

# **Rescue and Fire Fighting Service**

Task and Resource Analysis



# Background

On 5 April 2013 the International Civil Aviation Organisation (ICAO) issued a States Letter, ref. AN 4/1.2.24-13/20 setting out changes to ICAO Annex 14 Volume 1 which became applicable on 14 November 2013.

The following change was made to Chapter 9, Recommendation 9.2.41:

**9.2.41 Recommendation.**— *In determining the minimum number of rescue and fire fighting personnel required, a task resource analysis should be completed and the level of staffing documented in the Aerodrome Manual.*

*Note: - Guidance on the use of a task resource analysis can be found in the Airport Services Manual (Doc 9137), Part 1.*

Doc 9137 – AN/898  
Part 1



# AIRPORT SERVICES MANUAL

## PART 1

### RESCUE AND FIRE FIGHTING

Fourth Edition — 2014

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and published under his authority

INTERNATIONAL CIVIL AVIATION ORGANIZATION

## Chapter 10

### PERSONNEL

#### 10.1 GENERAL REQUIREMENTS

10.1.1 The total number of personnel, whether regular or auxiliary, required to deploy and operate the RFF service should be determined so as to meet the following criteria:

- a) the RFF vehicles should be staffed so as to ensure their ability to discharge at their maximum designed capability extinguishing agents, principal or complementary, both effectively and simultaneously, at an aircraft accident/incident; and
- b) any control room or communications facility operated by, and serving, the RFF service can continue to provide this service until alternative arrangements to undertake this function are initiated by the airport emergency plan.

10.1.2 In addition, in determining the minimum number of RFF personnel required, a task resource analysis (see 10.5) should be completed and the level of staffing documented in the Aerodromes Manual.

### 10.5.7.1 Phase 1

The airport operator must be clear as to the aims and objectives for the RFF services, and the required tasks that personnel are expected to carry out.

#### Example

##### Aim

To maintain a dedicated RFFS of qualified and competent fire and rescue personnel equipped with vehicles and specialist equipment to make an immediate response to an aircraft incident /accident on or in the immediate vicinity of the airport within the specified response time criteria.

##### Principal Objective of the RFFS

The principal objective of an RFFS is to save lives in the event of an aircraft accident or incident. For this reason, the provision of means of dealing with an aircraft accident or incident occurring at, or in the immediate vicinity of, an aerodrome assumes primary importance because it is within this area that there are the greatest opportunities of saving lives. This must assume at all times the possibility of, and need for, extinguishing a fire that may occur either immediately following an aircraft accident or incident, or at any time during rescue operations.

##### Tasks:

- a) Meet the required response time
- b) Extinguish an external fire
- c) Protect escape slides and exit routes
- d) Assist in the self-evacuation of the aircraft
- e) Create a survivable situation
- f) Rescue trapped personnel
- g) Maintain post fire security/control
- h) Preserve evidence

The task and resource analysis should identify the optimum time when additional resources will be available to support/augment and/or replace resources supplied by RFF services (Aerodrome Emergency Plan). It can also provide vital evidence to support the level of RFF vehicles and equipment.

#### Stated objectives for the RFFS:

- a) Instigate aerodrome emergency plan
- b) Respond within the required response time
- c) Select appropriate route & communications
- g) Position appliances in optimum positions and operate effectively
- h) Instigate Incident Command System
- d) Suppress/extinguish any fires
- e) Assist with self-evacuation of the aircraft
- f) If appropriate extinguish any internal fire
- g) If required ventilate aircraft to create survivable conditions
- h) Maintain post fire control of the critical area
- i) Preserve evidence

# TRA – 6 Phases

## **Phase 1**

The airport operator must be clear as to the aims and objectives for the ARFF services, and the required tasks that personnel are expected to carry out.

## **Phase 2**

Identify a selection of representative realistic, feasible accidents that may occur at the airport, this can be achieved by a statistical analysis of previous accidents on airports and by analysing data from both International National & Local sources.

## **Phase 3**

Identify the types of aircraft commonly in use at the airport; this is important as the type of aircraft and its configuration has a direct bearing on the resources required in meeting Phase 1 above, it may be necessary to group the aircraft types in relation to common aircraft configurations for ease of analysis or identify precise aircraft type that may have a unique configuration.

## **Phase 4**

Every airport is unique in that the location, environment, runway and taxiway configuration, aircraft movements, airport infrastructure and boundary etc may present specific additional risks.

