trim set at -7 degrees (aft range of green band), and Vr - 131 knots for 46,480 pounds. During the simulated takeoff there was no delay of elevator input, and the airplane performed a normal rotation. For details of the other four scenarios, refer to the public docket for this accident.

A post accident maintenance inspection by the airplane manufacturer, under the supervision of a National Transportation Safety Board air safety investigator, revealed that all systems were operating within allowable tolerances and the aircraft's performance was in accordance with expected parameters for the given conditions.

## ADDITIONAL INFORMATION

## Airplane Configuration

It was confirmed during the post accident examination of the airplane that the position of the stabilizer trim was set at -5.5 degrees, the flaps were set at 20 degrees, and the slats were both deployed. It was also confirmed that the speed bugs were set to the following values: V1 - 116 knots, Vr - 129 knots. It was also confirmed during the investigation that the third "crew seat" located in the cockpit was occupied by the 13th passenger.

## Weight and Balance

Weight and balance data from the TOLD card, which was entered by the first officer, indicated a Zero Fuel Weight of 24,400 pounds, fuel on board of 18,400 pounds, for a total Gross Takeoff Weight of 42,800 pounds; the entry on the TOLD card for the Gross Takeoff Weight was 45,400 pounds, a difference of 2,600 pounds. Additionally, the flight crew entered a figure of 45,300 pounds into the airplane's Aircraft Gross Weight Counter. Weight and balance data calculated by an FAA Aviation Operations Inspector revealed a Gross Takeoff Weight of 46,484 pounds, resulting in a calculated center of gravity (CG) of 15.73% of the Mean Aerodynamic Chord (MAC); the CG range for the airplane is 14% to 31% of MAC, and the maximum gross takeoff weight is 46,500. In its final report, the airplane manufacturer stated that "...the airplane appears to have been within authorized weight and CG limits at the time of the event."

## V Speeds

Reference speeds (V speeds) for the following weights are as follows:

45,400 pounds  
V1 - 113 knots  
V2 - 129 knots

46,480 pounds  
V1 - 118 knots  
V2 - 131 knots

## Heavy Weight Takeoffs

In a statement dated June 22, 2007, the pilot in command reported "...an interesting call was made by the chief test pilot at Dassault to our local investigative rep. He said that at gross weight takeoffs you will not get rotation at Vr (rotation speed) and [an] anomaly occurs with the Falcon 900. That it will only occur after holding the yoke full aft for 2 or more seconds. It makes me wonder what Vr really is. Did they know this before? Why is it not taught in the training centers that Vr is not really Vr." The pilot reported 400 hours total time in the Falcon 900 airplane.

In a statement dated August 8, 2007, a Falcon 900B captain, who was the accident captain's simulator partner during their type rating training, reported that while in Nepal, Tibet the previous month, he performed a takeoff near the maximum gross weight of 46,000 pounds, with a temperature of 24 degrees C and a CG of about 21% MAC. The pilot stated, "Upon rotation, I noticed that the nose was very slow to un-stick - so much so that I had to 'milk' the airplane off the runway by floating the elevator in and out of what seemed to be degradation of control of the

elevator surface. It felt to me like a breaking of the airflow over the horizontal stabilizer. Because of this rotation delay, far more runway was used upon rotation than the charted length." The pilot further reported that a few days later, while performing a similar takeoff at Farnborough, United Kingdom, in similar circumstances, the aircraft rotation reacted very similar to the takeoff described above. The pilot reported that he had logged over 400 hours in the Falcon 900B airplane.

On February 29, 2008, a FAA operations inspector conducted an interview with the Flight Safety International simulator instructor who provided instruction for the accident captain's simulator sessions 3 - 5. The instructor stated that during the training sessions the captain had performed several maximum weight takeoffs with the stabilizer trim set at the bottom of the green band for a forward CG.

In a telephone interview with the IIC, an FAA operations inspector, who was previously employed by Flight Safety International as a Falcon 900 simulator instructor, as well as a FAA Designated Pilot Examiner (DPE), reported that during his tenure as a Falcon 900 instructor, he and all of the other instructors taught maximum gross weight takeoffs with the stabilizer trim set at the bottom of the green band.

Stabilizer Trim

According to the Falcon 900 Operating Manual - Description, the horizontal stabilizer position can be checked on the instrument panel trim position indicator. This scale is graduated in degrees from +2 degrees NOSE DOWN to -10 degrees NOSE UP. The green range from -4.5 degrees to -7.5 degrees corresponds to takeoff positions. The -4.5 degree position is labeled "AFT" to indicate this is the appropriate position for aft CG locations, and the -7.5 degree position is labeled "FWD" to indicate that this is the appropriate position for forward CG locations.

According to the Falcon 900 Operating Manual – Procedures, under Taxiing:

- Take-off Trim. . . . . Set

Bring the tailplane back into the green take-off band by using the control on the control wheel to the appropriate position, which depends on the airplane CG position, e.g. FWD if the airplane has a forward located CG.

According to information provided by Dassault representatives, the Civil Aviation Authority of the United Kingdom (CAA-UK) performed an evaluation of the MF900 Airplane Flight Manual (AFM), which resulted in the CAA-UK including in their AFM findings, "There must be a simple chart relating c.g. to take-off trim position." (Refer to "Operation of Horizontal Stabilizer" chart attached). The CAA-UK requirement was taken into account and reflected in specific AFM pages for UK-registered aircraft, which included the MF900. Had such a chart been available and used prior to the accident flight's take-off for a calculated c.g. of 15.73% MAC, the referenced stabilizer trim setting would have been between -7 and -7.5 degrees.

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