Uncommanded pitch-up, Airbus A320-214, G-OOAR

Micro-summary: **This Airbus A320-214 experienced an uncommanded pitch-up.**

Event Date: **2002-10-27 at 1200 UTC**

Investigative Body: **Aircraft Accident Investigation Board (AAIB), United Kingdom**

Investigative Body's Web Site: **http://www.aaib.dft.gov/uk/**

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Airbus A320-214, G-OOAR

AAIB Bulletin No: 1/2004	Ref: EW/G2002/10/21	Category: 1.1
INCIDENT		
Aircraft Type and Registration:	Airbus A320-214, G-OOAR	
No & Type of Engines:	2 CFM56-5B4 turbofan engines	
Year of Manufacture:	2000	
Date & Time (Local):	27 October 2002 at 1200 hrs	
Location:	Kefallinia, Greece	
Type of Flight:	Public Transport (Passenger)	
Persons on Board:	Crew - 7	Passengers - 69
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Damage to rear galley drain mast	
Commander's Licence:	Airline Transport Pilot's Licence	
Commander's Age:	51 years	
Commander's Flying Experience:	11,282 hours (of which 3,593 were on type)	
	Last 90 days - 215 hours	
	Last 28 days - 64 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and enquiries by the AAIB	

History of the flight

The aircraft had been positioned, empty, from Gatwick to Kefallinia in preparation for public transport charter flights back to Gatwick via Zakinthos. On its arrival at Kefallinia 69 passengers boarded the aircraft prior to the short sector to Zakinthos. The commander was the handling pilot for this flight, which was preparing to depart from Runway 32. The surface wind was from 250º at 4 kt.

Having lined up on the runway for takeoff, the commander advanced the thrust levers to 50% N1 while holding the aircraft against the brakes. Once the engine parameters had stabilised he released the brakes and advanced the thrust levers to the take-off position. As the aircraft started its take-off roll the nose pitched up rapidly. The commander reduced the thrust to idle immediately and applied forward side-stick and gentle braking to encourage the aircraft to pitch back down, which it did promptly. The aircraft had very little forward speed and was quickly brought to a halt on the runway. Having liaised with the cabin crew, and made an announcement to reassure the passengers, the commander taxied the aircraft slowly back on to the stand whence it had just departed. There were no injuries; however, one of the cabin crew seated at the rear of the cabin had heard a scraping noise after the aircraft had pitched up. On investigation the flight crew discovered that all the passengers were

seated aft of row 13, which was significantly different from the distribution shown on the Load Form and Trim Sheet. These forms indicated that the passengers had been spread evenly through the cabin. An examination of the underneath of the tail of the aircraft revealed that the rear galley drain mast had been damaged. While conducting this external check, the first officer (FO) also saw that the nose oleo was very noticeably extended, which suggested a possible problem with the position of the CG.

Passenger Boarding

The aircraft had landed at Kefallinia at 1055 hrs and was scheduled to depart at 1200 hrs. On its arrival the handling agent informed the commander that the passengers were ready for boarding immediately. It was apparent to all the crew that the handling agent would be happy for this last flight of the holiday season to depart as soon as possible. The commander agreed that they would aim to depart 20 minutes early at 1140 hrs. The handling agent had arranged for the passengers to occupy the first five rows and the last six and a half rows in the cabin, leaving the remaining seats for the passengers due to join the aircraft in Zakinthos. Neither the commander nor the Flight Supervisor (FS), in charge of the cabin, recalled being made aware of this seating plan, which had been drawn up on a chart with the operator's name on. The commander did, however, recollect that during the positioning flight from Gatwick he had advised the FS that he wanted the passengers joining in Kefallinia to be spread evenly through the cabin, although he did not mind if they were predominantly in the middle and rear sections. By contrast the FS recalled the commander expressing the desire that the majority of the passengers should be at the rear of the cabin.