In order that the feasible accident scenario can be modeled/simulated a major factor is to consider the probable location for the most realistic accident type that may occur.

To confirm the location of the scenario it is important that a facilitator using a team of experienced fire service personnel, who have knowledge of the airport and the locations in which an aircraft accident is likely to occur evaluate the scenario.



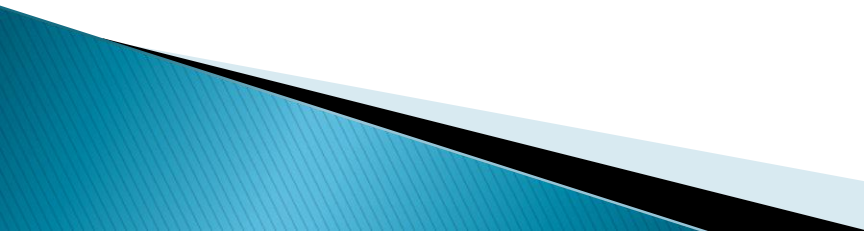
## **Phase 5**

This Phase combines the accident types to be examined as described in Phase 2, with the aircraft identified in Phase 3 and the locations as described in Phase 4. The accident types should be correlated with the possible location, in some cases this could be in more than one location on an airport, for which a task and resource analysis needs to be carried out.

The above information is to be built into a complete accident scenario that can be analyzed by experienced supervisors & firefighters for the task and resource analysis in Phase 6.

## **Phase 6**

By using a TRA facilitator with teams of experienced airport supervisors & firefighters the accident scenario(s) developed in Phase 5 are subject to a task and resource analysis carried out in a series of tabletop exercises/simulations.



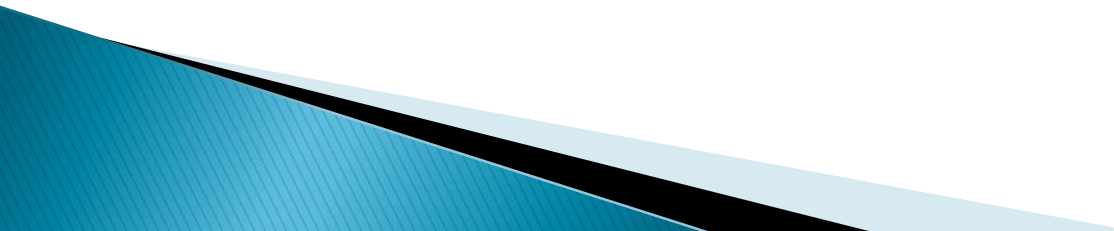
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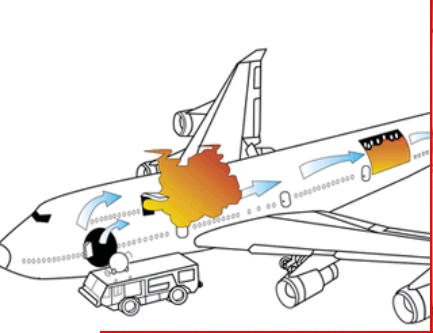
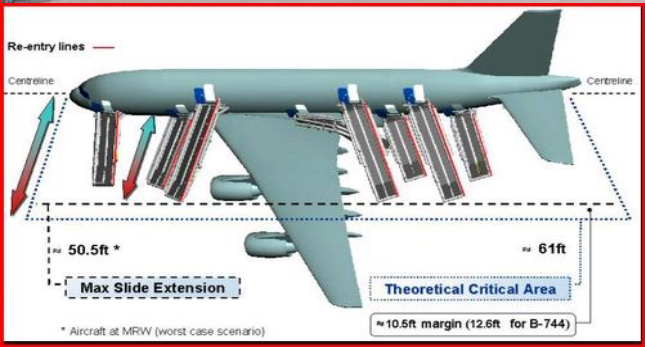
# How

- ▶ Research phases – 1, 2, 3
  - Requirements, rules
  - Aerodrome manual and Emergency Orders
  - Standard Operating Procedures (SOP's)
  - Local data
- ▶ Analytical phases – 4, 5, 6
  - Maps, layouts
  - Assistance
  - SOP's

# What about

- ▶ Challenges from management
  - ▶ EASA
  - ▶ Continuous Improvement
  - ▶ Effectiveness
  - ▶ Efficiencies
  - ▶ New FRS guidance e.g. BA, Command, Environment
- 





