

FINAL REPORT

AIRBUS A330, REGISTRATION 9V-STO DIVERSION AFTER SMOKE WARNING

22 APRIL 2013

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Air Accident Investigation Bureau of Singapore
Ministry of Transport
Singapore

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The Air Accident Investigation Bureau of Singapore

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CONTENTS

	Page
Glossary of abbreviations	3
Synopsis	4
1 Factual Information	5
1.1 History of the Flight	5
1.2 Injuries to Persons	8
1.3 Damage to Aircraft	8
1.4 Cargo Container 42L	9
1.5 Damage to Cargo Container and their Contents	9
1.6 Cargo Fire Protection System	9
1.7 Test and Research	10
1.7.1 Fire debris	10
1.7.2 Attempt to identify damaged cargo	11
1.8 Additional Information	12
1.8.1 Building up of container 42L in Singapore	12
1.8.2 Cargo Screening	12
1.8.3 Surveillance of cargo loading at C1 and cargo handler's facilities	13
2 Discussion	14
2.1 Observations	14
2.2 Rekindling of fire	15
2.3 Communication on presence of dangerous goods	15
2.4 Communication among ARFS, air traffic controller and the emergency aircraft concerning the status of an emergency	15
2.5 Flight crew's decision to terminate the emergency	16
3 Safety Recommendations	17

GLOSSARY OF ABBREVIATIONS

ARFS	Airport Rescue and Fire Fighting Service
ATC	Air Traffic Control
BITE	Built-In Test Equipment
CIFS	Central Institute of Forensic Science, Thailand
ECAM	Electronic Centralised Aircraft Monitor
FIR	Flight Information Region
FO	First Officer
IATA	International Air Transport Association
NOTOC	Notification to Crew
PIC	Pilot-in-Command
RCAR	Regulated Air Cargo Agent Regime
SDCU	Smoke Detection Control Unit
SP	Service Programme
TT	Thailand Times

SYNOPSIS

At 1858hr (Singapore time) on 22 April 2013, an Airbus A330 aircraft (registration 9V-STO) took off from Singapore Changi Airport, operating flight SQ446 bound for Dhaka, Bangladesh. Eighty-four minutes into the flight, while cruising at 36,000 feet over the Gulf of Thailand, about 8.1 NM off the coast of Thailand, the flight crew received a smoke warning that suggested a problem in the rear cargo compartment (which comprised an aft cargo compartment for cargo containers and pallets, and a bulk cargo compartment, separated by a cargo net). The flight crew discharged fire extinguishing agent into the cargo compartment.

The Pilot-in-command (PIC) decided to divert to Suvarnabhumi Airport in Bangkok. The aircraft landed uneventfully and stopped on the runway to allow for an external visual inspection by the Airport Rescue and Firefighting Service (ARFS). The aircraft taxied to a parking bay after the ARFS had found no sign of smoke or fire around the area of the aft cargo door. All the passengers and crew members disembarked safely from the aircraft using a passenger stairs.

White smoke started billowing out when the aft cargo door was opened after all on board the aircraft had vacated. The ARFS tended to it by discharging carbon dioxide into the cargo compartment. While unloading the cargo container that had been loaded in position 42L of the aft cargo compartment, the contents burst into flames. The ARFS extinguished the fire.

The contents of the cargo container from position 42L sustained significant damage. The exterior surfaces of the other cargo containers and pallets in the aft cargo compartment showed varying degree of singeing. Aircraft damage was limited to the sidewall and ceiling panels of the aft cargo compartment, and installations on the ceiling.

There were no injuries in this incident. The Department of Civil Aviation, Thailand classified this occurrence as a serious incident and delegated the conduct of this investigation to the Air Accident Investigation Bureau (AAIB) of Singapore.