The passengers were brought to the aircraft about 20 minutes after its arrival at Kefallinia. While they were embarking, the commander asked the FS where they were being seated. The FS remembered informing him that the passengers were seated in Rows 1 to 6. It is quite possible that at the time of this conversation the passengers that had boarded were those allocated seats in the first five rows, in accordance with the handling agent's seating plan, and that the passengers bound for the last six and a half rows in the cabin had yet to embark. However, the commander's understanding was that the passengers were nearly all on board, that they were sat in the front half of the cabin and that the first six rows were already full. The commander instructed the FS to move the passengers seated at the front of the cabin to seats further back, believing that she would still be aware that he wanted an even spread of passengers throughout the cabin. The FS asked the passengers to move to seats aft of Row 13, behind the overwing exits, informing them that they could return to their allocated seats after takeoff. She then advised the commander that the passengers had been moved. The handling agent asked the FS why the passengers had been moved and was advised that it was on the commander's instruction.

Effect of loading on the CG position

On arrival at Kefallinia the handling agent had presented the commander with the Load Form for the flight. This form indicated that 65 passengers were to be boarded using 'Standard Loading', which meant that, for a partial cabin load, the passengers would be evenly distributed between the three 'bays'. (For loading purposes the Operator assigns the 30 rows of seats in the cabin equally into three sections of 10 rows each. From front to rear they are designated 0A bay, 0B bay and 0C bay.) This was at variance with the handling agent's seating plan, which the commander did not see. The Load Form also indicated that all 62 bags to be loaded would go into the forward hold, Hold 1. The commander instructed the handling agent to load the baggage in Holds 3 and 4. The commander subsequently commented that his reasoning was based on his concern to avoid a forward CG. (This was because of an incident that he recalled from his previous company, a number of years beforehand, which involved a Boeing 737 that had rejected a takeoff above V_1 as a result of a CG outside the forward limit.) A second Load Form was then produced which reflected the new distribution of the baggage but still indicated that the passengers were subject to Standard Loading ie evenly spread between the bays. Using this data the commander compiled the Trim Sheet. The result produced an aft CG loading, which was within the limits. The Trim Sheet also included a Last Minute Change of

an additional two males, two females and five bags. This extra traffic load came to 369 kg, which was less than the 500 kg limit above which a new Trim Sheet would be required.

During most of these exchanges the FO was engaged on other duties associated with the turn-round and was not privy to much of the conversations. He was aware that the baggage was being loaded in Holds 3 and 4 at the commander's request, and his recollection was that passengers were sat at the front and rear of the cabin. Before starting the aircraft the commander asked him to carry out a gross error check on the Trim Sheet. In doing so, the FO's primary concern was to ensure that the weight calculations were correct. He remembered that the handling agent entered the flight deck on at least three occasions during the crew's pre-flight preparations and each time the crew explained to them why they could not depart any earlier. The aircraft taxied at 1150 hrs.

After the incident a Trim Sheet was compiled on the basis of the actual passenger loading. This produced a CG which was significantly beyond the aft limit of the CG envelope. A calculation of the CG based on the handling agent's original non standard passenger loading, with all the baggage placed in Hold 1 or split between Holds 3 and 4, confirmed that the aircraft would have departed with the CG within limits in either case.

Loading Procedures

The Operator's loading procedures in the Planning Manual for this aircraft type, which forms part of the Operations Manual, include two paragraphs on the commander's (Captain's) responsibility. They state:

> *By the nature of its business, the Company itself can have very little 'presence' at the large majority of the outstations it serves. It is, therefore, obliged to rely on handling agents for some of the loading documentation and all of the actual, physical, loading arrangements.*
>
> *Handling agents cannot always be relied upon to comply properly with the Company's laid-down procedures. Because of this, Captains, who are usually the senior Company representative present, have an overall responsibility to take such measures as are reasonably practicable to ensure that the procedures and requirements given in this section are complied with.*

A Load Form and a Trim Sheet are required to be completed as an accurate record of the load and trim of an aircraft prior to each flight. The forms are specifically designed for single sector loads and, under normal circumstances, the ground handling agents complete the Load Form and, using this information, the commanders complete the Trim Sheet.

