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Australian Transport Safety Bureau

Incorrect configuration involving an Airbus A320, VH-VFU,

Sydney Airport, New South Wales, 28 July 2014

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Published by: Australian Transport Safety Bureau
Postal address: PO Box 967, Civic Square ACT 2608
Office: 62 Northbourne Avenue Canberra, Australian Capital Territory 2601
Telephone: 1800 020 616, from overseas +61 2 6257 4150 (24 hours)
Accident and incident notification: 1800 011 034 (24 hours)
Facsimile: 02 6247 3117, from overseas +61 2 6247 3117
Email: atsbinfo@atsb.gov.au
Internet: www.atsb.gov.au

Addendum

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Incorrect configuration involving an Airbus A320, VH-VFU

What happened

Airbus A320: VH-VFU

Source: Allen Zhao

At about 1324 Eastern Standard Time on 28 July 2014, the flight crew of an Airbus A320 aircraft, registered VH-VFU, was preparing the aircraft for the fourth and final sector of the day. The flight was a return leg from Sydney, New South Wales, to Adelaide, South Australia.

There was a delay waiting for the aircraft to be refuelled, adding to the 25 minute delay already accrued during the first sector into Melbourne, Victoria.

Simultaneous opposite direction runway operations (SODROPS) were in place at Sydney, with arrivals using runway 34 Left (34L), and departures using runway 16 Left (16L). Air Traffic Control (ATC) issued the crew with a pre departure clearance (PDC) for the runway 16L Kevin Three standard instrument departure (SID).

The first officer (FO), the pilot monitoring (PM), calculated the performance data and established that a Configuration 2[1] (Figure 1) was required for take-off. As the pilot flying (PF), the Captain confirmed the performance data calculations and, using the multifunction control display unit (MCDU)[2] (Figure 2), entered the information into the flight management and guidance computer (FMGC). Shortly after, ATC advised the crew that due to an increased downwind component for runway 16L the PDC was cancelled. ATC then issued a departure clearance from runway 34L, via the Katoomba One SID.

Figure 1: Typical A320 Configuration settings

(1) FLAPS lever

The FLAPS lever selects simultaneous operation of the slats and flaps.

The five lever positions correspond to the following surface positions:

Position	SLATS	FLAPS	Indications on ECAM			
0	0	0			CRUISE	HOLD
1	18	0	1			
		10	1 + F	TAKEOFF		
2	22	15	2			APPR
3	22	20	3		LDG	
FULL	27	40	FULL			

Before selecting any position, the pilot must pull the lever out of the detent. Balks at positions 1 and 3 prevent the pilot from calling for excessive flap/slat travel with a single action.

Source: Jetstar A320 flight crew operating manual (FCOM)