AIRCRAFT DETAILS

Aircraft type	: Airbus A330
Operator	: Singapore Airlines
Aircraft registration	: 9V-STO
Date and time of incident	: 22 April 2013, 1222hr (SGT: 2022hr)
Location of occurrence	: Over the Gulf of Thailand, about 8.1 NM off the coast of Thailand's Prachuap Khiri Khan province
Type of flight	: Scheduled passenger flight
Persons on board	: 117

1 **FACTUAL INFORMATION**

All times used in this report are Singapore times. Thailand times (TT) are added to avoid ambiguity where desirable.

Singapore time is eight hours ahead of Coordinated Universal Time (UTC) and one hour ahead of Thailand time.

1.1 **History of the Flight**

- 1.1.1 The Airbus A330 was operating flight SQ446 from Singapore to Dhaka, Bangladesh on 22 April 2013. The aircraft took off from Singapore Changi Airport at 1858 hrs.
- 1.1.2 About 84 minutes into the flight, the aircraft was cruising at 36,000 ft over the Gulf of Thailand. Shortly after leaving the Bangkok Flight Information Region (FIR) and entering the Yangon FIR, the First Officer (FO) detected a slight burning smell coming from the ventilation blowers in his position. The Pilot-in-command (PIC) did not smell anything unusual as the vents of his blowers were in the closed position.
- 1.1.3 Shortly after, at 2022 hrs (1922 hrs TT), when the aircraft was over the Gulf of Thailand about 8.1 NM east of the coast of Thailand's Prachuap Khiri Khan province, a smoke warning illuminated¹ in the cockpit, suggesting a problem in the rear cargo compartment (which comprised an aft cargo compartment for cargo containers and pallets, and a bulk cargo compartment, the two compartments being separated by a cargo net). This was accompanied by the Electronic Centralised Aircraft Monitor (ECAM) "AFT/BULK CRG SMOKE"² warning on the Engine/Warning Display and a continuous repetitive chime.
- 1.1.4 Soon after, a cabin attendant contacted the flight crew through the cabin interphone located at Door 3 Left (D3L) to inform them that he and some passengers had detected a burning smell around D3L.
- 1.1.5 The flight crew referred to the "SMOKE AFT/BULK CRG SMOKE" ECAM checklist and performed the necessary action. The cargo fire extinguishing agent was discharged into the aft and bulk cargo compartments, in accordance with the checklist. According to the flight crew, the "AFT/BULK CRG SMOKE" ECAM message remained displayed for the rest of the flight.
- 1.1.6 The PIC decided to divert to Suvarnabhumi Airport in Bangkok as it was the nearest airport, and Yangon control was informed by the FO.

¹ The smoke warning is in the form of a red master warning light at the glareshield and an illumination of the annunciator on the overhead panel.

² The "AFT/BULK CRG SMOKE" warning is annunciated when smoke is detected in either the aft or bulk cargo compartment.

- 1.1.7 At 2037 hrs (1937 hrs TT), upon establishing contact with a Bangkok Approach controller, the flight crew declared MAYDAY. The controller requested for information regarding the number of persons on board, fuel remaining and the dangerous goods³ on board, if any. The flight crew replied that there were 117 persons on board, 35,000 kg of fuel remaining and that there were dangerous goods on board.
- 1.1.8 At 2042 hrs (1942 hrs TT), the Suvarnabhumi Airport Rescue and Firefighting Service (ARFS) was notified by the air traffic services unit of the emergency. The ARFS vehicles were immediately activated and deployed to the standby points on the side of the runway.
- 1.1.9 At 2045 hrs (1945 hrs TT), the flight crew established contact with a Bangkok Terminal Approach controller on a different frequency. The aircraft was given priority to land. The controller asked for the quantity of dangerous goods on board and was informed by the flight crew that there were three items of dangerous goods. The details regarding the three items (e.g. name, UN number⁴, location) were available to the flight crew in the form of a Notification to Crew (NOTOC). However, the flight crew did not volunteer any details of the three items to the controller.
- 1.1.10 At 2048 hrs (1948 hrs TT), the flight crew informed the controller that they would stop the aircraft on the runway upon landing and requested for emergency assistance to stand by at the runway. By then, the ARFS was already aware of the emergency (see paragraph 1.1.8).
- 1.1.11 The aircraft landed uneventfully on Runway 19R at 2053 hrs (1953 hrs TT). The flight crew stopped the aircraft on the runway and requested the ARFS to inspect the aircraft for evidence of smoke at the aft cargo area. The flight crew made the request three times over a period of about four minutes. The controller did not answer the request. Instead, the controller asked the flight crew if the flight crew could taxi the aircraft. After the flight crew's third request, the controller asked if the flight crew wished to have the emergency vehicles moved away so that the aircraft may taxi to the bay. The flight crew responded that if there was no smoke at the aft cargo area, they would like to taxi to the bay.
- 1.1.12 A while later the controller gave the taxi clearance⁵. The flight crew then commenced taxiing the aircraft to the parking bay.
- 1.1.13 While the aircraft was taxiing to the bay, the controller asked the flight crew if the emergency was terminated. The FO replied that the emergency was not terminated and requested that the emergency