**CFRA**  
 Chief Fire & Rescue School

Department  
 for Communities  
 & Local Government

**Fire and  
 Rescue  
 Authority**

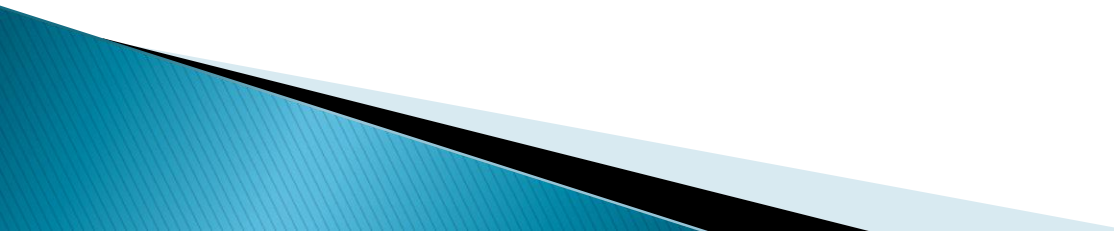
Operational guidance  
 Breathing apparatus



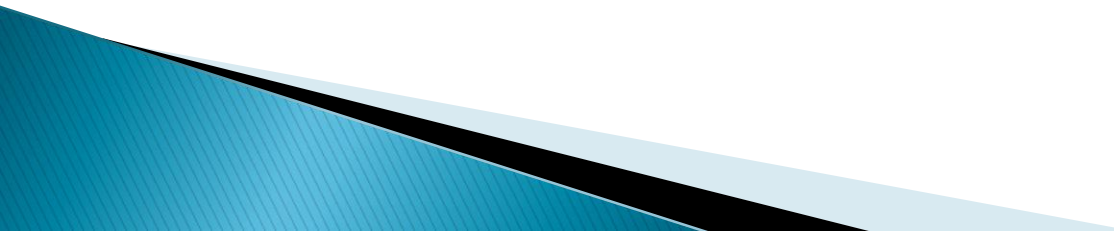
# Fundamental Review

- ▶ Look at:
  - Aims & Objectives
  - Equipment, Vehicles
  - Fire Fighting Tactics
  - Rescue
  - New Challenges
  - Tasks, who does what
  - Skills required

# Aims & Objectives

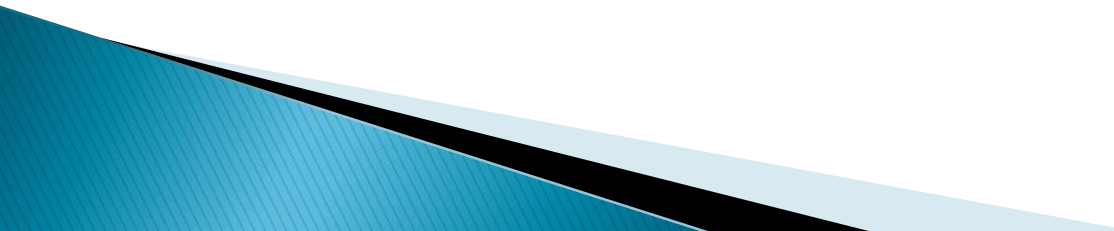
- ▶ 2/3 minutes response time
  - ▶ Continuous application
  - ▶ Assisted or self-rescue
- 

# Equipment, Vehicles

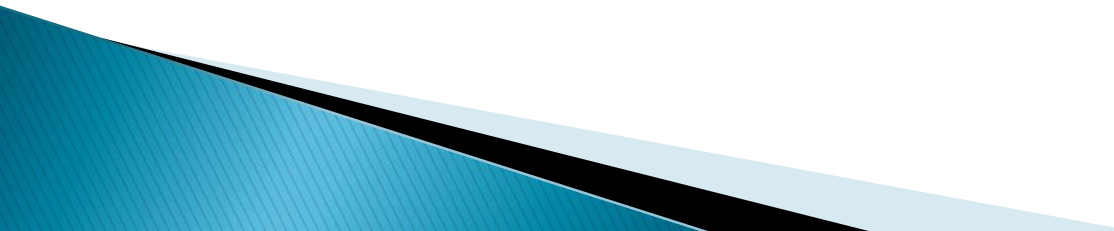
- ▶ Size of vehicles
  - ▶ More effective media
  - ▶ More effective application
  - ▶ Access equipment
  - ▶ Ventilation
  - ▶ Passenger Evacuation Management Systems
- 