Passengers, baggage and freight are subject to 'Standard Loading' or 'Non-Standard Loading'. Standard loading involves distributing the passengers evenly throughout the cabin and placing one third of the baggage and freight in Hold 1 and two thirds in Holds 3 and 4. Non-standard loading entails an uneven distribution of passengers in the cabin and a distribution of baggage and freight that is different from standard loading.

The Load Form indicates which method of loading has been employed. The mass and CG calculations are completed on the Trim Sheet using different trim tables for standard and non-standard loading.

With regards to passenger configuration, the operator's procedures advise cabin crew that, in the event of less than a full load of passengers, the passengers should be distributed as follows:

FWD cabin 25%

MID cabin 50%

AFT cabin 25%

This amounts to non-standard loading, in that the passengers are not distributed evenly throughout the cabin. The cabin crew are given no other advice on loading procedures.

Analysis

The handling agent had allocated passengers from Kefallinia seats in Rows 1 to 5 (the front of the cabin) and Rows 24 to 30 (the rear of the cabin), leaving Rows 6 to 23 and half of Row 24 for passengers joining in Zakinthos. This represented non-standard loading. However, the handling agent completed and signed the standard loading section on the Load Form. Had the commander seen a copy of the handling agent's seating plan, he would have been aware of the error.

The commander did observe on the Load Form that all the baggage had been allocated to Hold 1 and this prompted him to ask for the baggage to be moved to Holds 3 and 4 to move the CG further aft. His concern was based on his recollection of a rejected takeoff above V_1 involving a Boeing 737, which had been operated by his previous employer, where the CG had been beyond the forward limit.

The FS was unaware of the information on the Load Form or the seating plan. Had she had sight of the seating plan she would have appreciated the handling agent's intentions and how this differed from the advice she had been given in the operator's procedures on passenger configuration. Armed with a basic knowledge of the standard and non-standard loading procedures she would have been able to confirm with the commander which of these two configurations was in use, or if one changed to the other.

It is understandable that, with more passengers joining the aircraft at Zakinthos, the handling agent elected to employ non-standard loading. However, this was not communicated to the commander who completed the Trim Sheet on the basis of a standard passenger loading, as indicated on the Load Form. The commander had advised the FS, on the previous positioning sector, that he wanted the passengers joining in Kefallinia to be spread evenly throughout the cabin (standard loading), although he did not mind if they were predominantly in the middle and rear sections (non standard loading). The FS had understood the commander to mean that the majority of the passengers should be sat at the rear of the cabin and, following his instruction to move the passengers seated at the front of the cabin further aft, all passengers were subsequently seated behind Row 13. The result of this was that the CG was sufficiently beyond the aft limit that, when take-off thrust was selected and the aircraft started its take-off roll, the aircraft pitched up rapidly due to the couple created by the increasing engine thrust. By selecting idle thrust and applying the brakes, the commander was able to lower the nose wheel back on to the runway and restrict damage to that sustained by the rear galley drain mast.

The FS told the passengers who were moved aft that they could return to their original seats after the aircraft had taken off, which would have resulted in a significant CG shift, albeit back to within limits, once the aircraft was airborne. A basic knowledge of the concept of CG would have made the FS aware of the effect that moving passengers about in the cabin would have on an aircraft's CG.

The commander carried the responsibility for ensuring that the operator's loading procedures were complied with. By completing the Standard Loading part of the Load Form, the handling agent led the commander to believe that the passengers were evenly distributed throughout the cabin. Without entering the cabin himself or being advised that it was otherwise, he had no way of knowing that the aim was to split the passengers between the front five rows and the last six and a half rows in the cabin. The provision of the seating plan with the Load Form would have highlighted this intention and the erroneous completion of the Load Form. The conversation between the commander and the FS before arrival at Kefallinia, regarding passenger distribution, suggested that the crew did not appreciate that the handling agent would be allocating passengers specific seats.