³ Dangerous goods are items that may endanger the safety of an aircraft or persons on board it. The air transport of these dangerous materials is either forbidden or restricted.

⁴ UN numbers are four digit numbers that identify hazardous substances and articles in the framework of international transport. UN numbers are assigned by the United Nations Committee of Experts on the Transport of Dangerous Goods.

⁵ Apparently, the ARFS had found no smoke from their visual external inspection of the aft cargo area when the aircraft was on the runway and had informed the controller accordingly.

vehicles follow the aircraft to the bay and inspect the aft cargo area at the bay. The controller acceded to the request.

- 1.1.14 When the aircraft had arrived at the bay, the FO asked the controller if the ARFS observed any smoke from the aft cargo area and the controller responded that everything was normal. The controller requested the flight crew to shut down the engine as the fire trucks were behind the engines. Shortly after, the controller asked the flight crew to “report emergency terminated”. The FO responded that the emergency was terminated. The PIC intervened and informed the controller that he would terminate the emergency only after all the persons on board had disembarked and the aft cargo area had been inspected. The PIC further requested for the ARFS to stand by for another 10 minutes. The controller acknowledged and informed the flight crew that a mobile passenger steps was on its way to the aircraft.
- 1.1.15 About three minutes after the aircraft arrived at the bay, the engineering staff informed the flight crew through the flight intercom that smoke was coming out from the aft cargo area. The flight crew told the engineering staff not to open the cargo door until all the persons on board had disembarked.
- 1.1.16 At 2109 hrs (2009 hrs TT), a passenger stairs was connected to the front left door of the aircraft. All passengers and cabin crew members disembarked the aircraft via this door.
- 1.1.17 The flight crew passed the NOTOC to a ground handling staff before leaving the aircraft.
- 1.1.18 At 2115 hrs (2015 hrs TT), when all passengers and crew members had disembarked, the ground handling staff opened the aft cargo compartment door (which was on the right side of the aircraft). White smoke started billowing out of that door. In response, the ARFS discharged carbon dioxide into the compartment.
- 1.1.19 The ARFS requested the ground handling staff for information on dangerous goods. The ground handling staff informed the ARFS about the presence of only one dangerous goods on board, viz. Organophosphorus Pesticide, liquid, UN3018⁶.
- 1.1.20 At 2125 hrs (2025 hrs TT), the white smoke started to clear. The ground handling staff was requested to expedite the unloading of the cargo containers for the ARFS to locate the origin of the fire. However, the ground handling staff declined to get close to the dangerous goods as they were not suitably attired and equipped.

⁶ According to the NOTOC, the other two items of dangerous goods were Environmentally Hazardous Substance, solid, UN3077 and Environmentally Hazardous Substance, liquid, UN3082.

