Task Resource Analysis

Brisbane ARFFS

Contents

Brisbane Airport Overview

Brisbane Airport operates two runways, 24 hours a day, seven days a week and has two major terminals servicing 30 airlines flying to 79 destinations. Brisbane Airport is the largest airport in Australia by land size (2,700 hectares) which borders onto the Moreton Bay Foreshore. Reclaimed tidal areas and mangroves make up a lot of Northern & Foreshore area.

The third busiest capital city airport in Australia by aircraft movements (217,436 aircraft for the 2016 financial year). The third largest airport in Australia by passenger numbers with more than 22.8 million passengers travelling through the airport in 2017.

Brisbane Airport Corporation (BAC), the operator of Brisbane Airport (BNE), is a private, non-listed Queensland company, creating economic opportunities for the state of Queensland and the city of Brisbane equating to more than $4 billion dollars annually.

Currently 420 businesses are located at BNE, servicing a diverse range of industries offering services such as freight and aircraft handling, warehousing, transport and communications, manufacturing, research, property and infrastructure development, education and training, recreation, tourism, leisure and retail. Collectively these businesses employ around 20,500 people, a number expected to exceed 50,000 by 2029.

Passenger numbers are also forecast to more than double by 2034. (16 years)

BNE has $3.8 billion privately invested over the next decade to build critical infrastructure at the airport. Projects include a New Parallel Runway, new car parks and access facilities, terminal expansions, road upgrades, new aprons and aeronautical facilities and a number of new commercial buildings.

ARFFS Categories

24hrs service 7 days per week

Category 10 for 18 hrs 7 days per week

Category 9 for 6 hours overnight 7 days per week

Response Time Criteria

CASR (1998) 139.771 Response time of ARFFS

(1) An ARFFS must be able to meet the criteria for response time set out in Chapter 9 of Annex 14 to the Chicago Convention.

CASA 139H MOS 6.1.1.1 Response time is defined as the time between the initial call to the ARFFS and the time when the first responding vehicle(s) is (are) in position at the aircraft or site of the incident or accident, and if required, produce foam at a rate of at least 50% of the discharge rate specified in the Table defined in Chapter 7 of this Manual.

6.1.1.2 All other vehicles required to deliver the amount of extinguishing agent detailed in Chapter 7, must be capable of arriving so as to provide continuous agent application at the required rate.

6.1.1.3 The operational directive of the ARFFS must be to achieve response times not exceeding three minutes to the end of each runway in optimum visibility and surface conditions.

(a) the operational objective of the ARFFS is to achieve **a two-minute response time** to the end of each runway;

(b) the operational objective of the ARFFS is to achieve a response time not exceeding three minutes **to any part of the movement area;**

Current and future types of aircraft movements

Largest regular passenger aircraft currently in use at Brisbane Airport is the Emirates A380-800 with four movements daily seven days a week. This schedule is set to change temporarily and both flights may be replaced with Emirates B777 aircraft.

Arrival: DXB-BNE 06:40

Departure: BNE-AKL 08:25

Arrival: AKL-BNE 19:00

Departure: BNE-DXB 20:45

A large variety of International and Domestic (ARFFS Category 5 to Category 9) aircraft movements averaging around 16,000 movements per month also land. The airport has no curfew and the aircraft operate over the full 24hr period of each day. Some maintenance including military maintenance (refuelers and helicopter), freight and corporate aircraft. There are very limited GA or operational military flights into Brisbane.

Current RFFS Structure and Establishment

Australia provides a National ARFFS service through the Air Navigation Service Provider (ANSP) Airservices. Brisbane is one of 26 ARFFS services provided across Australia. Airservices ARFFS has around 850 qualified uniformed firefighters.

Brisbane Airport ARFFS has a Superintendent Ranked, Local Operations Manager (LOM) as the operational officer in charge. This position is Mon-Fri business hours and the manager is on call after hours and provided with an emergency response vehicle.

Current operational crews consist of four officers and 13 Firefighters for Category 10 with a Domestic Response Service. Each crew has a Fire Commander (FC) in charge and three Station Officers (SO). Crews may also have Sub Station Officers (SSO) who are qualified firefighters at Certificate 4 or Diploma level but have not yet obtained a promotion. Category 9 with DRS crewing consist of 3 Officers (FC & 2 x SO) and 10 Firefighters.

RFFS Qualifications/Competence (Training Programme and Facilities)

Airservices ARFFS crews are qualified under the National Public Safety Competency arrangements using a Recognised Training Organisation (RTO). These are the same qualifications used by all Australian Fire Services and approved by the Australian Fire Authorities Council (AFAC).

Superintendent/Inspector: Advanced Diploma Public Safety (Firefighting Management)

Fire Commander/Station Officer/Sub Station Officer (Qual): Diploma Public Safety (Firefighting Management)

Sub Station Officer: Certificate 4 Public Safety (Firefighting Supervision)

Leading Firefighter/Trainee Firefighter Certificate 2&3 Public Safety (Firefighting)

Extraneous Duties

CASA 139H MOS 22.1.2.3 Aerodrome fire alarms to terminate at aerodrome ARFFS FSCC.

CASR (1998) 139.710 Functions of ARFFS

(1) The functions of an ARFFS for an aerodrome are:

a) to rescue persons and property from an aircraft that has crashed or caught fire during landing or take off; and
b) to control and extinguish, and to protect persons and property threatened by, a fire on the aerodrome, **whether or not** in an aircraft.

(2) Nothing in sub regulation (1) prevents the ARFFS provider for an aerodrome from performing fire control services **or rescue services** elsewhere than on an aerodrome, but the provider must give priority to operations mentioned in sub regulation (1).

Under the Civil Aviation Safety Regulations (CASR) and the 139H Manual of Standards (MOS) all fires and fire alarms on the airport are the responsibility of the ARFFS. As a value-added service to the airlines and airports an advanced first aid response to customers and employees of the airport/airlines has also been provided for the past 20 years. This first aid service has been directly responsible for many lives being saved on airports across Australia.

Communications and RFFS Alerting system including Extraneous Duties.

CASA 130H MOS 22.1.2 FSCC Requirements

22.1.2.2 Crash Alarm and Direct Lines facilities must be provided where a TWR is located on the same aerodrome. Two-way activation of facilities is required.

22.1.2.5 Communication facilities for notification of emergency services.

22.1.2.6 Alerting P/A system for fire staff personnel located at the fire station and its environs.

22.1.2.7 All aircraft

CASA 139H MOS 22.1.4 Communication Equipment

22.1.4.1 All ARFFS vehicles must be provided with suitable communication equipment.

22.1.4.2 Communication equipment frequencies must be compatible with associated Air Traffic Services and Marine Frequencies (where appropriate).

22.1.4.3 Communication equipment within the fire station and work areas must be provided and be linked with the FSCC alerting system. The FSCC must have facilities to monitor operational, emergency and UHF radio frequencies as nominated by the ARFFS provider and approved by CASA.

Brisbane ARFFS has a range of digital radio equipment covering Air/Ground (VHF), ARFFS Operational (UHF) and Marine Radio. The ARFFS vehicles are also equipped with mobile phones. ARFFS was meant to implement the Government Radio Network (GRN) system which would have allowed direct communications between Police and Emergency Services at major incidents. This is a crucial lesson learned from many major incidents across the world. However, Airservices has delayed this project due to their current austerity measures.

Appliances and Extinguishing Agents available

Brisbane ARFFS has the following vehicles online:

Four Ultra Large Fire Vehicles (ULFV)

Rosenbauer Panthers with: 8,900 litre water 1,300 litre Solberg RF6 foam, 225kg Purple K Potassium Bicarbonate Dry Chemical Powder (DCP).

One Domestic Response Vehicle (Urban Pumper) Mercedes Benz, 2000 litre Water, 120 litre RF6, full suite of light duty (RAR) rescue equipment.

Reserve stocks of RF6 held at 200% of Category requirements.

DCP reserves held at 100% of Category requirements.

Specialist Equipment

Two Sea-Legs Amphibious Rescue Boats with ARP 20, 20-person rescue platforms sufficient for 50% of POB the largest aircraft (A380).

Airport Emergency Plan and Procedures

Airport Emergency Plan (AEP) is managed by Brisbane Airport Corporation BAC. ARFFS has input into the plan via the AEP Committee which meets Monthly.

Executive Summary:

The TRA process has highlighted significant short comings in the provision of ARFFS here in Australia. These are:

- Minimum agent quantities provided for external fire control.
- Suspect FOAM agent performance.
- No plan to establish sufficient water supplies for replenishment on scene.
- Insufficient ARFFS staffing to meet even basic rescue benchmarks.
- Insufficient ARFFS staffing to fully meet our own SOP's.
- No agent for internal firefighting provided.
- No staff to support evacuation and provide passenger safety and casualty assistance in the critical area and maintain control around slides.
- Insufficient Officers to provide an AIIM's compliant and practically achievable ICS as the Combatant Authority, in the combat zone and at the Forward Command Post.
- The current practice with the introduction of bumper monitors is to use mobile operations more effectively rather than rely on branch work.
- This practice will make it hard for simultaneous rescue operations to be mounted without a static vehicle to work from.
- The DRV used as a pre-planned CABA crew allows for the best entry time of rescue and firefighting crews into the fuselage without interfering with the major foam vehicles attack.
- The TRA process is site specific and this report is specifically about Brisbane ARFFS.
- As ARFFS in Australia is a National Fire Service it is obvious that many of the shortcomings noted in this report equally apply to all other ARFFS stations provided by Airservices.

- There are particularly ineffective staffing models at all Category's which is easily shown by a comparison with the NFPA staffing models.

The TRA is an exceptionally good process to provide an end to end assessment of the ARFFS capability at a real working fire/crash scene.

