



International Civil Aviation Organization
**Second Meeting of the Regional Aviation Safety Group –
Asia and Pacific Regions (RASG-APAC/2)**
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Agenda Item 3: Member State / Industry Presentations

**IMPROVING FIRE DETECTION SYSTEMS OF
AIRCRAFT CARGO COMPARTMENT**

(Presented by the Republic of Korea)

SUMMARY

This working paper shares the information on the activities that the Ministry of Land, Transport and Maritime Affairs (MLTM) of the Republic of Korea (ROK) had taken to improve cargo flight safety including installation of a fire surveillance camera system in the cargo compartment of aircraft, after the Asiana Airlines accident occurred in 2011.

1. INTRODUCTION

1.1 Asiana Airlines Flight 991, a Boeing 747-400 freighter crashed into the southern west sea of the ROK which is near the Jeju Island on 28 July 2011. The aircraft crashed shortly after the crew reported a fire in the cargo compartment and had been attempting to divert to Jeju International Airport. In-flight fire in the cargo compartment probably caused the accident, but its exact cause in accident has not yet been determined.

1.2 After the accident occurred, the MLTM conducted special inspections and took safety measures, i.e. reinforcement of crew training and pilot proficiency checks, increase of surveillance frequency for cargo handling and overseas transshipment airports, strengthening the inspection on fire warning system, fuel system and electrical wire harness, recruiting additional dangerous goods expert, etc. In addition, the Asiana Airlines determined to install a fire surveillance camera system in cargo compartment providing images for crew members to be aware of a situation and take the most appropriate action in a cargo fire situation as deemed most effective safety defense.

1.3 This working paper aims to share the information on follow-up actions taken after the Asiana Airlines accident.

2. DISCUSSION

2.1 Uncontrolled onboard fire is one of the serious threats to commercial aircraft safety, however, airlines and freight carriers are relying upon traditional smoke or fire detection systems which trigger often false alarms. In the case of the fire which is initiated in cargo compartment not normally accessible in flight, it is almost impossible to identify the exact source and location of fire. Under these circumstances, it is important to get the most accurate information and data to flight deck crews as quickly as possible in order to take the most appropriate action. It applies so aptly to the accident case of the Asiana Airlines.

2.2 Besides the accident of the Asiana Airlines, there are more similar cases of accidents which have occurred from fire in cargo compartment.

2.2.1 An UPS flight 1307, a McDonnell Douglas DC-8-71F, landed at its destination airport, Philadelphia International Airport, Philadelphia, Pennsylvania, after a cargo smoke indication in the cockpit, on 7 February 2006. The captain, first officer, and flight engineer evacuated the airplane after landing. The flight crewmembers sustained minor injuries, and the airplane and most of the cargo were destroyed by fire after landing. The U.S. National Transportation Safety Board determines that the probable cause of this accident was an in-flight cargo fire that initiated from an unknown source, which was most likely located within cargo container 12, 13, or 14. Contributing to the loss of the aircraft were the inadequate certification test requirements for smoke and fire detection systems and the lack of an on-board fire suppression system (Ref.:NTSB/AAR-07/07).

2.2.2 On 27 April 2004, Mountain Air Cargo Fokker F27-500 departed Buenos Aires, Argentina for a cargo flight to Sao Paulo-Viracopos, Brazil via Porto Alegre. En route on the first leg, a crew member noticed the presence of smoke and discovered a fire in the cargo bay. Efforts to extinguish the fire were unsuccessful. The crew declared an in-flight emergency to Montevideo control centre. The crew made a safe emergency landing at Melo, Uruguay, a small airport nearby. The crew evacuated the aircraft. Fire fighters arrived and succeeded in extinguishing the fire. The airplane suffered considerable damage in the cargo compartments E and F. There were no casualties. The fire was caused by improperly packaged and labelled hazardous materials (Ref.: DOT/FAA/AR-11/18).

2.3 In the case of fire in cargo compartment, accurate situation awareness of the flight crew is one of the most important factors to make the most appropriate decision to resolve the problem. Supporting flight crews to be aware of a situation and take necessary actions, visual or acoustic information of a cargo compartment may be required especially for an uncontrolled onboard fire.

2.4 According to Annex 8, fire precautions shall be provided to contain or to detect and extinguish such fires as might occur in such a way that no additional danger to the aeroplane is caused.

2.4.1 For aeroplanes for which the application for certification was submitted on or after 12 March 2000, cargo compartment fire suppression systems, including their extinguishing agents, shall be designed so as to take into account a sudden and extensive fire such as could be caused by an explosive or incendiary device or dangerous goods according to Annex 8 Part IIIA.

2.4.2 According to Annex 8 Part IIIB, each cargo compartment not accessible to a crew member shall be equipped with a built-in fire detection system and a built-in fire suppression system. And cargo compartment fire suppression systems, including their extinguishing agents, shall be designed so as to take into account a sudden and extensive fire such as could be caused by an explosive or an incendiary device or dangerous goods.

2.4.3 For aeroplanes for which application for certification was submitted on or after 24 February 2013, design precautions shall be taken to minimize the risk of an uncontained fire initiating in areas of the aeroplane that contain high concentrations of wiring or equipment that are not normally accessible in flight.

2.5 The fire suppression systems of cargo compartment mostly are adopting depressurization method which the fire is extinguished by oxygen deprivation. For this kind of fire suppression system, it is required to climb or descent to an adequate altitude, which is defined in Airplane Flight Manual (AFM), to extinguish fire in cargo compartment. After the flight crew confirm that fire is extinguished, airplane may be descent. If the fire is not extinguished completely, the fire may be propagated as airplane descends.

2.5.1 However, in some cases, time is needed to identify smoke particles by a smoke detector and in the worst; it could be already late to overcome the fire in cargo compartment.

2.5.2 If the fire is initiated in cargo compartment not normally accessible in flight, currently required built-in fire detection system is not sufficient for the flight crew to be informed of the presence of fire and take a swift reaction.

2.6 From this background, the Asiana Airlines are preparing to install Fire Surveillance Camera System in Boeing 747 freighters to provide real time situational information on the cargo compartment to flight crews and the MLTM will monitor the outcome and effectiveness of this installation.

2.6.1 Fire Surveillance Camera Systems is composed with video cameras, illuminating system including infra-red floodlighting, monitor on the flight-deck, or through the Electronic Flight Bag, and image data processor. The number of cameras required for each aircraft type should be confirmed after the completion of the aircraft surveys.

2.6.2 Fire in main cargo deck could be watched by flight crews in cockpit through a monochrome camera in real time. The video detection software automatically displays the smoke through the camera and at the same time audio alert will be provided to the crew.

2.6.3 Supplemental Type Certificate for this new system will be approved by the State of Design, and the Asiana Airlines is expecting to start their operation with this new system from December this year.

2.7 The amount of damage for the accident of Asiana B747-400 freighter is analysed as 190 million US dollars by the analyst of an insurance companies and calculated only with the considered of the value of airplane and cargo. Adding the value of flight crews the amount of damage will be more expensive.

2.7.1 The Asiana Airlines is expecting about 2 million USD per aircraft to install and get the certified the Fire Surveillance Camera System. Still not experienced but expecting the safety benefit and comparing the price of installation and the cost of damage of the Asiana Airlines flight 991, ROK views that installing this new system to improve safety should be considered by the ICAO, Member States and manufacturers.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

- a) note the information presented in this working paper;
- b) consider the effects of the installation of the fire surveillance camera system in cargo compartment; and
- c) request APRAST to evaluate the operational safety effectiveness of the fire surveillance camera system in cargo compartment and deliberate on the need for development of guidance in this area