- 1.1.21 At 2147 hrs (2047 hrs TT), dark black smoke started billowing out from the aft cargo compartment. Several explosion-like sounds were heard. Thereafter, a huge flame developed in the aft cargo compartment. The ARFS sprayed water at the flame until it was extinguished.
- 1.1.22 At 2227 hrs (2127 hrs TT), the ground handling staff, with ARFS personnel on standby beside them, commenced unloading the cargo containers from the aft cargo compartment using a high loader. The ARFS sprayed carbon dioxide fire extinguishing agent into the aft cargo compartment from time to time to cool the compartment.
- 1.1.23 While the cargo container which had been loaded at position 42L (hereinafter referred to as container 42L) was being unloaded, its contents burst into flames after the container was moved onto the high loader. The ARFS used carbon dioxide to extinguish the fire. After it was unloaded, container 42L was placed 100 m away from the aircraft.
- 1.1.24 The contents of container 42L re-ignited later. By then, the ARFS had found out that the container did not contain any dangerous goods and water was used to extinguish the fire.
- 1.1.25 After all the containers from the aft cargo compartment were unloaded, the ARFS used thermal imaging camera to check the aft and bulk cargo compartments for heat source and unusual condition. None was found and normalcy was declared.

1.2 **Injuries to Persons**

- 1.2.1 There was no injury to any person in this incident.

1.3 **Damage to Aircraft**

- 1.3.1 The aircraft sustained heat damages to the following areas:
- Four aft cargo compartment composite ceiling panels
 - Aft cargo compartment ceiling light fixtures
 - Two aft cargo compartment side wall lining panels
- 1.3.2 There were soot deposits in the following areas:
- Exterior of the aft cargo door
 - Aft outflow valve
 - All the aft cargo compartment composite ceiling panels and smoke detectors
 - Aft cargo compartment floor panels and door protection lining panel
 - Cargo net separating aft and bulk cargo compartment
- 1.3.3 Examination of the aircraft's wiring in the aft cargo compartment revealed no fused wires or evidence of electrical short circuit or fire initiation.

1.4 **Cargo Container 42L**

- 1.4.1 The cargo in container 42L consisted of 100 packages. None was a declared consignment of dangerous goods. The packages were built up into the container by the cargo handler contracted by the air operator (see paragraph 1.8.1 on the building up of container 42L).
- 1.4.2 The 100 packages were general freight, majority of which were fabric material, 99 of them having been consigned by one consigner (hereinafter referred to as C1) and the remaining one, an envelope containing a stack of documents, by another consigner (hereinafter referred to as C2).

1.5 **Damage to Cargo Containers and their Contents**

- 1.5.1 Container 42L was severely damaged. C1's 99 packages sustained varying degree of fire damage. C2's only package was not damaged.
- 1.5.2 The top panel of the cargo container loaded at position 43L in the aft cargo compartment (hereinafter referred to as container 43L), which was right behind container 42L, was damaged and a small portion of its contents was destroyed by fire.
- 1.5.3 There were varying degree of heat damage to the top of the plastic weather protection sheets covering the rest of the cargo containers and pallets in the aft cargo compartment. The contents in these cargo containers and pallets were not damaged.
- 1.5.4 The three items of dangerous goods were not in the cargo containers that were damaged by fire. They were not damaged in the incident.

1.6 **Cargo Fire Protection System**

- 1.6.1 The cargo fire protection for the aircraft consists of two systems, the cargo smoke detection system and the cargo fire extinguishing system.
- 1.6.2 The cargo smoke detection system consists of smoke detectors, a Smoke Detection Control Unit (SDCU) and warning indications⁷. There are two sets of smoke detectors in the aft cargo compartment and one set of smoke detectors in the bulk cargo compartment. When a smoke detector detects smoke, it generates a signal. The SDCU processes the signals received from the smoke detectors and generates a signal to activate the warning indications.
- 1.6.3 The cargo fire extinguishing system uses two halon fire extinguisher bottles. Depending on the selection by the flight crew in the cockpit, the

⁷ The warning indications include visual and aural annunciations in the cockpit.

extinguishing agent can be directed to either the front cargo compartment or the rear cargo compartment. One fire extinguisher bottle is of the quick discharge type while the other bottle is of the metered discharge type. When the fire extinguishing system is activated, the quick discharge type bottle will be discharged quickly into the front or rear compartment, as selected. After that, the metered discharge type bottle will be discharged gradually over the next 195 minutes into the selected compartment.