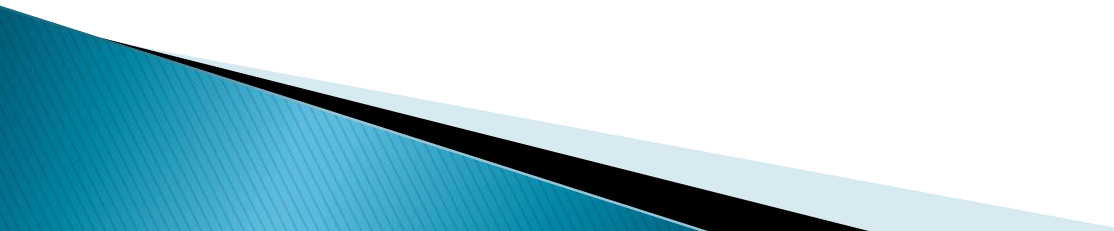
# Fire Fighting Tactics

- ▶ New equipment – New tactics
  - ▶ Align to Objectives
  - ▶ Review SOP's
  - ▶ Train to tactics
  - ▶ Always review and update
- 

# Rescue

- ▶ What is the Rescue aim
  - ▶ Self
  - ▶ Assisted
  - ▶ Offensive fire fighting and rescue
  - ▶ Mutual Aid
  - ▶ Command
- 

# Tasks, who does what

- ▶ Firefighting
  - ▶ Rescue
  - ▶ Supporting functions
  - ▶ Command
  - ▶ Passenger care
  - ▶ Aftercare
  - ▶ Review
- 

# Skills Required

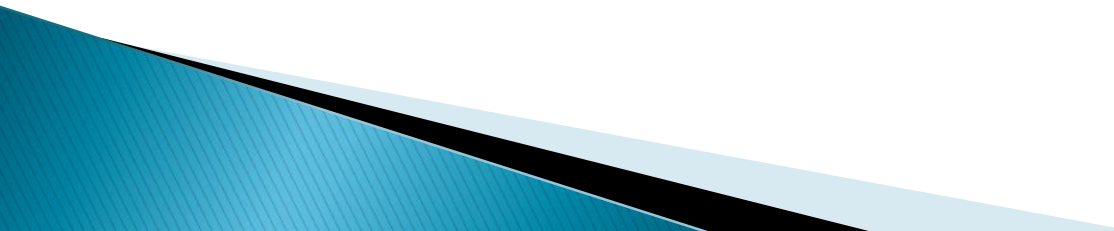
- ▶ Requirements
  - ▶ National
  - ▶ EASA
  - ▶ Maintenance
  - ▶ Oversight
  - ▶ Review
- 

# Summary

- ▶ What do you want the TRA to achieve:
  - Better effectiveness
  - Compliance
  - Efficiencies
  - Reduced costs
- ▶ Depending on what you want will determine how you carry out your TRA

# San Francisco 777

On 6 July 2013, a Boeing 777-200 (HL7742) being operated by Asiana Airlines, on a scheduled passenger flight (214) from Seoul Incheon to San Francisco, crashed within the airport perimeter shortly before completing a landing after the aircraft had hit the sea wall situated prior to the runway and the tail had detached. The aircraft was destroyed by the impact and post crash fire. Three of the 307 occupants were fatally injured, 49 were seriously injured and the remaining 255 received minor injuries or were uninjured.



# Requirements for ARFF staffing.

Seven ARFF vehicles and 23 ARFF personnel from SFO's fire department were involved in the initial response to the accident. This equipment level exceeded the FAA-required minimum of three vehicles, and there is currently no FAA-required minimum staffing level. Because of the amount of available ARFF vehicles and personnel, the airport firefighters were able to perform exterior firefighting and send firefighters into the airplane who rescued five passengers who were unable to self-evacuate amid rapidly deteriorating cabin conditions. Due to the lack of an FAA-required minimum staffing level, passengers involved in an aviation accident at a smaller airport may not be afforded the same level of protection that the passengers of flight 214 had.

# Airport Cooperative Research Program 2009

## How Proposed ARFF Standards Would Impact Airports.<sup>1</sup>

“This work was sponsored by the Federal Aviation Administration (FAA) in cooperation with the Airport Cooperative Research Program (ACRP) Oversight Committee (AOC).