Observations:

Two highly experienced Queensland Fire Emergency Services (QFES) officers (Area Commander / Inspector & Station Officer rank) assisting with the TRA and peer reviewing this report included the following. Overall in their expert opinion:

- ARFFS was lacking in enough resources to adequately control all contingencies likely to arise at an incident of this magnitude.
- No spare capacity for anything beyond the pre-planned initial operations. (e.g. Implementing the Tactical Plan initial knockdown of critical area in 1 min, if no problems encountered)
- No capacity for simultaneous operations for conducting firefighting, passenger rescue and evacuation support.
- If problems are encountered, for example, if the wing exploded injuring staff as per the Emirates B777 crash recently there would be insufficient staff to cope with that situation and continue with the firefighting and rescue operations effectively. The heat illness issues encountered in the Emirates B777 incident would also seriously impact on ARFFS firefighting capability.
- ARFFS overall Incident Command was compromised by insufficient officers to properly implement an AIIMS compliant ICS/IMT. One officer with no support back at the FCP.
- Officers functioning as both incident controllers, operations officers and sector commanders were also expected to take on Safety Officer and Entry Control Officer (ECO) functions, this is patently unsafe and has been named as the cause of firefighter line of duty death (LODD) or serious injury during many operations.
- In these expert's opinions ARFFS were underestimating QFES response times and overestimating QFES support capability.
- Securing a viable water supply from a minimum of 2 designated hydrants and shuttling ARFFS vehicles to provide water is simply inadequate, Larger capacity vehicles, a hose layer or a water tanker needs to be provided. Without adequate water this operation will fail.
- Hot Swap Cylinder Changes for CABA crews is an unsafe practice and does not allow for cool down and proper assessment of the crew members ability to continue to operate safely in a life-threatening environment. (Relying on self-assessment by CABA operators has proven fatal at other incidents)

Findings:

Failed: Category 10 Aviation only Staffing: 3 Officers 11 Firefighters (ULFV x 4)

Failed: Perth Hybrid Model Staffing: 3 Officers 11 Firefighters (ULFV x 4 & DRV x 1)

Partial: Brisbane ARFFS Current Staffing: 4 Officers 13 Firefighters (ULFV x 4 & DRV x 1)

Passed: TRA Supported Effective Staffing: NFPA 15 minimum (Aviation) then TRA including effective ICS component, Rapid Intervention & CABA teams. (6+13) and a dedicated Watchroom Attendant.

Introduction

In 2013 the International Civil Aviation Authority (ICAO) approved and introduced recommended methodology called the Task Resource Analysis (TRA) for determining Aviation Rescue Firefighting (ARFFS) crew sizes, equipment, agent and vehicle resourcing for safe and **effective** ARFFS operations. Australia as a signatory to the ICAO Chicago Convention has obligations to endeavour to apply this ICAO Recommended Practice.

Civil Aviation Safety Regulation CASR 139.755 also states: (1) In this Division: ***applicable standards and requirements***, for an aerodrome of a particular category, means:

(a) for an aerodrome to which subregulation (2) applies—the standards **and requirements** for an aerodrome of its category set out in:

(i) **Chapter 9 of Annex 14 to the Chicago Convention**; and

(ii) the Manual of Standards; or

The CASA 139H Manual of Standards states in: 1.1.6 Related Documents

1.1.6.1 These standards should be read **in conjunction with**:

(a) ICAO Annex 14;

(b) Airports Services Manual Part 1;

There are several guidance documents available to ensure that the TRA is conducted correctly. Following and applying this guidance closely will ensure that the TRA process is not manipulated to reduce staffing below what can be proven via this method to be safe and effective operational staffing levels. It also provides justification for adequate staffing levels that meet the requirements under the WHS Act to provide **a safe system of work** for all employees.

The guidance documents used to inform this TRA report include: UK guide document CAP 1150, ICAO ASM Pt 1 (doc 9137), ICAO Annexe 14, CASR 1998 (Vol 4 139), the ARFFS Requirements Working Group TRA guidance document, the NFPA guide in NFC403, and ICAO RFFSP-9. The main points of each of these reference documents have been included in this report to validate any assumptions made or concerns raised.

The article titled Achieving ARFFS in a Challenging Economy by Chief Fire Officer Jack Kreckie was also used to provide an analysis of the argument between safety vs economy. These documents are written **by highly respected experts** in the field of ARFFS and they are acknowledged internationally as the authorities in credible and effective aviation rescue services.

Utilising these guidance documents the United Firefighters Union Aviation Branch conducted a TRA using a committee of 15 ARFFS Operational Staff, both current and recently retired members. This committee had a total of 299 years of diverse ARFFS operational experience including Category 10 to Category 6 Incident Commanders, ARFFS Supervisors, ARFFS practitioners and ARFFS training instructors.

There was also input from a work health safety (WHS) expert and from two highly experienced members of the QFES who played the role of devil's advocate and peer review. This required the committee to be able to justify why a resource was requested and to prove it was required before it could be added to the TRA.

The TRA committee was also warned to be aware of using their assumptions, or lens of belief when conducting this assessment. Behavioural conditioning and accepted norms impact on how things are seen or processed. An example of this being that the recommended timeframes for CABA operations provided by the ARFFRWG paper and the RFFSP-9 were initially seen as unachievable or extremely optimistic. This assumption was based on the TRA committee's assessment using current Australian ARFFS staffing and resources and what in the committee's experience was **normal ARFFS practice** here in Australia. When an ARFFS is properly resourced, it is possible to operate effectively within the ARFFRWG & RFFSP-9 timeframes.

Peer Review

Following on from this initial TRA group the draft TRA documents were peer reviewed and challenged by both ARFFS job experts and experts with experience from other Public Safety and WHS organisations. Their brief was to strongly critique the draft TRA for any errors, omissions, and for procedural or resource requirements that met minimum requirements for both effectiveness and safety.

TRA Design Considerations

The TRA committee assessed a tabletop scenario based on category, worst case and most likely. There was a review done for the worst crash location on Brisbane Airport however it was agreed by the TRA committee to place the crash scene within the NFPA defined area termed (RRA) Rapid Response Areas where historically 85% of accidents occur.

The other factor of concern to the TRA committee was the time of the incident. The morning and afternoon A380 arrival flights may overlap the Brisbane peak hour traffic periods and so impact severely on timing of emergency services support. This would impact on the accuracy of timing for the support services making a TRA based on best guesses.

The incident was agreed to have occurred in the quiet period of the late departure flight at 21:00, using the QFES (Firecom) supplied official timing for fire & rescue assets departing from their assigned stations to the AIP Staging area. But these arrival times are best case not worst-case scenarios. Like the ARFFS the QFES are always looking at efficiencies which means that these support stations are busy and not always instantly available to respond. For example, the aerial vehicle is one of several that service the entire Greater Brisbane area.

This TRA report applies four potential crew sizes for Brisbane ARFFS at Category 10 to this one scenario. The scenario was followed until pinch points were found and noted with the four staffing models. The follow up by TRA committee members assessed ways to overcome the pinch points identified within the confines of available staffing without significant compromise on operational effectiveness.

ARFFS also often make assumptions about roles that can be delegated to the ARO (Airport Safety Officers) during ARFFS training sessions. But these assumptions are not always accurate regarding their availability, role requirements and capability. The ARO role at a lot of airports, is also victim to efficiency measures and minimising resources. So, any role in the TRA assigned to the ARO needs to be checked and verified as an accurate, planned and practiced function of the ARO role. This will prevent basing critical ARFFS decisions on an imaginary resource.

Scenario:

A380 departing Brisbane for Dubai on Main Runway heading 01 taking off towards Moreton Bay 21:00 (local). Passengers 465 (90% passenger loading), nil dangerous cargo.

- Airbus A380 Aircraft Rejected Take-Off
- Time 21:00 Crashes Overshoot Runway 01
- POB: 465 Crew 30 Total 495 Souls
- Fuel: 265,000 litres
- Problem: Incorrect input into flight computer (based on Emirates EK407 20 March 2009, Airbus A340-541, registered A6-ERG overrun on take-off scenario in Melbourne)
- Dangerous Goods: NIL
- Cargo: 10 pallets ordinary cargo and baggage. Livestock (pets) and mail
- Final Location: 200m into overshoot runway 01 (statistically most likely)
- Aircraft Crash Conditions: Fully involved ground fire port side, ground fire rear of wing starboard side, fuel tanks ruptured, undercarriage collapsed, wind moderate from the North favouring the Port (Critical) side.
- Evacuation in progress Starboard side forward exits.
- All ARFFS resources at station ready to respond (no AFA or Medical response in progress)

QFES Initial Response Times

QFES Firecom Procedure: 1km = 1 min no traffic

Initial response QFES Fire Stations to a major aircraft crash at Brisbane Airport. (Hendra, Windsor, Taigum, Chermside, Cannon Hill, Kemp Place)

Hendra Fire Station (1 Pumper, 1 Aerial, 6 staff) 7km - 7 mins

Windsor Fire Station (1 Pumper, 4 staff) 12.2km 13 mins

(Heavy Traffic Area)

Taigum Fire Station (1 pumper, 4 Staff) 15.4km 16 mins

Chermside Fire Station (1 Pumper 4 staff) 17.2km 18 mins

(Heavy Traffic Area)

Cannon Hill Fire Station (1 Pumper 4 Staff) 15.9km 16 mins

(Gateway Bridge Alternate Airport Link Tunnel) 21.7km 22 mins

Kemp Place Fire Station (2 Pumpers 8 staff) 13.6km 14 mins

Airport Link Tunnel (City Traffic & Lights) 14.5km 15 mins

Note: all these times are best case nil traffic. Peak Hour or other busy times they are not realistic. These are also very busy fire stations and may be already committed.

QAS Initial Response Times

Initial response QAS Ambulance Stations to a major aircraft crash at Brisbane Airport. (Northgate, Kedron Park, Balmoral, Mitchelton, Roma Street, Sandgate, South Brisbane, Eaton's Hill, Kenmore)

Northgate	6.8km 6 mins
Kedron Park	9.7km 8 mins
Balmoral	13.7km 12 mins
Mitchelton	16.2km 15 mins
Roma Street	16.5km 15 mins
Sandgate	17.8km 16 mins
South Brisbane	19.2km 18 mins
Eaton's Hill	23km 22 mins
Kenmore	24km 23 mins

QPS Initial Response Times

Initial response QPS Police Stations to a major aircraft crash at Brisbane Airport. (Hendra, Morningside, Stafford, Fortitude Valley, Boondall, City, Rome Street, Wynnum, Southbank, Sandgate)

Hendra Police Station	5.7km - 5 mins
Morningside Police Station	14.23 km 13 mins
Stafford Police Station	11.6km 10 mins
Fortitude Valley Police Station	13.6km 12 mins
Boondall Police Station	15.1km 13 mins
City Police Station	18km 16 mins
Roma Street Police Station	16.6km 15 mins
Wynnum Police Station	20.2km 18 mins
Southbank Police Station	17.7km 15 mins
Sandgate Police Station	17.6km 15 mins

Critical Timing Factors

Refill of Mk 8 Rosenbauer Panther (8,900 litre) from a designated hydrant:

CASA MOS 139H 7.1.3.3 Hydrants with a minimum flow of 30 l/s must be available for the refilling of emergency fire service vehicles. The hydrants must be easily accessible and identified in the ARFFS SOPs.

Theoretical: 296 seconds (4.9444 minutes)

Actual: Satellite Fire Station (SFS) Designated Hydrant (6 mins 5 seconds)

Travel time Mk 8 from overshoot area to MFS or SFS for refill including runway and taxiway crossings and ATC permission. 3-5 mins

Run out, connect, disconnect, operate on/off and clear feed length (60 secs)

Approximate time to be used for TRA is **13-16 mins** away from scene for each vehicle refill.