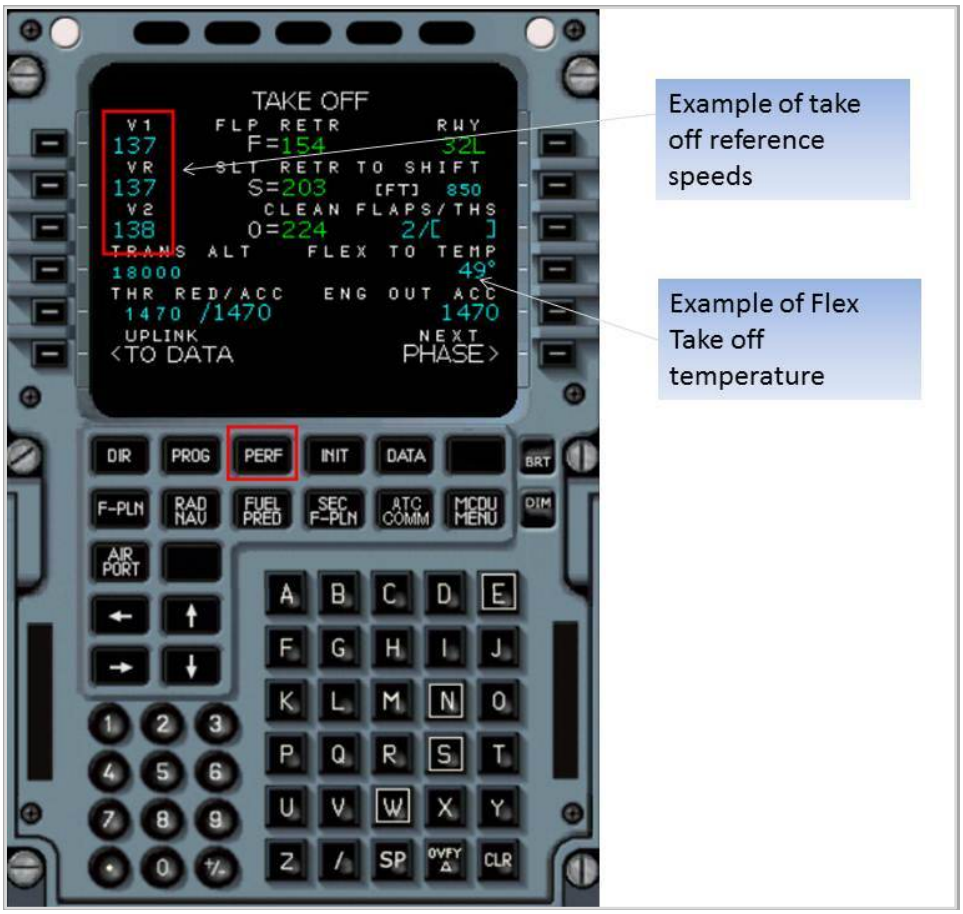
To minimise any further delay, the PM worked on the load sheet calculations, while the PF re-calculated the new performance data required as a result of the runway change. It was

[1] Configuration 2: Slats 22°, Flaps 15° setting. This is achieved by selecting Flap 2.

[2] MCDU is the primary interface between the pilot and the FMGC.

established that a Configuration 1 + F[3] would now be required for take-off. The PF completed new take-off and landing data (TOLD) cards, and updated the FMGC with the new performance data; including new take-off reference speeds[4] and flex take-off temperature[5] (Figure 2).

Figure 2: MCDU Performance page: Examples of take-off speeds and flex temperature



Source: EFB Desktop

It was reported that the PM independently verified the performance calculations, and also checked the data in the FMGC. The crew then briefed on the new departure, including the new take-off reference speeds; however, neither crew member recalled specifically briefing on the changed take-off configuration.

As part of the after start procedures (Figure 3, shown as PNF list), the PM inadvertently selected the originally calculated Flap 2 take-off setting. He then checked the flap position on the upper ECAM, which was showing this selection. As he believed he needed to set flap 2, the flap 2 setting displayed on the ECAM confirmed what he believed to be correct.

Note: For a Flap1 take-off, the relevant combination of slats and flaps are commanded (Figure 1) by moving the flap lever to the flaps 1 position and the indication on the upper ECAM becomes 1 + F.

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[3] Configuration 1 + F : Slats 18°, Flaps 10° setting

[4] Take-off reference speeds (V speeds) are:
- V_1 - decision speeds (with respect to continuation of the take-off following an engine failure)
- V_R - speed at which the pilot initiates rotation of the aircraft to the take-off pitch attitude
- V_2 - take-off safety speed (minimum speed that needs to be maintained up to the acceleration altitude, in the event of an engine failure after V_1.

[5] Flex temperature (higher than the actual ambient temperature) is entered by the crew to allow for a reduced thrust (flex temperature) take-off. Labelled FLEX TO TEMP on the MCDU.

Despite carrying out all the required flows and checklists, as they taxied the aircraft to the runway 34L holding point, neither of the crew detected the incorrect configuration setting.