It was conducted through ACRP, which is administered by the Transportation Research Board (TRB) of the National Academies.”

1 – [http://onlinepubs.trb.org/onlinepubs/acrp/acrp\\_webdoc\\_007.pdf](http://onlinepubs.trb.org/onlinepubs/acrp/acrp_webdoc_007.pdf)



# Summary of Safety Analysis

**Figure 7: Average and Total Firefighters and Vehicles**

Reported Firefighters and ARFF Vehicles and Estimated Total for Part 139 Airports							
Airport Class	IIIA/IIA	IA	IB	IC	ID	IE	Total
Number of Firefighters From Interviews	60	103	193	256	215	460	1,287
Number Of Airports Responding	8	10	13	9	5	4	49
Average Number of Firefighters	8	10	15	28	43	115	26
<b>Estimated Firefighters for 476 Airports</b>	<b>743</b>	<b>1,349</b>	<b>1,648</b>	<b>2,219</b>	<b>1,419</b>	<b>2,760</b>	<b>10,137</b>
Number of ARFF Vehicles From Interviews	10	17	22	38	22	29	138
Number Of Airports Responding	8	11	13	12	5	4	53
Average Number of ARFF Vehicles	1	2	2	3	4	7	3
<b>Estimated ARFF Vehicles for 476 Airports</b>	<b>124</b>	<b>202</b>	<b>188</b>	<b>247</b>	<b>145</b>	<b>174</b>	<b>1,080</b>

**Figure 12: Summary Cost Impacts of ICAO and NFPA Standards at 476 Airports (\$millions)**

Standard	Total Initial Costs	Annual Operating and Depreciation Costs
ICAO Minimum Vehicles	\$36.3	\$16.5
ICAO Three-Minute Runway Response	\$884.5	\$232.8
NFPA Minimum Firefighters and Vehicles	\$143.5	\$568.3
NFPA Two-Minute Runway Response	\$2,858.1	\$1,033.9
NFPA Three Minute Maneuvering Area Response	\$1,220.2	\$747.8

Note: Response standard estimates include meeting minimum standards for vehicles and firefighters, as appropriate.

- **The NFPA two-minute runway response requirement is estimated to increase airport investment costs for constructing and equipping fire stations and acquiring ARFF vehicles by \$2.9 billion.**
- **The NFPA three-minute response to anywhere on the airport maneuvering area has estimated investment costs of \$1.2 billion and annual recurring costs of \$747.8 million.**
- **The ICAO three-minute response standard has estimated investment costs of \$884.5 million and annual recurring costs of \$232.8 million.**



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## ORDER

Order of 18 January 2007 on the applicable service rescue and fire fighting against aircraft  
on airfields technical standards

NOR: EQUA0700113A

consolidated version 19 February 2014

II.- minimum number of vehicles and personnel required under [section D. 213-1-3](#) of the Code of Civil Aviation (art. 3)

LEVEL protection Airfield	NUMBER ARFF vehicles	NUMBER OF PERSONAL
10	3	6 Fire airfield + 1 head of maneuver
9	3	6 Fire airfield + 1 head of maneuver
8	3	6 Fire airfield + 1 head of maneuver
7	2	4 Fire airfield + 1 head of maneuver
6	2	4 Fire airfield + 1 head of maneuver
5	1	2 Fire airfield
4	1	2 Fire airfield
3	1	2 Fire airfield
2	1 light vehicle	1 firefighter aerodrome
1		

# Airport 1

Single runway


Cat 9 (B777 with potential for B747)

1 Fire Station





# What did TRA look at ?

- ▶ 5 Major Foam Vehicles, 3 with piercing nozzles, infra-red cameras and recording, low attack monitors
  - ▶ Dual Media and firefighting tactics
  - ▶ Access roads
  - ▶ Water supplies, hydrants and tanks
  - ▶ Passenger Emergency Management System (PEMS), access stairs
  - ▶ Support staff (trained)
  - ▶ Firefighter training – schools and local
  - ▶ Enhanced medical training
  - ▶ Local authority support – integrated and validated
  - ▶ Effective communications
- 