Firefighter Don full Personal Protective Equipment (PPE) on scene:

Approximate timing provided 30 secs. (knee boots/bunkered)

Time may be extended if ankle boots worn due to difficulty donning these in a standing position.

The ARFFRWG allows for dressing in PPE on route, this is against the current SOP. It is considered that if properly prepared with bunkered over-trousers and pull on boots in their riding position that the Branch person may be partially clothed in PPE before arrival without compromising the seatbelt rule.

Firefighter Don only Compressed Air Breathing Apparatus (CABA) on scene:

Approximate timing provided 50 secs.

Firefighter Don and start up CABA on scene:

Approximate timing provided 1 Mins 45 secs. Don correctly with safety checks conducted. Previous ARFFS target time pre-flash-hood, DSU and Torch was 90 seconds.

2 Firefighters acquire 7 m ladder, from vehicle carry to point of entry, erect 7 m ladder to mid deck door:

Approximate timing provided under 2 mins.

3 Firefighters acquire 9 m ladder, from vehicle carry to point of entry, erect 9 m ladder to mid deck door:

Approximate timing provided 2 mins.

3 Firefighters run attack line (38mm hose, 3 lengths, TFT Mid-Matic) under control to point of entry:

Approximate timing provided 1 minute

2 Firefighters run Handline (50mm hose, 2 lengths, FB10X) under control to protect fuselage:

Approximate timing provided 1 minute

Emergency Services time to escort to crash scene from AIP:

Distance from Chloris St Airside Inspection Point (AIP) to crash site is 3.5km in a direct line. Convoy is under escort needs to stay controlled by the ARO, cross the Domestic Apron then cross the Main runway (01/19) to the Eastern Perimeter Rd or take the taxiways through to the Cross Runway (14/32). Conservative ETA at Forward Command Post 4 to 5 mins.

Test time in ARFFS General Use Vehicle (GUV): 4.25 mins

Key Point Considerations

DOT/FAA/AR-11/29 Methodologies for Calculating Firefighting Agent Quantities Needed to Combat Aircraft Crash Fires July 2012 Final Report

A simple summary has been provided by Tom Lindemann, a past member of the NFPA 403 Technical Committee [17], which states that FAA research indicates that when an aircraft is involved in a fuel spill fire, the **aluminium skin will burn through in about 1 minute**. If the fuselage is intact, the sidewall insulation will maintain a survivable temperature inside the cabin **until the windows melt in approximately 3 minutes**. At that time, the cabin temperature rapidly increases beyond a survivable temperature of 400°F (204C).

The ARFF equipment and agents can control a fire in 1 minute. Therefore, ARFF personnel and equipment **must reach the scene in 2 minutes** to meet the anticipated burn through scenario. (Page 6) ARFFS in Australia do not apply this even though it as an ICAO recommendation and will accept three minutes response by choice just to avoid extra cost or inconvenience when building and locating new fire stations. (Eg: Brisbane NPR)

It was found that an escaping passenger from a small aircraft would be subject to unbearable pain while exiting the aircraft, and the exposed flesh would have third-degree burns prior to reaching a safe distance from the fire. With a larger aircraft, the situation becomes even worse. When applied to a B-747 aircraft, the model predicted that at clear path occupant fire separations of 46ft (14m) and 92 ft (28m) (0.2 and 0.4 L), the escapee would suffer third-degree burns while exiting the aircraft. At a separation of **128 ft** (39m) (0.6 L) from the fire, the occupant would be able to traverse a short distance along the escape path before receiving third-degree burns.

The Gage report analysis showed the practical limitations of the escape path concept as applied to the critical fire area concept of maintaining fuselage integrity. In other words, the TCA/PCA, where the fire area is intended to be controlled very quickly (60 seconds) by the first arriving vehicles, **is not necessarily a clear rescue path for ambulatory occupants.** Rather, the intent (as emphasized in

Annex B of NFPA 403) is to protect the aircraft skin from melting under severe fire conditions. (Page 10)

128ft is 39m so only controlling the critical area does not ensure safe escape paths, this is a known fact so only providing minimum agent means that part of your Q2 agent is used in providing safe escape routes and not in consolidating the PCA. This means you may have insufficient agent to control any burn backs through your foam blanket or maintain safety for the rescue operations taking place in the fuselage, there is also no Q3 agent to fight internal fires.

Cherry found that fire damage to aircraft is less severe when landing gear collapses and the fuselage is resting on the ground [36]. This seems logical, because

- a fuel spill is less likely to spread under the aircraft.
- burning of the underbelly is prevented.
- weak points of the fuselage, e.g., ventilation openings, are less likely to be exposed.

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4.9 AIRCRAFT EVACUATION TIME. Cherry [36] estimated the time to initiate evacuation. Of the 147 major incidents reviewed, 7 were identified as featuring an intense fire threat, in which the initiation of evacuation time could be estimated. This time ranged from 8 to 40 seconds. Time to complete evacuation was also assessed for 24 accidents involving fire. Times ranged from 55 to 360 seconds, partially a function of occupant load. The data suggested that 50% of evacuations were completed within 130 seconds and 90% within 325 seconds. (Page 54)

This means that by the time ARFFS is in place and has control of the PCA, evacuation in most instances has been completed (2-5 mins). This data is contrary to the current ARFFS assumption that evacuation will delay ARFFS CABA Operators making entry into the fuselage.

4.11 AGENT QUANTITIES FOR INTERIOR FIRE CONTROL. The loss history does not provide quantitative data on the amount of agent needed for an interior attack. In major accidents, large quantities of agent are used after the ground fire is extinguished, as shown in section 4.10.

Omans [33] contends that current CFR agent quantities **are not adequate** for most confined spills and interior fires. He notes that many aircraft interior fire situations are not near a firefighting water supply; **he recommends that tankers for resupply** be part of the airport or mutual aid response. Certainly, there are accidents in the loss history where ARFF response to potential trapped or non-ambulatory survivors is less than optimum in terms of availability of equipment, including hand lines.

This was recognized by the NFPA 403 committee in the 1993 revision cycle, where Q3 was added. It is also recognized in the allowance for **airports to specify HRET equipment** for ARFF vehicles.

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The Gage report identified the basic stages of a crash fire as consisting of

- a residual fire involving spilled or/and spilling fuel that gradually increases in intensity.
- This developing fire may ignite other combustibles, such as magnesium components, tyres, oil, hydraulic fluid, and cargo.
- a developing fire that reaches a level of maximum intensity in about 2 to 5 minutes.
- a gradual decrease of the maximum-intensity fire when the spilling and spilled fuel is exhausted. This may not occur for a considerable time and may be quite slow.

The development of the fire may be accelerated, or its maximum intensity may be increased by vapor-air explosions in confined spaces or by the sudden overpressure failure of the tankage under fire exposure. There is no ready method to estimate when fuel tanks or lines may rupture, but it may be relatively rapid. In the China Air incident (Okinawa, 2007), a starboard wing tank ruptured in about 1 minute (see section 4.5.2.1). Interior aircraft fires may be increased in intensity by the relieving of oxygen cylinders. (Page 66)

For plausibly survivable aircraft crash scenarios involving scheduled aircraft with nine or more passengers, occurring at the middle, end, or near the end of the farthest runway, sufficient firefighting agent and capabilities should be provided to ensure the:

- survivability of ambulatory occupants.
- ability of responders to rescue non-ambulatory survivors and recover victims.

Based on the historical basis of requirements, the loss history, and a fire threat analysis, ARFF firefighting agents are provided to:

1. protect the aircraft fuselage in order to protect ambulatory occupants within an intact fuselage who have not escaped before the arrival of ARFF.
2. control any fire in the immediate crash area that threatens occupants who have escaped the aircraft.
3. establish a safe area for continuous post-crash rescue and recovery efforts.
4. affect final extinguishment of all exterior and interior fires.
5. prevent
    - burn-back of foam applied to liquid spills.
    - re-ignition of three-dimensional liquid fuel spills.
    - re-ignition of Class A/D exterior and Class A interior materials.

NFPA 403 implicitly requires agents for these requirements in the *Q*1, *Q*2, and *Q*3 approach, and explicitly in the ICAO Annex 14 rationale. The FAA and ICAO do not explicitly recognize the *Q*3 (interior firefighting) requirement. (Page 89)

There is an attached appendix which shows the historic amounts of agents used in actual crashes and also a survey of what major airports in the US provide for their ARFFS agent quantities over an above the regulatory requirements.

NFPA 1710

3.3.44 Rapid Intervention Crew (RIC)

A dedicated crew of firefighters who are assigned for rapid deployment to rescue lost or trapped members.

3.3.44.1 Initial Rapid Intervention Crew

Two members of the initial attack crew who are assigned for rapid deployment to rescue lost or trapped members.

5.2.4.1.3

When an incident escalates beyond an initial full alarm assignment or when significant risk is present to the members due to the magnitude of the incident, the incident commander shall upgrade the

IRIC to a full RIC that consists of an officer and at least three members who are fully equipped and trained in RIC operations.

A3.3.44 Rapid Intervention Crew (RIC)

The RIC reports directly to the Incident Commander or Operations Chief. This dedicated crew is not to be confused with the IRIC.

A5.5.62

The US Airforce has defined the areas involved in an emergency within 23M of the aircraft as Immediately Dangerous to Life and Health (IDHL).

Current ARFFS Category 6 & 7 crewing does not allow ARFFS compliance with this standard. In the absence of an Australian Standard then under the CASR regulations and the WH&S regulations ARFFS should comply with a relevant International Standard or Code of Practice.

The US Airforce standard mentioned at A5.5.62 of the NFPA 1710 standard is also a serious consideration for ARFFS firefighter safety now that B-787 and other new aircraft increase their composite materials load.

NFPA 1407

Chapter 3 Definitions

3.3.9 Rapid Intervention Crew / Company Universal Air Connection (RIC/UAC). A system that allows emergency replenishment of breathing air to the SCBA of disabled or entrapped fire or emergency services personnel.

Chapter 4

4.1 General

4.1.1 A rapid intervention training programme shall be developed for the safety of all fire suppression personnel.

4.1.2 Risks to safety of fire department members during training programmes shall be kept to a minimum.

4.2 Training policies and guidelines

The authority having jurisdiction (AHJ) shall establish written policies for rapid intervention training that meet the requirements of this standard.

4.2.1 Rapid intervention operations shall be guided by written operational policies or guidelines and be enforced through a comprehensive training programme.

4.2.2 The training programme shall be consistent with the department operational procedures, including automatic and mutual aid departments.

4.2.3 Rapid intervention training shall be developed and conducted to provide constant sustainable rapid intervention capability at the emergency scene utilising a minimum crew size as required by NFPA 1710 and 1720.

4.2.4 The rapid intervention crew training programme shall train firefighters to use individual rapid intervention crew skills as a part of a crew.