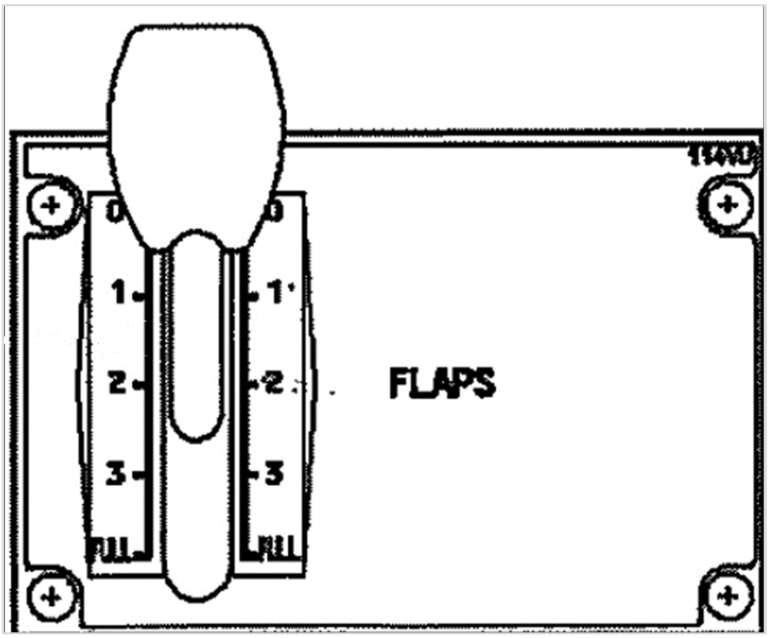
Figure 3: A sample Normal Procedures AFTER START checklist

AFTER START

PF		PNF	
ENG MODE selector	NORM		
APU BLEED	OFF	GND SPOILERS	ARM
ENG ANTI-ICE	AS RQRD	RUD TRIM	ZERO
WING ANTI-ICE	AS RQRD	FLAPS	SET
APU MASTER switch	AS RQRD	PITCH TRIM	SET
		ECAM DOOR PAGE	CHECK
•If STS label is displayed:			
ECAM STATUS	CHECK		
CLEAR TO DISCONNECT	ANNOUNCE		
AFTER START C/L			

Source: A320 Pilot operating handbook

Figure 4: Flap (and configuration) selection lever



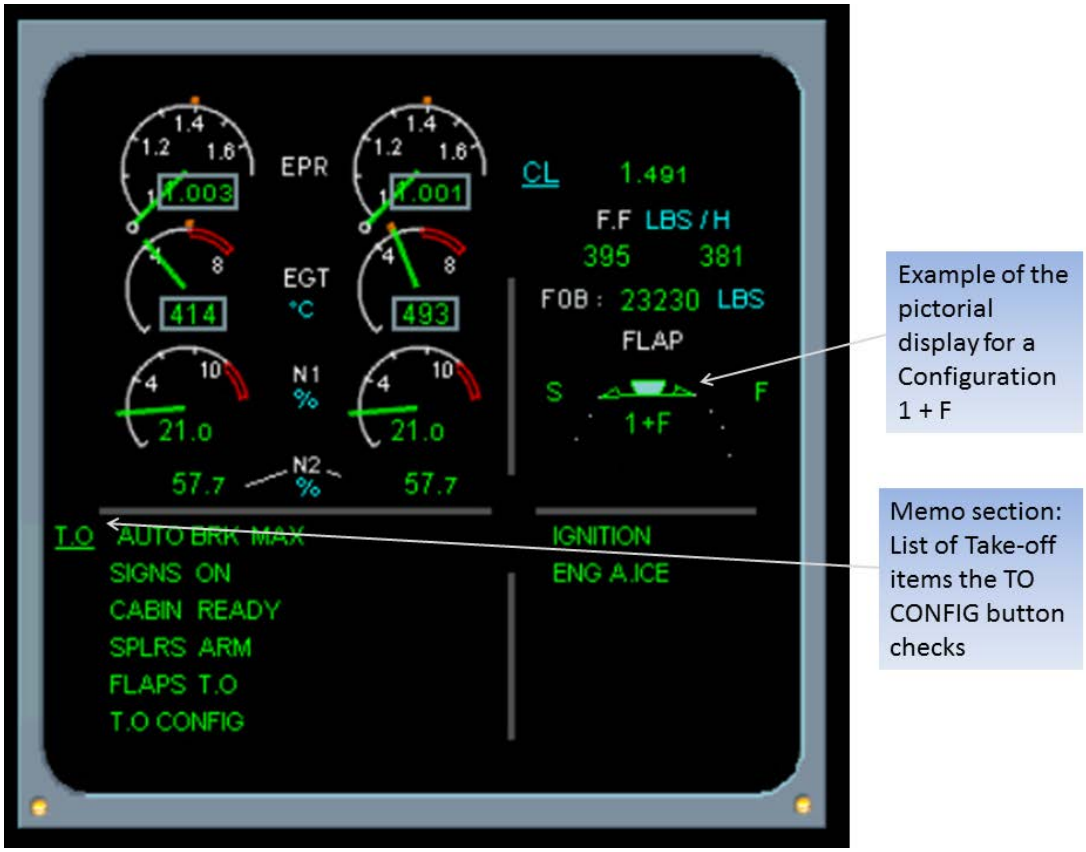
Source: Jetstar A320 Pilot operating handbook