1.7 Test and Research

1.7.1 Fire debris

1.7.1.1 After the fire incident, all the cargo containers and pallets from the aft cargo compartment were covered by plastic sheets to protect against weather (see **Figure 1**) and kept in a secure place by the ARFS pending examination by the aircraft accident investigators and fire experts.



Figure 1: Cargo containers and pallets protected with plastic covers pending examination

1.7.1.2 The investigators and fire experts examined the cargo containers and pallets on 24 April 2013 and identified an area in the lower middle part of container 42L which they believed was where the fire had originated (see **Figure 2**). Samples of fire debris around this area were collected by the investigators.



Figure 2: (Left) Cargo container 42L and its contents
(Right) Top view of container, red circle denotes area believed to be the fire origin

- 1.7.1.3 The investigators also found a damaged bale of fabric that was heavily soaked with an alcohol-like fluid. The investigators cut a sample from the bale and managed to collect a small quantity of the alcohol-like fluid by squeezing the sample (see **Figure 3**).



Figure 3: The bale of fabric heavily soaked in alcohol-like fluid.
(Inset: Fluid being collected by squeezing the sample of fabric)

- 1.7.1.4 The alcohol-like fluid was subsequently identified by laboratory tests⁸ to be ethanol, a flammable material. No other ignitable liquid was found.
- 1.7.1.5 On 6 June 2013, additional fire debris samples were collected from cargo container 42L for laboratory tests. No ignitable liquid was found.
- 1.7.2 Attempt to identify damaged cargo
- 1.7.2.1 While the shippers of the 100 packages in container 42L were known, the extent of the fire damage did not permit many of the packages to be identified. The investigators approached the shippers to find out what they had shipped with a view to correlating the shipment information that they might provide with the any tell-tale signs of the damaged packages.
- 1.7.2.2 For this purpose, a questionnaire was sent out to the shippers asking the following:
- What item was shipped
 - If it was a fabric shipment, what material or chemicals were used in the manufacturing process

⁸ The laboratory tests were conducted by the Central Institute of Forensic Science (CIFS) in Thailand. Test methods included polarised light microscopy, ion chromatography, gas chromatography, mass spectrometry, Fourier transform infrared spectroscopy, and dispersive Raman microscopy.

- Any unintentional shipment of dangerous goods
- 1.7.2.3 The questionnaire was sent to 26 shippers and 17 shippers replied. They indicated that their consignments of package contained no dangerous goods. Those who shipped chemicals were able to provide reports that proved that the chemicals were not dangerous goods.
- 1.7.2.4 The shippers of fabric materials were requested to provide samples similar to those that they had shipped. However, no samples were received.

1.8 **Additional Information**

1.8.1 Building up of container 42L in Singapore

- 1.8.1.1 C1's 99 packages were transshipment cargo. They had originated from various countries and were flown into Singapore to be consolidated for onward shipment to Dhaka. The first package arrived at C1's facility in Singapore around 0800 hrs on 22 April 2013, with the rest arriving throughout the day. The 99 packages were transported to the cargo handler's facility around 1700 hrs.
- 1.8.1.2 At the cargo handler's facility, a cargo loader manually loaded C1's 99 packages and C2's single package into container 42L. The cargo loader recalled loading the bale of fabric that the investigation team found to be heavily soaked with ethanol. He recalled that the bale of fabric was dry and did not have any unusual smell.
- 1.8.1.3 After the build-up, container 42L was delivered to the apron area at 1809 hrs for loading onto the aircraft.

1.8.2 Cargo screening

- 1.8.2.1 Information received from C1 indicates that 98 of the 99 packages had gone through X-ray screening⁹ at the countries of origin, as required by local regulations, before being shipped to Singapore.
- 1.8.2.2 C1 being a regulated air cargo agent (RCA) under Singapore's Regulated Air Cargo Agent Regime (RCAR)¹⁰, its cargo transshipment procedures required it to choose transshipment cargo at random for X-ray screening. Thus, seven of the 98 packages went through X-ray screening at C1's facility.