4.2.5 The policy shall address the entry level requirements for crew members, the training objectives, basic skills, equipment and training evolutions contained in this standard.

ARFFS in Australia has not provided this level of training and commitment to the rapid intervention crew procedures, equipment or even ensured that enough staff are available. Equipment to assist in removal or to supplement breathing air for the firefighter being rescued has not been considered or provided.

NFPA 1981

6.4.1 Each SCBA shall be equipped with a RIC/UAV male fitting to allow replenishment of breathing air to the SCBA breathing air cylinder.

ARFFS do not have this facility and have no plan in place to provide rescue air to a trapped or disabled firefighter by an RIC during rescue operations.

Carter J. Ph.D and Wright S. The Effectiveness of Current Fire Fighter Rapid Intervention Teams. January 2010 Final report Work Safe BC

This study set out to determine the effectiveness of a 2-person RIT team compared with a 4-person team. Results from the study demonstrated that a 2-person RIT team may not be able to rescue a downed or trapped firefighter and will not be able to rescue two or more trapped fire fighters. If a 2-person RIT team attempts to rescue a victim fire fighter, the quality of the rescue will be compromised. The current study found that it is very difficult for 2 fire fighters to locate, package, and remove a victim safely while maintaining and the victim's critical air supply and effective fire ground communication. (page 4)

Phoenix Study

One of the few well controlled and documented RIT studies was completed by the Phoenix Fire Department (PFD) following the death of a fire fighter in a supermarket in 2001. The RIT activities were monitored and timed, with the data being analysed by an Arizona State University statistician.

The results from the Phoenix study show that Rapid Intervention is not very rapid. Important RIT time statistics from this study were:

- Rescue ready state: 2.50 minutes
- Mayday to RIT entry: 3.03 minutes
- RIT contact with the downed fire fighters: 5.82 minutes
- Total time inside building, for each RI: 12.33 minutes
- Total time for rescue: 21.00 minutes

The study also concluded that there were three consistent ratios:

- It takes 12 fire fighters to rescue 1

- 1 in 5 RIT members will get into some type of trouble themselves
- A 3000-psi (206 bar) cylinder will provide 18.7 (+/- 30%) minutes of air

(Page 13 & 14)

CAP 1150:

- Tasks:
- Meet the required response time.
- Extinguish an external fire.
- Protect escape slides and exit routes.
- Assist in the self-evacuation of the aircraft.
- Create a survivable situation.
- Rescue trapped personnel.
- Maintain post fire security/control.
- Preserve evidence.

If it is required for the RFFS to attend structural incidents and road traffic accidents in addition to aircraft incidents/accidents due regard must be given to the inability of not meeting required response times **and robust procedures** should be introduced accordingly.

In Australia these robust procedures included a Domestic Response Service (DRS). This service is now under risk due **to efficiencies** even though the regulation is clear in making ARFFS responsible regarding fires on the airport other than in aircraft and the MOS 139H requires all alarms to terminate at the ARFFS FSCC.

Task and resource analysis seeks to identify the minimum number of personnel required to undertake identified tasks **in real time** before supporting external services are able to effectively assist RFFS.

The importance of an agreed framework for incident command should form a primary part of the considerations. In Australia the agreed framework is the Australian Inter-Service Incident Management System (AIIMS). It is also an agreed position under the National Airport Emergency Planning (AEP) committee that the Senior Police Officer assumes the role of Incident Controller. Brisbane AEP requires a Forward Command Post to be set up and for the ARFFS OIC to attend the FCP. ARFFS is the combat authority until the combat/hot zone is declared safe.

Human factor principles should include the effects of human performance for example **workload,** capabilities, functions, decision aids, environmental constraints, team versus individual performance and training effectiveness. Knowledge, experience, staffing including numbers, skill levels and organizational structure, safety and health aspects, safety systems and protective equipment, not forgetting **fatigue and the need for adequate relief** should also be considered.

NFPA NFC 403:

Objective: To save lives.

- Tasks:
- (1) Meet the required response time.
- (2) Extinguish an external fire.
- (3) Protect exit routes.
- (4) Assist in passenger and aircrew self-evacuation.
- (5) Extinguish an internal fire.
- (6) Rescue trapped personnel.

NFPA 403 Page 8 provides the amounts of agent required for category. Unlike ICAO the agents are divided into 3 columns 1/AFFF, 2/ Fluorine-Free Synthetic Foam, Fluoroprotein, or FFFP and 3/ Protein foam. ARFFS here use RF6 which is a FFF product and requires more agent than AFFF.

Category 9: NFPA FFF = 46,500 L or 51,245 L for multi deck (A380 or B747), 4 ARFFS vehicles to be available for Cat 9 and 1 HRET, 15 ARFFS staff minimum plus a TRA. NFPA allows for Q1, Q2 and Q3 for internal firefighting. NFPA Q1&2 Discharge Rate (13,722 Lpm). NFPA Q3 Discharge Rate (945 Lpm) or Multi Deck A380 or B747 (1,420 Lpm).

Category 10: NFPA FFF = 67,500 L, NFPA requires 4 ARFFS vehicles to be available for Cat 10, two with HRET and 15 ARFFS staff minimum plus a TRA, NFPA Q1&2 Discharge Rate (16,759 Lpm). NFPA Q3 discharge rate (1890 Lpm).

B.4 Discharge Time. At RFFP-I, the Panel agreed that discharge rates should be designed to achieve the lowest possible fire control time that is consistent with the objective of preventing the fire from melting through the fuselage or causing an explosion of the fuel tanks. The Panel also agreed that the equipment and techniques to be used should **be capable of controlling the fire in the critical area in 1 minute and of extinguishing the fire within another minute.**

NFC 403-14 B.6 Today's Situation. The basic concepts developed by the ICAO RFFPs are still considered valid. However, the variables previously mentioned that are used to develop the *f* factor for *Q*2 have been refined over time and are now expressed as follows:

(1) *Aircraft Size.* Aircraft size reflects the potential level of risk. This risk factor is a composite of the passenger load, the potential internal fire load, flammable liquid fuel capacity, and the fuselage length and width. Careful consideration of all these factors allows the identification of a meaningful operational objective, that is, the area to be rendered fire free (controlled or extinguished).

(2) *Relative Effectiveness of Agent Selected.* This variable is accounted for by the specific application rate identified for each of the common generic foam concentrate types.

(3) *Time Required to Achieve PCA Fire Control.* Information from reliable large-scale fire tests, empirical data from a wide variety of sources, and field experience worldwide indicate that 1 minute is both a reasonable and a necessary operational objective.

(4) *Time Required to Maintain the Controlled Area Fire Free or to Extinguish the Fire.* An operational objective that provides a safety factor for the initial fire attack on the PCA while waiting for the arrival of backup support or to complete extinguishment of remaining fires outside the PCA.

The quantity of water for foam production required for 1-minute fire control of the PCA is still referred to as *Q*1. However, data collected in the ensuing years now permit us to specify the required application rates for three generic foam types needed to extinguish fire in 1 ft2 or 1 m2 of the PCA as follows:

(1) AFFF = 0.13 gpm/ft2 or 5.5 L/min/m2

(2) FP = 0.18 gpm/ft2 or 7.5 L/min/m2

(3) PF = 0.20 gpm/ft2 or 8.2 L/min/m2

B.6.3 The values of *Q*3 are based on accepted water flow requirements for the type of fire-fighting operations to be experienced when combating an interior aircraft fire. They are determined as shown in Table B.6.3.

In December 2000, ICAO RFFP-9 met. It was agreed that to accomplish a timely interior fire suppression, **all necessary equipment and personnel should be in place and the suppression activity should be in action within 5 minutes of notification of the accident event**. This requirement places a premium on the need to have sufficient personnel and equipment to perform this task **in the first responders group.**

ICAO Annexe 14

9.2 Rescue and fire fighting

General

Introductory Note. — The principal objective of a rescue and firefighting service is to save lives in the event of an aircraft accident or incident occurring at, or in the immediate vicinity of, an aerodrome.

The rescue and firefighting service is provided to create and maintain survivable conditions, to provide egress routes for occupants and **to initiate the rescue of those occupants unable to make their escape without direct aid**. The rescue may require the use of equipment and personnel other than those assessed primarily for rescue and firefighting purposes.

It is very clear in ICAO that rescue is a separate act to just firefighting and involves physically rescuing the incapacitated passengers and crew from off the aircraft and out of the critical area.

The most important factors bearing on effective rescue in a survivable aircraft accident are: the training received, the effectiveness of the equipment and the speed with which personnel and equipment designated for rescue and firefighting purposes can be put into use.

Category 10: ICAO Performance Level B, Minimum Agent Requirement 32,300 litres and 11,200 lpm discharge rate.

Category 9: ICAO Performance Level B, Minimum Agent Requirement 24,300 litres and 9,000 lpm discharge rate.

Actual Agent levels provided for Brisbane ARFFS Category 10: 35,600 litres and 19,200lpm discharge rate using primary monitors only. Category 9: 26,700 and 14,400lpm discharge rate.

It is important to note that in a genuine comparison with other world class ARFFS, Australia has significantly less available firefighting agent. This is even further compromised by having no real plan in place to replenish firefighting agents, water or foam other than returning to a designated hydrant

which may be kilometres away from the crash site. It should also be noted that the current foam used has substantial evidence including an independent test commissioned by Airservices that shows it has failed ICAO-B on several occasions.

Whether it fails or just passes if everything falls in its favour it is still highly suspect performance wise if you are only going to provide minimum amounts. Airservices use this foam from the coldest parts of Australia (Hobart) right across the country to the tropics of Darwin, Broome and Cairns. The agent needs to work anywhere, anytime and at the very least to the required ICAO-B performance standards. Otherwise you should provide more of it.

ICAO ASM Part 1 (doc 9137):

2.3.10 However, as of 1 January 2015, 2.3.7 requires the quantities of agent to be recalculated for aerodromes where operations by aeroplanes larger than the average size in a given category are planned. As the A380 is larger than the average aeroplane used for calculation of quantities of extinguishing agents for category 9 in Table 2-3, the actual quantities to be provided need to be recalculated. Since 2.1.3 b) permits a remission factor of one, the largest quantity for category 9 ie. 41,483L (for performance level A foam) should be provided. As a comparison, this quantity is more than the median quantity of 36,400L for category 9 in Table 2-3 but less than the maximum quantity of 54,242L for category 10 in Table 2-4.

For Brisbane using ICAO-B Foams this means a minimum of 27,858 litres minimum if remission were introduced which cannot be currently provided with 3 ULFV Mk8 Panther vehicles.

2.5 DISCHARGE RATES

2.5.1 The discharge rates of the foam solution should not be less than the rates shown in Table 2-3.

The recommended discharge rates are those **required to obtain a one-minute control time** on the practical critical area and have therefore been determined for each category by multiplying the practical critical area by the application rate. The discharge rate of the foam solution is thus equal to the water quantity Q1 in a control time of one minute.