Conclusions

Neither the commander nor the FS were aware which seats the handling agent had allocated to the passengers boarding the aircraft at Kefallinia. The Load Form indicated that the passengers had been

subject to standard loading and were spread evenly between the three bays in the cabin. However, the seating plan, which the crew did not see, showed that the passengers had been allocated the first five rows and the last six and a half rows in the cabin, leaving the remaining seats for the passengers due to join the aircraft in Zakinthos. This amounted to non-standard passenger loading but the commander completed the Trim Sheet on the basis of standard passenger loading, whilst taking account of the non-standard baggage loading.

The commander bore responsibility for the correct use of the loading procedures. Without a sight of the handling agent's seating plan, he was reliant on the information on the Load Form. The FS saw neither of these two documents, although both were at variance with the passenger distribution indicated in the operator's advice to cabin crew for a partial passenger load. The commander's instruction to the FS to move the passengers at the front of the cabin further aft was not understood in the way that he intended, moreover, it reinforced his previous instruction that the passengers should be 'predominantly in the middle and rear sections'. These instructions resulted in a non-standard distribution, which was contrary to the information on the Load Form, which the commander used to complete the Trim Sheet. This contradictory situation did not comply with the company's Standard Operating Procedures (SOPs). The FS and commander did not appreciate the effect of the subsequent alteration on the aircraft's CG, and the latter did not know where, ultimately, the passengers were sat. The handling agent enquired as to the reason for the movement of the passengers but did not question it. Effectively, each of the commander, FS and handling agent were in possession of some of the information but none of them had the full picture. In view of his responsibility, the commander needed to be in possession of all the relevant information.

The result of the commander asking the FS to move the passengers at the front of the cabin towards the rear was that all the passengers were subsequently seated behind Row 13. This created a CG which was sufficiently beyond the aft limit that, when take-off thrust was selected and the aircraft started its take-off roll, the aircraft pitched up rapidly due to the couple created by the increasing engine thrust.

Amendments to the Operator's Procedures

In the light of this incident the operator has introduced changes to the company procedures. The Ramp Handling Manual, which is distributed to handling agents, has been revised to emphasis the correct loading procedures for all the aircraft types operated by the company. This includes the 'standard loading procedures' for Airbus A320 flights carrying less than a full load of passengers, which require the passengers to be distributed evenly throughout the cabin.

The company SOPs for the Airbus A320 have been amended to improve the cross checking of the load sheet and trim sheet by the commander and FO including the instruction that they make every effort to ensure that the paperwork accurately reflects the actual loading.

A revision to the Cabin Crew Safety Manual, which applies to the Airbus A320, A321 and Boeing 757, has also been drafted. This states that;

> *Standard passenger loading for ALL aircraft is for passengers to be EVENLY DISRIBUTED THROUGHOUT THE ENTIRE CABIN. On completion of boarding, the Flight Supervisor is to check that passengers are seated in this manner. In the event that this is not the case, the Flight Supervisor must inform the captain without delay and prior to engine start. The captain will then take the appropriate action to verify that the distribution is suitable or redistribute accordingly.*

This subject is to be included and expanded on during Cabin Crew recurrent training and all future FS courses.

Recommendation 2003-104

It is recommended that Air 2000 review the advice given to handling agents at outstations to ensure that the commanders of the company's aircraft are in possession of all the relevant loading information before they compile a Trim Sheet.

Recommendation 2003-105

It is recommended that Air 2000 review the training given to Flight Supervisors for the Airbus A320 with regard to passenger distribution in the cabin and its effect on the CG of the aircraft.