The take-off configuration check (TO CONFIG)

As part of the pre-take-off checks conducted prior to line up, the PM pressed the take-off configuration pushbutton. This button simulates take-off power being applied, and is a final check for the crew on the take-off settings they have selected. The check is designed to trigger a warning if the aircraft is not properly configured for take-off. Any warnings appear in the memo section on the upper electronic centralised aircraft monitor (ECAM) or Engine/Warning Display (E/WD) (Figure 5).

Note: This check does not crosscheck the manually selected take-off flap (configuration) (Figures 1 and 4) with the information programmed by the crew into the FMGC. The system is designed to check that any of the take-off flap positions (1, 2 or 3) has been manually selected, not which particular setting. Therefore, despite the crew incorrectly selecting a Flap 2 (configuration) for take-off, no messages appeared on the ECAM.

Figure 5: A 320 Upper ECAM Engine / Warning Display



Source: EFB Desktop

The take-off and initial climb

During the take-off run there were no warnings or alerts. Had a FLAP 1, 2 or 3 not been selected, a master warning light (MWL) and a continuous repetitive chime (CRC) would have activated when the thrust levers were advanced.

Apart from dealing with an increased crosswind, the PF reported that the rotation and initial climb to the thrust reduction altitude of 800 ft above ground level was normal.

Passing through 800 ft, the PF set the thrust lever in to the climb thrust detent which commanded the aircraft to reduce engine thrust to a climb thrust setting. Upon reaching the acceleration altitude set by the flight crew of 800 ft, which was the same as the thrust reduction altitude, the aircraft started to accelerate. At this time the PF noted on the primary flight display that the aircrafts speed was above the flap retraction speed, annotated as 'F' speed[6] on the speed tape. The flight crew reported that this was unexpected as there would not normally be an indication of an 'F' speed following a configuration 1 + F take-off, instead they were only expecting a slat retraction or 'S' speed to be indicated.

At this time the flight crew realised that they had positioned the flap lever in the flap 2 position which meant that additional slats and flaps were deployed for the take-off (Figure 1). As the airspeed was above F speed, the flap lever was moved to the flap 1 position where the aircraft continued to accelerate toward the S speed indication. After reaching the required S speed the PNF selected Flaps 0, thereby stowing the remaining slat and flap. The remainder of the flight to Adelaide was uneventful.

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[6] F speed – The retraction speed for the next stage of flap

Captain experience and comments

The Captain had accumulated over 8,400 flying hours with about 1,200 command hours logged on A320 aircraft.

He reported that he had signed on at 0540 and although he felt he had only an 'average' night's sleep the night before, assessed himself as fit to fly. He had also flown a similar program the day before. He did comment that he felt his alertness had reduced throughout the day.

The Captain stated that the first sector of the day had been characterised by high workload, with delays and a strong jetstream wind enroute to Melbourne. The workload had also increased at Sydney as he had not operated into this port for some time.