⁹ The X-ray screening is to detect the presence of explosives or incendiary devices.

¹⁰ The RCAR is a security measure to enhance air cargo security on commercial passenger aircraft. The RCAR has been implemented in Singapore since 1 April 2008. As part of the regime, each Regulated Air Cargo Agent (RCA) is required to submit a Security Programme (SP). The SP specifies the measures and procedures that the RCA employs in handling, clearing, storing, securing and transporting cargo from the time the cargo is accepted by the RCA until it is lodged at the air freight terminal or handed over to another RCA.

- 1.8.2.3 The remaining one of C1's 99 packages had originated from New Zealand, which had a similar RCAR as Singapore's. This package did not go through X-ray screening in New Zealand before being shipped to Singapore and was also exempted from C1's sampling procedures for X-ray screening.
- 1.8.2.4 The cargo handler did not screen the 100 packages consigned by C1 and C2, as they were considered as screened consignments, in accordance with their procedures.
- 1.8.3 Surveillance of cargo loading at C1 and cargo handler's facilities
- 1.8.3.1 At the request of the investigation team, C1 and the cargo handler shared with the investigation team their available surveillance camera footages related to the cargo loading and container build-up processes. However, no useful information could be derived.

2 DISCUSSION

2.1 Observations

2.1.1 The smoke warning in flight, by itself, does not necessarily prove that there was indeed smoke or fire in the aft or bulk cargo compartment of the aircraft. However, in view of the subsequent fire event after the aircraft had diverted to Bangkok, it is more likely than not that there was a fire in the aft cargo compartment in flight.

2.1.2 In response to the ECAM “AFT/BULK CRG SMOKE” warning and the feedback from a cabin attendant regarding a burning smell around D3L, the flight crew discharged the cargo fire extinguishing agent into the aft and bulk cargo compartments. The action appeared to have extinguished the fire and the continual discharge of the metered discharge type bottle would have starved the aft and bulk cargo compartments of oxygen and prevented a rekindling of fire.

2.1.3 The area of fire origin is most likely in cargo container 42L, although it is not possible to pinpoint the exact location, given the extent of the fire damage of the contents of the container.

2.1.4 While the presence of ethanol, an ignitable liquid which could have fueled the fire, was found by the investigators, the heat source that was needed to ignite the ethanol could not be determined.

2.1.5 The investigation could not establish the source of the ethanol and there was no declared shipment of ethanol based on the description of the consignments.

2.1.6 The three items of dangerous goods as declared in the NOTOC were not involved in the fire event. The investigation is unable to determine if there were undeclared items of dangerous goods involved.

2.1.7 The investigation was unable to determine the exact cause of the fire. Nevertheless, the incident highlighted the following aspects worth discussing:

- (a) Rekindling of fire
- (b) Communication of dangerous goods
- (c) Communication among ARFS, air traffic controller and the emergency aircraft concerning the status of an emergency
- (d) Flight crew’s decision to terminate the emergency

2.2 Rekindling of fire

2.2.1 The fire at cargo container 42L was rekindled after the aft cargo door was opened. This suggested the presence of embers within the contents of cargo container 42L and the rekindling of the fire was triggered by the

fresh supply of air despite the spraying, from time to time, of carbon dioxide into the aft cargo compartment by the ARFS.

2.2.2 However, the ARFS, which was on standby near the aircraft as the cargo unloading started, reacted quickly when fire rekindled.

2.2.3 Any airport fire service should always be ready to respond to the possibility of the rekindling of fire. They should not consider that a fire-related emergency is over unless the necessary fire risk checks have been carried out.

2.3 Communication on presence of dangerous goods

2.3.1 Details of the dangerous goods were given in the NOTOC. There seems to have been opportunities for the flight crew to volunteer the details of the dangerous goods to the air traffic services unit before they landed the aircraft. Somehow they did not do so.