2.7 RESPONSE TIME

2.7.1 The operational objective of the RFF service should be **to achieve response times of two minutes and not exceeding three minutes** to the end of each runway, as well as **to any other part of the movement area,** in optimum conditions of visibility and surface conditions. Response time is considered to be the time between the initial call to the RFF service and the time when the first responding vehicle(s) is(are) in position to apply foam at a rate of at least 50 per cent of the discharge rate specified in Table 2-3.

Determination of realistic response times should be made by RFF vehicles operating from their normal locations and not from positions adopted solely for test purposes.

2.7.3 Any other vehicles required to deliver the amounts of extinguishing agents specified in Table 2-3 should arrive **in three minutes and no more than four minutes** from the initial call so as to provide continuous agent application.

It is currently debateable as to whether the Resources from the current Main Fire Station (Fire Station East) will meet a four min response criterion to the new Parallel Runway.

3.1 AIRPORT WATER SUPPLY

3.1.1 Supplementary water supplies, **for the expeditious replenishment of RFF vehicles, should be prearranged.**

Beyond identifying at least two fire hydrants anywhere on the airport with more than 30 lps flow rate ARFFS in Australia has no water supply planned for a major incident.

The objective of providing additional water supplies at adequate pressure and flow is to ensure rapid replenishment of aerodrome RFFS vehicles. This supports the principle of continuous application of extinguishing media to maintain survivable conditions at the scene of an aircraft accident for far longer than that provided for by the minimum amounts of water set out in Chapter 2.

3.1.2 Additional water to replenish vehicles may be required **in as little as five minutes** after an accident, therefore an analysis should be conducted to determine the extent to which it, and its associated storage and delivery facilities, should be provided.

3.1.3 When conducting the analysis, the following factors are amongst those items which should be considered but not limited to:

a. Sizes and types of aircraft using the aerodrome.

b. The capacities and discharge rates of aerodrome fire vehicles.

c. The provision of strategically located hydrants.

d. The provision of strategically located static water supplies.

e. Utilisation of existing natural water supplies for firefighting purposes.

f. Vehicle response times.

g. Historical data of water used during aircraft accidents.

h. The need and availability of supplementary pumping capacity.

i. The provision of additional vehicle-borne supplies.

j. The level of support provided by Local Authority Emergency Services.

k. The Pre-Determined Response of Local Authority Emergency Services.

l. Fixed pumps where these may provide a rapid and less resource-intensive method of replenishment.

m. Additional water supplies adjacent to airport fire service training areas.

n. Overhead static water supplies.

9.3.7 *Watchrooms.* **In all fire stations** there must be a central point for the reception of emergency calls, from which fire vehicles may be dispatched for responses of all kinds and resources can be mobilized and directed. This should be in the form of a watchroom, which should be sited in a position which **overlooks as much of the movement area** as possible.

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. **During flight operations sufficient trained and competent personnel** should be designated to be readily available to ride the RFF vehicles and to operate the equipment at maximum capacity.

These personnel should be deployed in a way that ensures **that minimum response times can be achieved** and that continuous agent application at the appropriate rate can be fully maintained. Consideration should also be given for personnel to use hand lines, ladders and other RFF equipment normally associated with aircraft RFF operations. The responding vehicles should provide at least the minimum discharge rates specified in the tables. The remainder of the vehicles may be staffed by personnel not necessarily employed in close proximity to their vehicles but able to respond when the alarm sounds **so as to reach the scene of the accident no more than one minute after the first responding vehicle(s)** so as to provide continuous foam application.

10.5.1 If an airport operator requires the RFFS to attend structural incidents and road traffic accidents in addition to aircraft incidents/accidents due regard must be given to the inability of not meeting required response times and **robust procedures should be introduced accordingly**.

These robust measures that have been in place for 20 years are the DRS service. Airservices is removing this safeguard under the embedded or Perth model. This will mean potentially only 2 officers and 9 staff responding to Category 10 to save on overtime and staffing costs.

The Airport Services Manual Part 1 also includes an example of a TRA. It should be noted that this is a category 9 response to a 747-400 with an engine fire, at an airport with only one runway. They are provided with 4 major attack foam vehicles, 44,000 litres of agent, 10 firefighters and four officers with a dedicated watch room attendant. It should also be noted that the TRA identified a pinch point in this crewing example which they felt could be overcome with the staffing provided. It should also be noted that in this scenario 20 persons were left onboard indicating the scenario had no significant internal fire. Current aviation crewing for category 9 in Australia is just two officers and eight firefighters with only three ULFV trucks with 26,700 litres of agent. Even with the DRS crew at category 9 it is still 13 staff.

FAA Aviation Rulemaking Advisory Committee (ARAC) Aircraft Rescue and Fire Fighting Requirements Working Group (ARFFRWG): (Draft Report)

The ARFFRWG identified key tasks that ARFFS services should provide at an aircraft accident/incident within specified time objectives. The location of an aircraft accident/incident, for planning purposes, should be the furthest end of the farthest runway.

These key tasks and time objectives, as follows, provide benchmarks on which to determine ARFFS staffing requirements.

Category 8, 9, & 10 Airports

3 Minutes	Begin discharge of required agent from first required vehicle
4 Minutes	Begin discharge of required agent from all other required vehicles
	Establish incident command system and request additional resources
	Initiate access to aircraft cabin
5 Minutes	Begin interior aircraft rescue and firefighting
	Establish rapid intervention team
6 Minutes	Initiate second access to aircraft cabin
	Establish second interior aircraft rescue and firefighting team
	Establish emergency medical services
	Establish water supply
8 Minutes	Establish third interior aircraft rescue and firefighting team
	Establish second rapid intervention team
	Resupply required ARFFS vehicles
	Provide stationary vertical access to aircraft

The key tasks identified by the ARFFRWG are described below:

a. Discharge required extinguishing agent from the first required ARFFS vehicle – Adequate ARFFS personnel shall be available to safely and effectively drive and operate the required ARFFS vehicle. ARFFS personnel shall be capable of discharging required extinguishing agent at the required discharge rate from the first required ARFFS vehicle.

b. Discharge required extinguishing agent from all other required ARFFS vehicles - Adequate ARFFS personnel shall be available to safely and effectively drive and operate the other required ARFFS vehicles. ARFFS personnel shall be capable of discharging required extinguishing agent at the required discharge rate from these vehicles.

c. Establish incident management system - An incident management system shall be implemented and an on-scene ARFFS incident commander shall be designated. The incident commander shall give an initial report to the main emergency communications facility and request, as necessary, additional resources (personnel, vehicles, etc.). Adequate ARFFS personnel shall be available to perform incident management functions during an aircraft incident or accident.

d. Initiate access to aircraft cabin - ARFFS personnel shall be capable of initiating access to the aircraft cabin, using forcible entry tools and ground ladders. ARFFS personnel shall be capable of gaining vertical access to the aircraft by ground ladder, aerial fire apparatus, or mobile stair. ARFFS personnel gaining access to the cabin shall be protected by ARFFS vehicle turrets and/or handlines. Adequate ARFFS personnel shall be available to safely and effectively perform these functions.

e. Begin interior aircraft rescue and firefighting - An interior ARFFS team, consisting of not less than two ARFFS personnel, shall be capable of entering the aircraft with a charged handline. The interior ARFFS team shall be equipped with protective clothing and self-contained breathing apparatus. The interior ARFFS team shall be protected by ARFFS vehicle turrets and/or additional handlines. Interior aircraft and firefighting shall be conducted in accordance with 29 CFR 1910.134.35 36

f. Establish a rapid intervention team (RIT) - A RIT, consisting of not less than two ARFFS personnel, shall be prepared to rescue the interior firefighting and rescue team. RIT personnel shall be equipped with protective clothing and self- contained breathing apparatus. Interior aircraft and firefighting shall be conducted in accordance with 29 CFR 1910.134. At Category 4 and 5 airports, one member of the RIT team may act as the initial incident commander until relieved from the RIT or incident command is assumed by another qualified person.

g. Provide emergency medical services - An advanced life support team, consisting of not less than two personnel trained at the emergency medical technician – paramedic level and two personnel trained at the emergency medical technician – basic level shall be on scene and equipped to provide basic and advanced life support, including mass casualty management. Emergency medical personnel may be non-ARFFS personnel, if they are not assigned to rescue and firefighting tasks.

h. Establish second interior ARFFS team - A second interior ARFFS team, consisting of not less than two ARFFS personnel, shall be capable of entering the aircraft with a second charged hoseline. The second ARFFS team shall be equipped with protective clothing and self-contained breathing apparatus.

NOTE: The second interior ARFFS team may consist of non-ARFFS personnel if they have been trained in interior structural firefighting and are equipped with protective clothing and self-contained breathing apparatus.

i. Establish water supply and resupply required ARFFS vehicles – A continuous water supply of the rate specified shall be established for firefighting. All required ARFFS vehicles shall be reserviced to their required capacity. Adequate ARFFS personnel shall be available to safely and effectively drive and operate ARFFS vehicles. Non-ARFFS personnel may operate structural fire apparatus and other support vehicles to accomplish these tasks.

j. Initiate second access point to aircraft cabin - ARFFS personnel shall be capable of initiating a second means of access to the aircraft cabin, using forcible entry tools. ARFFS personnel shall be capable of gaining vertical access to the aircraft by ground ladder, aerial fire apparatus, or mobile stair. ARFFS personnel initiating access to the cabin shall be protected by ARFFS vehicle turrets and/or handlines. Adequate ARFFS personnel shall be available to safely and effectively perform these functions.

k. Provide stationary vertical access to aircraft cabin - ARFFS personnel shall be capable of providing stationary vertical access and a water supply of not less than 250 gpm to the aircraft cabin by means of aerial fire apparatus or other suitable platform. These tasks may be performed by non-ARFFS firefighter personnel if they have been trained in interior firefighting and are equipped with protective clothing and self-contained breathing apparatus. Adequate ARFFS and non-ARFFS firefighter personnel shall be available to safely and effectively perform these functions.

Fire Safety of Advanced Composites for Aircraft Mouritz A.P. (2006)

2.3 FAA fire safety regulations

The FAA determines the fire safety regulations on the materials used in US designed and manufactured civil aircraft. These regulations are generally applied across the global aviation sector, including within Australia. Aircraft fires fall into three categories: ramp, in-flight and post-crash. Ramp fires occur when an aircraft is parked at the terminal ramp, and the incidence of fire in this state is very low.

The fire hazard is much more common during flight, such as occurred to Swissair 111 on 2 September 1985, or, in particular, post-crash. For this reason, the FAA regulations consider the fire, smoke and toxicity properties of cabin materials for a post-crash fire scenario. The scenario dictates that passengers **must be able to escape** a large, wide-body aircraft **within five minutes** of a crash landing without being incapacitated, injured or hindered by heat, toxic fumes or smoke released from combustion of the cabin materials.