During the taxi and take-off, the Captain reported that he had in his mind that it was still a Flap 2 (configuration) for take-off. Until this incident, he had believed that pressing the Configuration Take-off (CONFIG TO) (Figure 1) button would alert the crew by way of a memo on the ECAM.

Although the CONFIG TO pushbutton functionality is normally included in the A320 aircraft type rating, the Captain could not recall any specific training in this area. To date, he had not previously experienced a configuration warning on the A320.

He also commented that Sydney is one of the few places that a configuration 1 + F is used. This is because 34L is such a long runway and there are no significant obstacles after take-off.

First Officer experience and comments

The First Officer had accumulated around 3,800 flying hours, with almost 500 hours on the A320 aircraft.

He reported that he had also signed on at 0540. The FO reported feeling some effects from a busy previous few days but assessed himself as being fit to fly. He stated that he was due to go on annual leave at the completion of this flight.

He also stated that he had been PF for two of the previous sectors that day, including a landing at Sydney in a 15 knot crosswind. He reported that this had increased his workload on what he felt developed into a more demanding tour of duty than normal given that he is still relatively new to the aircraft type.

He recalled briefing the new departure with the PF after the PDC change, but not specifically the change in take-off configuration. He reported that in his experience to date, some crews include a change in configuration in their briefings and others do not. He could not recall if the new take-off information had been put into the FMGC before or after he did the crosscheck. He recalled checking the TOLD card and FMGC data.

He commented that the after start scans where he selected Flap 2 are a memory item. At this stage in the flight deck preparation, the FO believed that both the crew were confident that everything was going to plan. He also recalled that during the checks and flows that he looked at the flap position on the upper ECAM, but for no reason he could establish, did not crosscheck this information with the TOLD card.

Operator report

The operator conducted an investigation into the incident. Their report noted the following items:

- Both crew members reported being tired at sign on; however, had judged themselves fit to fly.
- There had been a change in procedure after the change in PDC from ATC. The PF revised the performance data which changed the take-off configuration to a Flap 1 + F and then entered this new information into the MCDU before the FO had checked the data in the performance manual. The PF also updated the TOLD cards at this time.

  Company procedures stated that:

The PF will only enter the performance data into the MDCU once they have checked and confirmed the calculated data is correct. If the PF identifies an error in the PNF's calculations and the PNF is absent (ie. walk around duties), the PF may recalculate and amend the recorded data but this must not be entered into the MCFU until the PNF checks and confirms the amendment. In any case both PF and PNF must agree on any data before entry into the MCFU occurs.

- The PF briefed for a 34L departure, but as the crew had not briefed for a 16L departure, they did not include the threat that the change in runway and subsequent altered CONFIG setting may have.
- A new automatic terminal information service (ATIS) was issued around the time of pushback. After the engine start the PM conducted his after start scan, but still retained a mental image of a 16L departure, leading to the selection of CONFIG 2 instead of CONFIG 1 + F. The PF did not monitor the PM or notice this error.
- Although the checks had all been completed, the crew were briefly distracted by a new Cathay Pacific 747-800 departing.
- The combination of the distraction of the 747 and task focussing contributed to the PF not detecting the incorrect take-off flap setting.
- Although the crew conducted the before take-off checklist they did not notice that the flap setting was incorrect. The decreased vigilance was most likely a result of the crew not operating at their optimum due to the continuous high workload and decreased level of operational capability at the start of duty.

ATSB comment

The mismatch in actual versus intended take-off configuration meant that the calculated take-off reference speeds and aircraft performance would have been different. While the crew encountered no particular difficulties on this occasion, in more extreme cases, particularly those involving significantly inaccurate aircraft weights, or under more critical take-off conditions, inaccurate take-off reference speeds and performance predictions can have more serious consequences.

The ATSB Research Report, *Take-off performance calculation and entry errors: A global perspective* looks more closely at the origin of these errors by both international and Australian crews between the period of January 1989 and June 2009. There is a focus on aircraft weights and V speeds, and more importantly it provides an analysis of the safety factors that contributed to the international occurrences and suggests ways to prevent and detect such errors.

