SERIOUS INCIDENT

Aircraft Type and Registration:	Boeing 737-33A, G-POWC	
No & Type of Engines:	2 CFM56-3C1 turbofan engines	
Year of Manufacture:	1991 (Serial no: 25402)	
Date & Time (UTC):	19 November 2013 at 0112 hrs	
Location:	Edinburgh Airport	
Type of Flight:	Commercial Air Transport (Cargo)	
Persons on Board:	Crew - 3	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	None	
Commander's Licence:	Airline Transport Pilot's Licence	
Commander's Age:	58 years	
Commander's Flying Experience:	15,600 hours (of which 6,000 were on type) Last 90 days - 58 hours Last 28 days - 16 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

Synopsis

The aircraft was loaded with the unit load devices (ULD) in the reverse order to that intended. This resulted in the aircraft CG being forward of the flight envelope limits. The crew encountered handling issues during takeoff but the aircraft landed safely at the destination.

History of the flight

The aircraft was on a cargo flight from Edinburgh Airport to Stanstead Airport. The cargo load consisted of eight unit load device (ULD) containers. The ULDs were loaded into the aircraft through a large cargo door located in the forward left fuselage. Due to the centre of gravity of the basic aircraft it was normal, when carrying mail freight, for the ULDs to be loaded with the heaviest at the rear of the aircraft, then in descending weight order towards the front of the aircraft with any empty ULDs loaded into the forward positions. The commander witnessed the ULDs arrive beside the aircraft and recalls noting that the number on the side of one of them was consistent with that on the load instruction form. The crew did not check the position of the ULDs after they were loaded in the aircraft. The operator's Operations Manual did not require the crew to check, and stated:

> *'A final check can be carried out by checking that the last ULD loaded into position (bay A[1]) was expected to be there and not in the first loaded position bay H'.'*

The commander stated that, because the turnaround had been rushed due to the late arrival of the load and fuel, this check had not been carried out.

The remainder of the pre-flight preparation continued normally. The commander, who was PF, stated that when he attempted to rotate the aircraft he experienced a greater than normal control column back-pressure that resulted in a slow and late rotation. During the climb the crew observed that approximately 1 – 1½ more units of nose-up pitch trim were required than usual. The crew discussed the situation and concluded that there may have been a loading error. However, as the aircraft was apparently flying normally, they elected to continue to the destination. During the approach the crew again noticed that more nose-up pitch trim was required than normal. After landing, the commander went to the cabin to disarm and open the doors and discovered that the ULDs had been loaded in reverse order.

Loading operation

The operator was contracted by a mail company to provide routine freight services. Prior to loading an aircraft, the mail company completed a Load Order Form that detailed a suggested load plan. Flight crew were required to check and accept this before loading commenced; the mail company would then load the aircraft. On this occasion the Load Order Form correctly reflected the intention to load the heaviest ULDs towards the rear of the aircraft but the aircraft was inadvertently loaded in reverse order with the heaviest ULDs towards the front.

Weight and balance

In the planned configuration for the aircraft load, the takeoff CG index would have been 38.8 units. The flight envelope forward limit at this takeoff weight was approximately 16 units. The actual index with the ULDs reverse loaded, was 3.8 units.

Recorded data

The FDR revealed that a pitch input was made between 133 and 137 KIAS and that the aircraft started to rotate at approximately 141 KIAS, then continued to rotate at a rate of approximately 1º/second to a pitch angle of 15º. The calculated V_R was 128 KIAS and the normal rotation rate for this aircraft is between 2.5 and 3°/second.

Analysis

The ULDs were loaded in the reverse order to that intended. As a result, the CG of the aircraft was forward of the flight envelope limit. With pitch trim pre-set to that required for the intended loading configuration, the handling pilot experienced greater than expected

Footnote

[1] Bay A is at the front of the cabin and Bay H is at the rear.

control column forces on rotation, which resulted in a slow and delayed rotation. During the flight, the pitch trim required was more nose up than usual to achieve trimmed flight. The Load Order Form showed the intended loading configuration but neither the loading team nor the flight crew noticed that the actual configuration was different.

Safety action

In order to prevent a reoccurrence, the operator now requires a flight deck crewmember to check each ULD number as it is loaded, and has adopted a 'pyramid' loading system whereby the heaviest ULDs are loaded towards the centre of the aircraft in order to mitigate the effects of any errors.