All non-metallic materials used inside the pressure vessel of commercial aircraft are subject to the FAA flammability regulations. There are several fire tests mandated by the FAA to assess the flammability and fire performance of materials, and these are specified in FAR 25.853. The key fire properties considered by FAR 25.853 are total heat release, heat release rate and smoke emission. The FAA sets performance limits for heat and smoke on cabin materials to delay cabin flashover and thereby increase the escape time for passengers. Cabin flashover is a fire event characterised by ignition of the hot smoky layer below the cabin ceiling that contains incomplete combustion products released by the burning and smouldering cabin materials. When flashover occurs the cabin temperature rises rapidly, the flames spread rapidly, and the chances of survival for passengers and crew are virtually non-existent.

The FAA mandates that the heat release properties of non-metallic materials must be measured using the Ohio State University calorimeter test operated at a heat flux of 35 kW/m2, as described in ASTM E906. As part of the safety regulations, the test material is required to have a total heat release of less than or equal to 65 kW/m2 over two minutes and a peak heat release rate of less than or equal to 65 kW/m2 over the five-minute duration of the test. These specifications are used to ensure a cabin material **does not contribute** to the growth and spread of a fire **during the first five minutes** following a crash landing.

Note this FAA standard and the flammability tests design criteria supports the ARFFRWG and ICAO RFFP-9 requirement of commencing internal firefighting within 5 mins of the crash occurring.

OSHA'S RESPIRATORY PROTECTION STANDARD 29 CFR 1910.134

Procedures for interior structural firefighting. In addition to the requirements set forth under paragraph (g)(3), in interior structural fires, the employer shall ensure that:

1910.134 (g) (4) (i): At least two employees enter the IDLH atmosphere and remain in visual or voice contact with one another at all times;

1910.134 (g) (4) (ii): At least two employees are located outside the IDLH atmosphere; and

1910.134 (g) (4) (iii): All employees engaged in interior structural firefighting use SCBAs.

Note 1 to paragraph (g): One of the two individuals located outside the IDLH atmosphere may be assigned to an additional role, such as incident commander in charge of the emergency or safety officer, so long as this individual is able to perform assistance or rescue activities without jeopardizing the safety or health of any firefighter working at the incident.

Note 2 to paragraph (g): Nothing in this section is meant to preclude firefighters from performing emergency rescue activities before an entire team has assembled.

Most Australian Fire Services have adopted a two in two out policy except for ARFFS with the current DRS crewing of only 3 staff, and with current cat 6 crewing of 1+4 there is no provision for at least one of the firefighters remaining outside to be dedicated to the IRIC role as the standard requires.

ARFFS CABA operations require a minimum 4 wearers (per delivery) initially. ARFFS CABA Operations then require a minimum of six firefighters once the initial crew are to be relieved. (2 on task, 2 on relief/rescue, 2 on rehab)

Airservices Regulations 1995

Division 2 Rescue and firefighting services

4.02 Functions of the Rescue and Firefighting Service

(1) The functions of the Rescue and Firefighting Service are:

(a) **to conduct operations** to rescue persons and property from an aircraft that, as the result of an incident at, or in the vicinity of, an aerodrome, has crashed or caught fire; and

(b) to conduct operations to control and extinguish, and **to protect persons and property** threatened by:

(i) a fire at an aerodrome, **whether in an aircraft or elsewhere**; or

(ii) a fire in the vicinity of an aerodrome that is in, or that started in, an aircraft.

(2) In carrying out its functions under subregulation (1), AA must give priority to operations that are conducted:

(a) at an aerodrome; or

(b) within 1000 metres of any boundary of an aerodrome.

Note: The wording in the Airservices Regulation uses the word **conduct,** which as a noun is given the meaning: the manner in which an organization or activity is **managed or directed**. As a verb it is given the synonyms: manage, direct, run, **be in control of**, control, oversee, supervise, **be in charge of**, preside over, regulate, mastermind, administer, organize, coordinate, orchestrate, handle, guide, govern, lead, carry out, carry on.

This regulation which is specific to Airservices, provides a greater level of accountability for rescue operations at a major incident than the wording in the CASR 1998.

Civil Aviation Safety Regulations 1998 Volume 4

139.710 Functions of ARFFS

(1) The functions of an ARFFS for an aerodrome are:

(a) to **rescue persons and property from an aircraft** that has crashed or caught fire during landing or take-off; and

(b) to control and extinguish, and to protect persons and property threatened by, a fire on the aerodrome, **whether or not** in an aircraft.

139.765 Knowledge, equipment and expertise to deal with aviation hazards

An ARFFS provider must have the knowledge, equipment and expertise **to deal with any hazard** likely to arise during an aviation accident or incident, including any hazard mentioned in the Manual of Standards.

139.835 Number of operating personnel

(1) During any period announced in ERSA as a period during which ARFFS is available at an aerodrome, there must be enough trained personnel available at the aerodrome to operate the equipment and vehicles **required to provide the service at full capacity**.

(2) Those personnel must be stationed at places that allow the ARFFS to respond to an emergency at least as quickly as required by the applicable standards and requirements.

CASA 139H MOS

20.1.2.5 When formulating staff numbers, consideration must be given to the type of aircraft using the aerodrome and the need for personnel for vehicle operation, to use handlines, ladders, and other rescue and firefighting operations **including command and control of fire ground as the combatant authority**.

ERDSS Chemical Companion Foam

The ERDSS database is used to show that ICAO's current minimums for agents required and discharge rates **are very conservative**. Australian Fire Services attending to a fuel pool fire would base their estimated agent and discharge requirements on the ERDSS data. They would also not then arbitrarily reduce that requirement by 1/3rd as ICAO do with the use of a .66 Practical Critical Area reduction. It also uses 6.5lpm per m2 as the critical application rate for Solberg RF6 and states in the guidance notes that fuels with a wide boiling range may require up to 8.1lpm per m2 critical application rate. Jet fuels fall into a classification known as a middle distillate and has a boiling range 205C to 300C. ERDSS is based on a total extinguishment and cooling time of 15 mins application, to ensure no reignition.

The Emergency Response Decision Support System (ERDSS) provides first responders with decision support for hazardous environments contaminated with chemical agents. This software tool, which operates on Windows and iOS, is provided free-of-charge to the military, law enforcement, and fire departments. Developed by Queensland Fire Emergency Services, Georgia Tech, Electro Optical Systems, CTTSO Combatting Terrorism Start up Office, TSWG Tactical Support Working Group.

This database provides scientifically valid and operationally sound advice on amounts of agents, and discharge rates required for dealing with major incidents including pool fires of non-polar fuels. In comparison with ICAO requirements the major difference besides the critical application rate increase is the amount of time for application recommended. The explanation provided for this is that a spill fire on a hard stand area has a very shallow depth. Because of this factor, unlike a deep pool fire that has been burning for a significant period there is less heat retention in the shallow fuel and so extra water for cooling the fuel is not as critical.

ERDSS Report based on a pool fire in the ICAO Theoretical Critical Areas for all categories of Aircraft:

Category TCA	Foam Required	Concentrate Required 6%	Discharge Rate
Cat 1 (9m x 14m)	12,280 litres	737.1litres	819 lpm
Cat 2 (12m x 14m)	16,380 litres	982.8 litres	1,092 lpm
Cat 3 (17m x 18m)	29,840 litres	1,790 litres	1,989 lpm
Cat 4 (21m x 24m)	49,140 litres	2,948 litres	3,276 lpm
Cat 5 (34m x 28m)	92,820 litres	5,569 litres	6,188 lpm
Cat 6 (35m x 39m)	133,100 litres	7,985 litres	8,872 lpm
Cat 7 (35m x 49m)	167,200 litres	10,030 litres	11,150 lpm
Cat 8 (37m x 61m)	220,100 litres	13,200 litres	14,670 lpm
Cat 9 (37m x 76m)	274,200 litres	16,450 litres	18,280 lpm
Cat 10 (38m x 90m)	333,400 litres	20,010 litres	22,230 lpm

It is also interesting to note that for a closer comparison using ICAO Q1&Q2 with the ERDSS discharge rate. Q1 is 22,230 litres (1 min application) and Q2 is 42,237 litres (190% of Q1) Under ERDSS the TCA for Category 10 requires 64,467 litres of agent very close to the NFPA requirement and the PCA requires 42,584 litres. More than 10,000 litres more than ICAO recommend.

Achieving effective ARFFS in a challenging economy (J. Kreckie 2011)

Practical considerations by an ARFFS expert.

In addition to the two primary regulators of ARFFS e.g. ICAO and the FAA, there are consensus standards that are provided to indicate a **'best practice'** in any number of categories. Many of the consensus standards developed by the **National Fire Protection Association (NFPA)** have been adopted or used as guidelines at various locations around the world.

Information from actual incidents in recent years indicated that with increased aircraft crash worthiness, **water for interior fire-fighting operations is also necessary**. This quantity of water (called Q3) is based on the need for hand lines to be used for interior firefighting.

ARFFS in Australia do not train to man the slides or assist the evacuation process. They state that the Airline crew are responsible for this. However, is this reasonable or practical? They may not even survive the crash or be capable due to injury.

Aircraft **evacuation is a critical event** during an aircraft emergency. The specific staffing required for ARFFS to assist in an aircraft evacuation is not referred to by ICAO or the FAA. In order to consider what the airport should provide in terms of staffing, an understanding of evacuation requirements, modelling and human factors should be studied.

Airport planners must consider in a practical application what type of assistance during evacuation satisfies the airport's intent during an emergency. Bear in mind that during an emergency, the area under the aircraft where the slides meet the ground is in the 'hot zone'. **Only trained, properly protected emergency responders should be allowed in the 'hot zone'**.

If a B-747 is to be evacuated of its 400 plus passengers and crew, and everything works correctly, 10 escape slides will be deployed. It is very clear that **injuries are likely to occur during evacuations**. Is it reasonable to staff the bottom of each slide with one person, assisting the passengers safely away

from the aircraft and directing them to a safe area of refuge? If not every slide, should the plan be to staff half of the slides? If so, which ones? If **the wind is blowing** and the **slides are being raised off the ground**, how many slides should be manned? How many people should be staffing a slide when a passenger leaps into it through the smoke?

The passenger demographics of today's typical flight are comprised of much more **diverse profiles of age, health and physical condition.** There are a percentage of passengers on **every flight** who would be **unable to evacuate** an aircraft in an emergency.

Airport operators, air carriers and regulators all strive to provide a product that is safe, efficient, attractive and affordable. Each strives to be seen as 'the best,' or ideally recognised as 'world class.' **Minimum standard has no correlation to 'world class.'**

Airservices Report: ARFF Operational Safety Review Workshop October 14th and 15th 2002 Rydges Eagle Hawk Canberra.

