ZV 252 Occurrence Investigation

Executive Summary

On 6 May 2016, an Airbus A321-200 aircraft of V Air[1], scheduled passenger flight ZV 252, nationality and registration number B-22610, on a flight from Taoyuan International Airport (hereinafter Taoyuan Airport) to Tokyo Haneda International Airport, with 2 flight crew, 4 cabin crew and 163 passengers, totally 169 people on board.

The occurrence aircraft took off from Runway 23L of Taoyuan Airport on 2226[2]. On 2250 when this aircraft was cruising at flight altitude 35,000 feet, a cabin crew informed the flight crew on intercom, saying that “smoke is coming out of the power bank of a passenger”. The pilot replied the cabin crew to handle the situation as soon as possible, and decided to return to Taoyuan Airport. The cabin crew reported back on 2256 that “the fire had been put out, the power bank was put inside a trash can full of water to lower the temperature, and this trash can was locked inside a toilet”.

The pilot was cleared at 2309 by air traffic control to descend to 4,000 feet and approached by instrument landing system on Runway 23 of Taoyuan Airport. On 2321 the aircraft landed on Runway 23 of Taoyuan Airport safely, with no casualty and no substantial damage to the aircraft.

Pursuant to the Aviation Occurrence Investigation Act of the Republic of China and, referring to Annex 13 to the Convention on International Civil Aviation, the Aviation Safety Council (hereinafter

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1 V Air terminated its business as from October 1, 2016.

2 Unless otherwise indicated, all the time in this report refers to Taipei Local Time (UTC + 8 hours).

ASC), an independent aviation occurrence investigation agency, started the investigation. The organization or agency been invited to join the investigation team included: Civil Aeronautics Administration, Ministry of Transportation and Communications, National Police Agency, Ministry of Interior and Bureau d'Enquêtes et d'Analyses of France.

The 'Draft Investigation Report' of the occurrence was first reviewed and approved by the ASC's 52th Board meeting on December 27, 2016. This Report was sent to relevant agencies for comments. Upon compilation and integration of comments and suggestions, this Report was finally approved as amended on March 28, 2017 by the 55th Board meeting of the ASC.

Based upon the factual information gathered during the investigation process and the results of analysis, 9 findings were obtained and 2 safety recommendations for improvements were issued as follows.

Definitions of the findings as the result of this investigation: The ASC presents the findings derived from the factual information gathered during the investigation and the analysis of the occurrence. The findings are presented in three categories: **findings related to probable causes**, **findings related to risk**, and **other findings**.

The **findings related to probable causes** identify elements that have been shown to have operated in the occurrence, or almost certainly operated in the occurrence. These findings are associated with unsafe acts, unsafe conditions, or safety deficiencies associated with safety significant events that played a major role in the circumstances leading to the occurrence.

The **findings related to risk** identify elements of risk that have the

potential to degrade aviation safety. Some of the findings in this category identify unsafe acts, unsafe conditions, and safety deficiencies including organizational and systemic risks, that made this occurrence more likely; however, they cannot be clearly shown to have operated in the occurrence alone. Furthermore, some of the findings in this category identify risks that are unlikely to be related to the occurrence but, nonetheless, were safety deficiencies that may warrant future safety actions.

Other findings identify elements that have the potential to enhance aviation safety, resolve a controversial issue, or clarify an ambiguity point which remains to be resolved. Some of these findings are of general interests that are often included in the ICAO format accident reports for informational, safety awareness, education, and improvement purposes.

Findings as the result of this investigation

Findings Related to Probable Causes

1. The occurrence power bank could have had internal malfunction or defects before it was connected to a passenger's mobile phone for charging, causing combustion and resulted in the power bank to smoke and fire. Due to the circuit-protecting board and two battery cells were burned out, the exact causes for this malfunction could not be identified consequently. （1.15, 1.16.1, 2.2）

Findings Related to Risk

1. If a lithium-ion battery is located in an overheated environment, impacted from outside, overcharged, or if this battery has imperfection in its design or production, this battery's temperature will rise from chemical reactions of the battery discharging. Suppose the rising temperature from battery discharge further rise the

temperature of this battery, a lithium-ion battery thermal runaway may be induced by the high temperature. (1.16.1, 1.18.3.1, 2.2).

2. If this power bank carried by passenger has not been properly certified or it had been impacted upon somewhere, then charging or discharging battery by passengers during flight is prone to induce the battery cell thermal runaway as a result of exothermic chemical reaction during battery cell discharging. (1.16.2, 1.18.3, 2.2)

3. In the twelve months prior to this occurrence, the Taoyuan Aviation Police Bureau, National Police Agency of Ministry of Interior, found out some 150,000 items of power bank or spare lithium battery with lithium-ion from checking baggage in Taoyuan Airport. This indicates that passengers neglected to pay attention to the regulation or they are not aware of such regulations requiring hand carry lithium-ion battery. There is room for improvement in terms of educating or informing passengers through publicity, or through check-in counters reminding the passengers. (1.18.4.2, 2.3.2)

Other Findings

1. During this occurrence, the cabin crew complied with the abnormal procedures of the V Air Cabin Crew Operation Manual in passenger evacuation, reporting, fire-extinguishing, and in the handling of the occurrence power bank. (1.15, 2.1)

2. The anode connecting metal plate of two unburned battery disrupted, causing suspected arcing cut, this should have been caused by other burning batteries. (1.16.1, 2.2)

3. Both the laws of the Republic of China and of the International Civil

Aviation Organization require that spare lithium-ion battery should be properly protected to avoid short circuit. The Civil Aeronautics Administration indicated that all the power banks for sale in the market have already wrapped up the anode and cathode as well as the printed circuit board inside the battery; there is no possibility of the cathode and the anode contacting one another. Such products have already complied with the regulations of this country. Therefore, no tape should be attached to insulate the anode and the cathode. (1.18.3, 2.3.1)

4. In practice, the aviation Police Bureau would find it difficult to impose a requirement upon all the passengers that all power banks must have been certified as safe by the National Standard Bureau before they can be taken on board. (1.18.3, 1.18.4.2, 2.2, 2.3.2)

5. Except Mainland China, most countries throughout the world do not prohibit passengers on board an aircraft cabin from using power banks for charging or discharging. Current practice of Civil Aeronautics Administration complies with related international regulations and practice governing the transportation of lithium batteries. (1.18.3, 2.3.1)

Safety Recommendation

To Civil Aeronautics Administration, Ministry of Transportation and Communications

1. Evaluate the risks of passengers using lithium-ion battery power bank for charging or discharging during flight; continue to understand the international norms and possible actions of this issue; take timely revision of corresponding regulations of the Republic of China to

reduce the potential risks.

2. Supervise national civil aviation transportation category airlines companies to enhance air safety education and publicity programs regarding the transportation of lithium-ion battery power bank and spare lithium battery that passengers should hand carry or through a carry-on luggage when boarding an airplane.