2.3.2 The flight crew passed the NOTOC to the ground handling staff in Suvarnabhumi Airport before they left the aircraft. The ground handling staff did not seem to have passed the NOTOC details to the ARFS immediately.

2.3.3 Although the three declared dangerous goods were not involved in the fire in the aft cargo compartment, information regarding the presence, location and nature of the dangerous goods is vital for a firefighting service to plan for response action. The effectiveness of the response could be compromised without such information.

2.3.4 The need for quick communication of information concerning dangerous goods is emphasised in paragraph 9.5 of Annex 18 (*The Safe Transport of Dangerous Goods by Air*) which requires that, if an in-flight emergency occurs, the pilot-in-command shall, as soon as the situation permits, inform the appropriate air traffic services unit, for the information of the aerodrome authorities, of any dangerous goods on board the aircraft.

2.4 Communication among ARFS, air traffic controller and the emergency aircraft concerning the status of an emergency

2.4.1 While the aircraft was on the runway, the flight crew asked the air traffic controller repeatedly for ARFS to check if smoke was present at the aft cargo area. It is important for the flight crew to know the status and progress of ARFS' operation, so as to be able to make an informed decision (e.g. whether to activate emergency evacuation).

2.4.2 There was no direct communication between the ARFS and the flight crew. The communication between them had to rely on the controller. A direct communication channel between the ARFS and the flight crew

would have allowed a speedier communication and more expeditious and effective decision-making. The availability of such a communication channel would also relieve the controller of the communication middleman task and allow the controller to focus on air traffic control matters. It is to be noted that, for any such direct communication to be effective, the parties involved need to be able to communicate with basic proficiency in English.

2.4.3 The controller had asked the flight crew if the emergency was terminated. It is unclear what information the controller intended to extract from the flight crew, but it seems obvious that the ARFS, being in charge of the emergency management operation, would in general have been a better source for information pertaining to a fire-related emergency.

2.5 Flight crew's decision to terminate the emergency

2.5.1 After the aircraft had arrived at the bay and in response to a question from the FO, the controller told the flight crew that everything was normal. It is not known whether the controller had checked with the ARFS about the condition at the aft cargo area. The FO might have assumed that the controller had done so. And when the controller asked the flight crew to "report emergency terminated", the FO somehow concluded that the emergency was over. It would have been more prudent for the FO to consider that the emergency was still not over. It was fortuitous that the PIC intervened to request that the ARFS remain in position to provide fire protection cover for the aircraft until all the persons on board have disembarked and the aft cargo area checked for any further fire risk.

2.5.2 Flight crews should not consider that a fire-related emergency was over unless they have received the relevant input from the aircraft rescue and firefighting authority and satisfied themselves that the necessary fire risk checks have been carried out.

3 SAFETY RECOMMENDATIONS

A safety recommendation is for the purpose of preventive action and shall in no case create a presumption of blame or liability.

It is recommended that:

- 3.1 The operator consider requiring its flight crews to inform air traffic controllers on the details and locations of dangerous goods on board once a smoke or fire related emergency is declared. [AAIB Recommendation R-2015-001]
- 3.2 The operator remind its flight crews that they should not consider that a fire risk has been contained, mitigated or removed, unless they have received the relevant input from the aircraft rescue and firefighting authority and satisfied themselves that the aircraft rescue and firefighting authority has performed the necessary checks. [AAIB Recommendation R-2015-002]
- 3.3 The Suvarnabhumi Aerodrome Control Tower remind its air traffic controllers that it may be preferable to obtain information pertaining to the fire emergency management (e.g. fire risk, status of firefighting operation) from the ARFS rather than from the flight crew of the aircraft concerned. [AAIB Recommendation R-2015-003]
- 3.4 The Suvarnabhumi airport authorities consider implementing an arrangement whereby, in an emergency, the ARFS could communicate directly with the flight crew of the aircraft concerned, instead of communicating through the air traffic controllers. [AAIB Recommendation R-2015-004]