ICS and Communications were also the big issues found in this risk workshop conducted by senior ARFFS experts in 2002 during preparations for Category 10 operations. They recommended a fulltime SFC/Insp and used Sub Station Officers to supplement the command and control functions.

10. Overview of proposed ARFF requirements for introduction of Category 10 Airbus A380 (Very large Aircraft)

10.1 Staffing: Proposed requirements.

1 x SFC
1 x FC
2 x SOs
3 x SSOs
11 x LAFFs

Incident Control

The responsibility for Incident Control rests with the Police who should address media, traffic plans, security, general staging etc. This should free up the Senior Fire Commander and Fire Commander/s to deal with their responsibility as the Combat Authority and dedicate their resources to managing the aircraft accident site.

Management of the command post

All agreed that without timely representation by ARFF at the command post, ARFF operations would be dramatically affected.

Timing of the arrival of ARFF resources at the command post was given a great deal of attention. The real concern was that when the fire station manager was not available for immediate response that the coordination of oncoming services (outside agencies) was not controlled. The groups were then tasked with assessing the locations where an immediate response by a Senior Fire Commander was required.

The role of the SFC at the forward command post would:

- formally establish the authority under the Air Services Regulations of the ARFF as the combatant authority ("Officer-in-charge")
- ensure that local agencies are sent to the accident site in a controlled manner and at a rate that the Fire Commander can manage in building up his/her command structure through sectorisation.
- provide advice to the IC (Police) on the fireground situation.
- commence longer term planning (resources etc)
- monitor VHF Tower/Ground/MBZ frequencies to relieve the Fire Commander of that function.

For example: Sydney ARFF can expect a response from local brigades and other services within 13 to 20 minutes. Response by off duty SFC may be well outside this time. Therefore, the risk to ARFF operations is that the Police Incident Controller sends resources forward to the incident site BEFORE ARFF are in a position to manage those resources. This would then flood the incident site and overwhelm the command structure which then begins to fail.

The findings of both groups is that at least at major airports when the response to an aviation incident by emergency services is within the 13 min time frame, a dedicated SFC should be available to report to the command post in the first instance. This would be an additional diploma rated person within the current crew numbers.

ARFFS TRA Task Sheet Data:

TRA Task Sheet Category 10 DRV: (Current Model 4+13)

TRA Task Sheet Category 10: (3+11 no DRV)

TRA Task Sheet Category 10 No DRV crewing: (3+11 DRV part of Aviation Crew)

TRA Task Sheet Meeting All Effectiveness Objectives: NFPA 15 + TRA. (6+13 & dedicated FCC)

Summary:

The Task and Resource Analysis (TRA) Committee put together by the United Firefighters Union Aviation Branch contained serving and recently retired ARFFS experts with **over 299 years** of ARFFS operations experience. They represented a role and experience variation from Leading Firefighter right up to Deputy Chief Fire Officer. It also included several professional ARFFS training experts, and previous Fire Station Managers responsible for managing Category 10 ARFFS stations.

ARFFS TRA Committee made the following observations on the current ARFFS service delivery compared to all the recommendations in NFPA NFC 403, CAP 1150, ICAO Annexe 14 & ASM Part 1, and the FAA ARFFRWG paper.

ARFFS in Australia has not conducted a Task Resource Analysis as recommended by ICAO Annexe 14 and ASM Part 1.

The current embedded DRS or Perth Model for Category 10 staffing can potentially reduce the initial aviation response to only 2 officers and 9 firefighters for a Category 10 aircraft, this model would fail at operations beyond initial monitor work and response times.

- ARFFS in Australia has no dedicated Fire Control Centre Operator as required under ICAO ASM Pt1.
- ARFFS in Australia has less than Minimum Staffing as recommended by NFPA NFC 403 for all airport categories.
- ARFFS in Australia do not carry sufficient agent or output requirements under NFPA NFC 403 for Q1, Q2 and don't even consider Q3. The NFPA provides compelling operational and research-based arguments for providing Q3 agent for internal firefighting.
- ARFFS in Australia are barely compliant with ICAO Minimum Agent Quantity Requirements at all the larger category airports. (Cat 9-10) ARFFS in Australia use remission factor (allows less ARFFS staff & Agent to be provided) at many of the smaller but still critical risk airports (Cat 7-9).
- ARFFS in Australia use (RF6) Fluorine Free Foam (FFF) but make no considerations for its degraded performance in comparison to C6 or C8 foams as recognised by NFPA.
- NFPA NFC 403 recommends carrying significantly more agent if Fluorine Free Foam's are used, placing it in the same column as Fluro Protein in their table with a required critical application rate of 7.5lpm/m2.
- EDRSS Chemical Companion Software recommends 6.5lpm/m2 and an increase in discharge rates over the ICAO standards (11,200lpm). This is more in line with the NFPA requirements.
- ARFFS in Australia makes no consideration for extra agent and output for multi deck aircraft such as the B747 and A380. NFPA NFC 403 recommends carrying significantly more agent for fighting fires in Multi Deck aircraft.
- ARFFS in Australia makes no consideration for HRET technology or any kind of effective defensive operation. NFPA recommends 2 HRET for Cat 10 and 1 for all categories down to Cat 6.
- Australia has no fuselage piercing technology currently online.
- Australia ARFFS currently has no equipment to support precautionary disembarkation, and the current Airservices Airstairs project will not fix this issue or provide a safe working from heights solution for over 96% of the ARFFS service.
- Australia ARFFS has no contemporary rescue from heights capability despite regularly working at firefighting and rescue operations at heights greater than 8 metres. (Statistics show 50% of Working at Heights fatalities fall less than 3m)
- The ARFFS Local Operations Manager (LOM) is only available for ICS on duty 20% of the time without being called back. ARFFS allows the LOM up to a 90-minute call back time.
- There are two critical areas of incident control required; ARFFS Operations Officer in the Combat/Hot Zone controlling ARFFS operations. ARFFS Commander at the Forward Command Post liaising with arriving services and providing situational awareness and resource requirements to the Police Incident Controller.

- The ARFFS Fire Commander cannot be expected to do all this alone and be the fire ground safety officer, Entry Control officer (ECO) or commander for a sector of operations as well.

- No Government Radio Network (GRN) to allow direct communications between attending services due to recent ARFFS efficiency measures stopping the project. Some larger stations have bridging to Fire Services only. Air ground to ARO (Safety Officer) is available but relies on the training of the ARO, the Airport being closed, and ATC not using the frequency to warn or divert aircraft etc. Also broadcasts critical emergency operations on an open frequency.

- Brisbane Climate data realistic worst case in January is 33C with 63% humidity during the day. (Hot to Very Hot Range in AFFM-01 Heat Stress Chart)

- Australia ARFFS Firefighter Rehabilitation equipment is Ad-Hoc and not immediately available on scene and no extra staff are available to obtain it, set it up or operate it. Stored in either the station storage areas or some stations have provided a resource trailer.

- ARFFS policies and procedures as detailed in AFFM-01 Heat Related Conditions are unachievable with current staffing models. AFFM-01 states: 10-15-minute task rotations, 15-20 mins work followed by 20-30 min rests in the shade.

- It was also noted that some ARFFS SOP's & Policies like the Heat Related Conditions, Driving, CABA, Safety Officer, ICS all look good in isolation but are unachievable in the context of an operational deployment with current staff numbers.

- CASA should validate existing staffing models utilising the ARFFS training establishment in Melbourne to simulate a realistic fully involved crash scenario using realistic response times for supporting emergency services.

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United Firefighters Union Australia (Aviation Branch)

Task Resource Analysis Brisbane Airport Scenario:

Considerations:

The worst plausible incident for Brisbane Airport would always involve an Airbus A380. The Airbus A380 flies into Brisbane twice a day and departs twice a day (4 movements). That means currently there are 1460 movements in and out of Brisbane per annum.

EK435 Departure 21:00 local

Arrival 19:10 local

EK434 Departure 08:10 local

Arrival 06:25 local

The Airbus A380 is the largest passenger airliner flying with several significant challenges for an ARFF response. First of all is the overall size of the aircraft.

Overall length	72.72 m
Cabin length	49.90 m
Fuselage width	7.14 m
Cabin width	
Main deck:	6.5 m
Upper deck:	5.8 m
Wing span	79.75 m
Height	24.09 m
Door Sill Height:	8m (upper)

The other features that make this aircraft very difficult for an ARFF team is the multiple decks with a floor height of 8m for the upper deck. This significantly complicates any rescue or firefighting operations for persons trapped on the top deck.

It should also be noted that Safe Working from Heights considerations are applied under WHS regulation at any workplace where there is the risk of falls and specifically where there are portable ladders in use. Over a 12-year period ending in 2013 there were 359 workers killed following a fall from a height. Half of these falls involved **falling three metres or less**. So, making entry or exit for

firefighting our rescue purposes from any of the larger passenger aircraft places firefighters at serious safety risk from working at heights.

The aircraft is also 25% by weight Advanced composite materials. To put this in perspective the aircraft weighs 369 tonnes empty so that equates to over 92 tonnes of advanced composite materials broken up and burnt all over the aviation firefighter's workplace. The entire work site is now a hazardous materials incident.

The aircraft has a range of 15,200 km and the four massive engines are supplied with up to 320,000 litres of fuel on board. This presents an extraordinarily high-risk environment with extreme fuel loads, fire risk, explosion risk and hazardous and carcinogenic chemical exposure risk. (See MSDS for Jet A1).

It can also carry 13 pallets of cargo in its 184 m3 cargo holds. Cargo can range from standard cargo and baggage to Hazardous Substances or Chemicals and/or Radioactive materials. There can also be livestock or Pets on board as well as mail and high value items.

Emirates A380 flies in a three-class configuration with 517 passenger seats total and 31 crew members so potentially 548 souls on board. 90% loading then would see 465 passengers. The seats and other furnishings within the aircraft as well as lubricants, hydraulic fluids, anti-icing chemicals, oxygen, oxygen generators, batteries, lithium batteries and ballast all add risk and fuel to the scenario. Significant toxic smoke is generated creating a rapidly lethal environment that the firefighters are expected to work in.

Brisbane to Dubai is 11,986 km which is around 79% of this aircrafts range. So, we could expect the fuel load to be over the 250,000 Litre mark.

Two of these aircrafts movements coincide with heaviest peak vehicle traffic times for Brisbane roads. The third is tapering off traffic wise except for Fridays when the Brisbane to Sunshine Coast exodus creates serious traffic issues. Also, any major events playing at the Brisbane Entertainment Centre can cause significant traffic issues on the Gateway Arterial Road.