The report is available at: www.atsb.gov.au/publications/2009/ar2009052.aspx

Safety action

Whether or not the ATSB identifies safety issues in the course of an investigation, relevant organisations may proactively initiate safety action in order to reduce their safety risk.

Jetstar has advised the ATSB they are taking the following Safety Actions.

Although the CONFIG TO pushbutton functionality is defined in the Company FCOM, Jetstar have decided to undertake a detailed review of the results from their Flight Safety Integration Audit (FSIA) program. This is a continuous safety audit program targeted toward identifying specific operational threats and risks associated with failed/erroneous Human-Machine Interface activities such as seen in this occurrence.

Jetstar expects the review to be completed by the end of the first quarter of 2015. The airline will then develop action plans to address any identified themes.

Another Safety Action initiative taken by Jetstar is to incorporate a summary of the incident in the next edition of the company flight crew Technical Newsletter. This will include suggestions on how to mitigate against similar occurrences.

Safety message

This incident highlights the importance of careful attention to the actions taken during flows and checks, particularly under circumstances where there is a change in plans, such as a changed departure runway. The incident also highlights the importance of careful attention to cross referencing calculated performance data and configuration with the inputted data and displayed configuration information. This is particularly important under circumstances where a crew may be susceptible to the effects of reduced vigilance, or where there is an increased risk of distraction. Under these circumstances, crew monitoring and cross-checking assume greater importance.

The Airbus Safety Magazine: Safety first #18 reports on potential problems with using incorrect V speeds. A chapter dedicated to take-off speeds highlights the design and operational considerations underlying all recommendations Airbus has issued to flight crews.

The article is available at:
www.ukfsc.co.uk/information/safety-briefings-presentations/335-airbus-safety-first-magazine

Although both crew members had presented for duty that morning stating they were fit to fly, both also reported feeling tired at sign on. The Captain commented on an 'average' night's sleep and a long duty on the previous day.

Neither crew member judged themselves as unfit to discharge their duty at any time throughout their day; however, the high workload, delays and distractions they experienced appeared to augment the tiredness they felt. Crews need to remain aware of the vigilance decrements that can occur when they detect tiredness within themselves during the final sector of a busy duty day.

Many research papers on fatigue, sleep and the circadian cycle are available to provide pilots and operators with further insights into the complex interaction of variables which may contribute to how a crew member performs their tasks if tired or fatigued.

General details

Occurrence details

Date and time:	28 July 2014 – 1337 EST	
Occurrence category:	Incident	
Primary occurrence type:	Incorrect configuration	
Location:	Sydney Airport, New South Wales	
	Latitude: 33° 56.77' S	Longitude: 151° 120.63' E

Aircraft details

Manufacturer and model:	Airbus Industrie A320-232	
Registration:	VH-VFU	
Operator:	Jetstar Airways Pty Ltd	
Serial number:	5814	
Type of operation:	Air Transport High Capacity – Passenger	
Persons on board:	Crew – 2 flight crew	Passengers –Unknown
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Nil	

About the ATSB

The Australian Transport Safety Bureau (ATSB) is an independent Commonwealth Government statutory agency. The ATSB is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers. The ATSB's function is to improve safety and public confidence in the aviation, marine and rail modes of transport through excellence in: independent investigation of transport accidents and other safety occurrences; safety data recording, analysis and research; and fostering safety awareness, knowledge and action.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to fare-paying passenger operations.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and Regulations and, where applicable, relevant international agreements.

The object of a safety investigation is to identify and reduce safety-related risk. ATSB investigations determine and communicate the safety factors related to the transport safety matter being investigated.

It is not a function of the ATSB to apportion blame or determine liability. At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

About this report

Decisions regarding whether to conduct an investigation, and the scope of an investigation, are based on many factors, including the level of safety benefit likely to be obtained from an investigation. For this occurrence, a limited-scope, fact-gathering investigation was conducted in order to produce a short summary report, and allow for greater industry awareness of potential safety issues and possible safety actions.