# Results



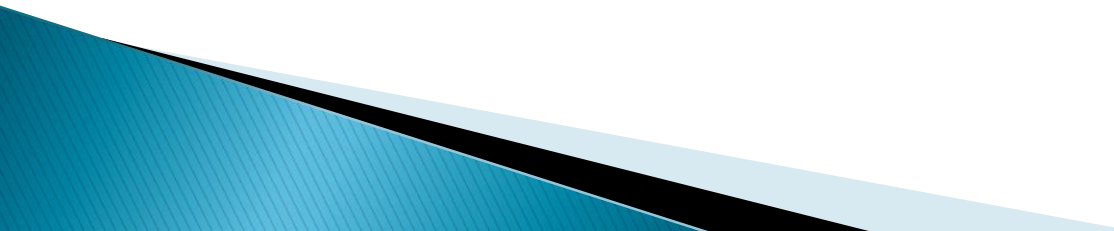
# Airport 2

Two runways  
Cat 10 (A380)  
2 Fire Stations

Fire on parked Ethiopian Airlines 787 temporarily shuts down London Heathrow



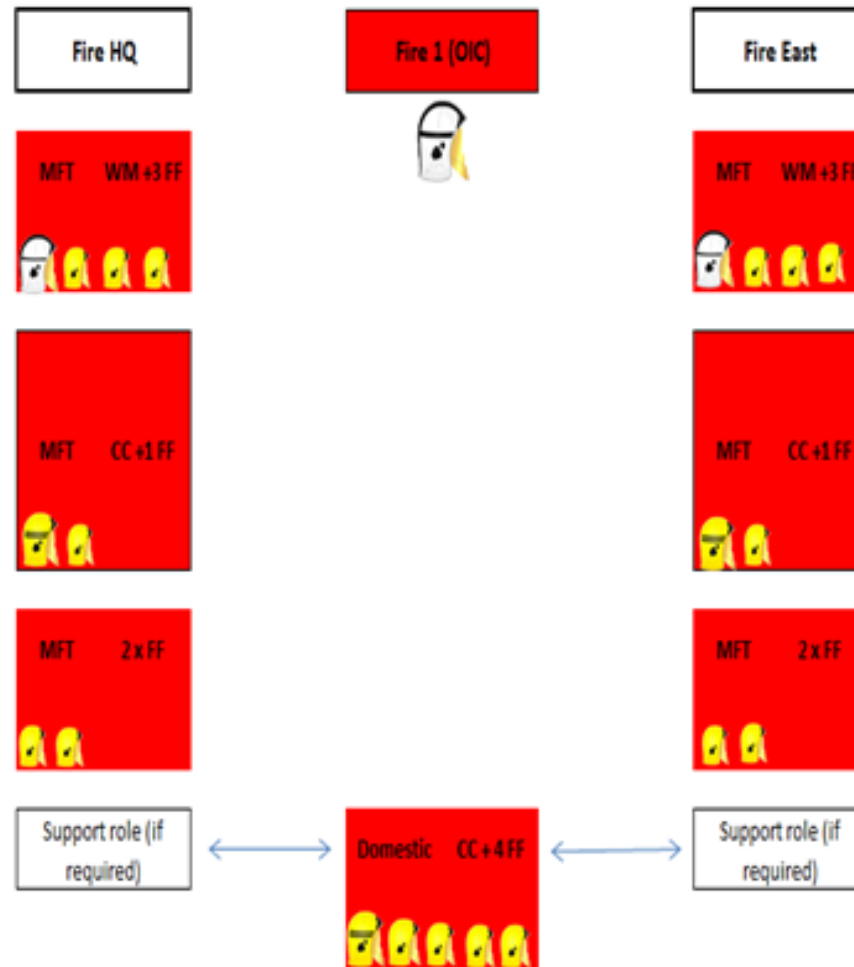
# What did TRA look at ?

- ▶ Mobilisation
  - ▶ Deployment
  - ▶ Firefighting
  - ▶ Scene Management
  - ▶ Breathing Apparatus
  - ▶ Entry to aircraft
  - ▶ Replenishment and EWS
  - ▶ Medical resources
  - ▶ Equipment
  - ▶ 1000m area
- 



# Results

2 x CAT 10 Operations.



# Airport 3

- ▶ Single Runway
- ▶ Cat 6
- ▶ 1 Fire Station

# Vehicles



7 personnel





Sirocco



Centaure



Altair



Sigma



Omega



Kappa



Stella



Nadir



Pluton



Titan



Sirius



Médical



Sanita



Plasma



Saturne



Isotta



Zénith



Orion



Libra



Agena



Mercure



Atlantis



Pallas



Neptune

# Thank you

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