The last A380 movement of the night ETD 21:00, is the one most likely not to have serious traffic delays for the support services. Given that it would be simply guess work to estimate the arrival times of supporting services during peak traffic times we have decided to use the movement least effected by traffic,

Brisbane has some significant difficult terrain within the airport boundary. This is tidal marshes directly at the end of the main runway. The surrounds of the airport are also covered in Mangroves around the fringes of Moreton bay, Schultz canal, Boggy Creek and the extensive airport drains network. Again, the variable of including these as the worst probable location would make it impossible to accurately forecast the delays and complications experienced by the attending crews. It would vary from having to use full crash remote procedures only to a compromised less than optimum positioning and access.

Because of this we will use the most likely area for crashes to occur based on the NFPA 403 Rapid Response Area (RRA) and Critical Rescue and Fire Fighting Access Area (CRFFAA) where historically 85% of all aircraft accidents occur.

Brisbane climate has long periods of significant heat and humidity. It would be expected that at 21:00 this risk is diminished significantly. However, in most accident scenarios the capacity of ARFFS firefighters to keep working hard in extreme and stressful conditions without succumbing to heat

stress or illness is also a serious consideration for staff numbers. The recent Emirates B777 crash highlighted this risk with multiple firefighters (8) succumbing to heat stress, and two injured in an explosion. With current ARFFS staffing Brisbane would have only 4 staff left operational.

Scenario:

A380 departing Brisbane for Dubai on Main Runway heading 01 taking off towards Moreton Bay 21:00 (local). POB 465, nil dangerous cargo

Airbus A380 Aircraft Rejected Take-Off

Time 21:00 Crashes Overshoot Runway 01

POB: 465 Crew 30 Total 495 Souls (90% load)

Fuel: 265,000 litres

Problem: Incorrect input into flight computer (as per Melbourne Emirates B777 scenario)

Dangerous Goods: NIL

Cargo: 10 pallets ordinary cargo and baggage. Livestock (pets) and mail

Final Location: 200m into overshoot runway 01 (statistically most likely)

Aircraft Crash Conditions: Fully involved ground fire port side, ground fire rear of wing starboard side, fuel tanks ruptured, undercarriage collapsed, wind moderate from the North favouring the Port (Critical) side.

Evacuation in progress Starboard side forward exits.

TRA will be conducted using the following ARFFS resources:

- Category 10 Staffing: 3 Officers 11 Firefighters (ULFV x 4 + no DRV)
- Perth Hybrid Model Staffing: 3 Officers 11 Firefighters (ULFV x 4, Integrated DRV)
- Category 10 Staffing: 4 Officer 13 Firefighters (ULFV x 4 + dedicated DRV & Crew)
- NFPA NFC 403 Minimum Staffing Index A: (Category 9&10) 15 staff minimum + a TRA.

TRA Conclusion:

UFUA supported acceptable, effective and safe ARFFS staffing.

The leanest model found to support a cat 10 operation consisted of 19 Fire Staff and a dedicated Watchroom attendant to support ICS and logistics.

This is provided by an on-duty Inspector (ICS), 5 Officers and 13 Firefighters. It includes a minimum of 4 ULFV, 1 DRV, 1 ASV (Airstairs), 1 Insp Vehicle (ICV).

This is very similar to the original Risk Assessment conducted by ARFFS which also included a fulltime senior fire commander being on duty 24/7. This assessment recommended 18 staff which included 4 officers and 14 firefighters.

Task Resource Analysis: Brisbane ARFF (Cat 10 No DRV)

Time	Task (4 ULFV 3+11)	T1 (FC) MFS	T1 (Dr) MFS	T1 (Op) MFS	T1 (Br) MFS	T2 (SO) SFS	T2 (Dr) SFS	T2 (Op) SFS	T3 (SO) MFS	T3 (Dr) MFS	T3 (Op) MFS	T3 (Br) MFS	T4 (Dr) MFS	T4 (Op) FCC1	T4 (Br) FCC2
21:00	FCC/ATC Activate Crash Alarm														X
	Crash response message broadcast over PA all crew respond.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3 minutes ARFFRWG: 3 Minutes Begin Discharge of Required Agent from First required Vehicle (Passed)															
21:01	4 vehicles 14 crew departed both stations MEX response times 45-75 secs.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
21:02	All vehicles on scene arrival, Tenders 1&2 take up tactical positions on nose front quarters. Tenders 3&4 commence mobile operations. Rear quarters and protect evacuation and slides.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4 minutes ARFFRWG: Begin Discharge of required agent from all other required vehicles. (Passed) Establish Incident Command (ICS) and request additional resources. (Partial FC Combat zone ARFFS only) Initiate access to aircraft cabin. (Failed) Note that no DRV means Branch Persons required for CABA operations which requires the ULFV to stop Mobile Operations to allow them to leave the vehicle and prepare for entry and fire attack, interferes with mobile ops need to prioritise actions.															
21:04	1 x Aerodrome Reporting Officer (ARO) on scene ARO is the Airport Safety Officers. 1 x Aerodrome Reporting Officer at the Airside Inspection Point.														
21:04	FC, SO & 3X Br out of vehicles don PPE. FC continues size up. 2 X Br clear persons and injured to safety, support evacuation and slides. Combat area and casualty clearing zones nominated by FC. 1 X Br runs out attack line. Sectors Forward (FC) and Rear (SO T3) nominated Sector Commanders. No CABA being worn (Rely on Foam Blanket for CF suppression)	X			X	X						X			X

Task Resource Analysis: Brisbane ARFF (Cat 10 No DRV)

Time	Task (4 ULFV 3+11)	T1 (FC) MFS	T1 (Dr) MFS	T1 (Op) MFS	T1 (Br) MFS	T2 (SO) SFS	T2 (Dr) SFS	T2 (Op) SFS	T3 (SO) MFS	T3 (Dr) MFS	T3 (Op) MFS	T3 (Br) MFS	T4 (Dr) MFS	T4 (Op) FCC1	T4 (Br) FCC2
5 minutes ARFFRWG, NFPA & ICAO RFFP-9: Begin interior aircraft rescue and firefighting. (Failed) Establish Rapid Intervention Team (RIT) (Failed) Achieve 90% Knock Down of the critical area (ICAO/NFPA) in one minute (Passed)															
21:05	QPS Hendra Police Station arrive at the Airside Inspection Point. 1 senior officer, 4 constables and 3 cars. AFP arrival at the Airside Inspection Point 3x police cars 5 staff.														
21:05	FC completes full size up and establishes control point to the combat area. FC assumes the Fireground Safety Officer and initial IC Role.	X													
21:05	Operators Tender 1&2 out of vehicle don PPE and CABA. SO T2 dons PPE and CABA			X		X		X							
21:05	Drivers T1,2,3 &4 Operators T3&4 continue to operate primary and secondary monitors. SO controls T3&4 mobile ops rear sector. Sitrep to FC.		X				X		X	X	X		X	X	
21:06	2x Br acquire and pitch 7M ladder to the L1 door				X							X			
6 mins ARFFRWG: Initiate Second Access to aircraft cabin. (Failed) Establish second interior aircraft rescue and firefighting team. (Failed) Establish emergency medical services. (Failed) Establish water supply. (Failed) ARFFS has no water supply arrangements minimum agent quantities carried and then rely on a shuttle of water from a designated hydrant that meets 30lps output. All Fire in practical critical area extinguished 1 min after control achieved. (Failed)															
21:06	QAS North Gate Arrive at the Airside Inspection Point. 2 Ambulances, 1 Senior Officer Vehicle, 5 paramedics.														
21:06	First CABA fire attack and rescue team donned and started up. CABA team nominated Internal sector SO in charge.			X		X		X							
21:06	Initial Attack line charged under control L1 for mid deck entry.		X												X

Task Resource Analysis: Brisbane ARFF (Cat 10 No DRV)

Time	Task (4 ULFV 3+11)	T1 (FC) MFS	T1 (Dr) MFS	T1 (Op) MFS	T1 (Br) MFS	T2 (SO) SFS	T2 (Dr) SFS	T2 (Op) SFS	T3 (SO) MFS	T3 (Dr) MFS	T3 (Op) MFS	T3 (Br) MFS	T4 (Dr) MFS	T4 (Op) FCC1	T4 (Br) FCC2
21:06	All vehicles back to Tactical positions on the nose of the aircraft. Tender 4 nearly empty. Tender 3 less than ¼ tank. Tenders 1&2 just on ¼ tank.		X				X		X	X	X		X	X	
21:06	Back up line and 2 x FB10X lines ordered from Tenders 1&2. Tender 3 to attack stubborn fire/hot spot around U/C port side, secondary monitor/DCP/Attack line CABA sets required (Carbon Fibres)	X							X	X	X			X	X
21:07	QFES Hendra arrive at the Airside Inspection point. 1 Aerial, 1 Pumper, 6 Firefighters. (2000 litres water 120 litres RF6 Foam)														
21:07	Tender 4 with driver only sent to SFS for replenishment of water. (against SOP)	X											X		
21:07	First CABA team (1SO & 2FF) open the L1 door, hose aloft and tie off hose and ladder, make entry L1, fire and heavy smoke present. SitRep to FC. Stage One CABA control board in use. (T1 Dr)	X	X	X		X		X							
21:08	ARO at Airside Inspection point briefs the first arriving support crews in preparation for escort. Form up convoy and supported by AFP with Airside roads drivers permit.														
8 minutes ARFFRWG: Establish third interior aircraft rescue firefighting team. (Failed) Establish second rapid intervention team. (Failed) Resupply required ARFF Vehicles. (Failed) Provide Stationary vertical access to aircraft. (Failed)															
21:08	QAS Kedron Park arrive at the Airside Inspection Point and join first convoy. 2 Ambulances 4 Paramedics														
First arriving support teams at AIP consists of: 1 Pumper 1 aerial (6 firefighters) 3 QPS police cars (5 QPS officers) 5 ambulances (9 paramedics) 3 AFP cars (7 AFP Officers)															

Task Resource Analysis: Brisbane ARFF (Cat 10 No DRV)

Time	Task (4 ULFV 3+11)	T1 (FC) MFS	T1 (Dr) MFS	T1 (Op) MFS	T1 (Br) MFS	T2 (SO) SFS	T2 (Dr) SFS	T2 (Op) SFS	T3 (SO) MFS	T3 (Dr) MFS	T3 (Op) MFS	T3 (Br) MFS	T4 (Dr) MFS	T4 (Op) FCC1	T4 (Br) FCC2
21:08	Second ARFF CABA team ordered to don sets. Dedicated ECO now required.				X							X			
21:09	Casualties removed to doorway L1 R1 by Internal sector														
21:10	First Convoy of support services departs the Airside Inspection Point under escort.														
Distance from Chloris St Airside Inspection Point (AIP) to crash site is 3.5km in a direct line. Convoy under escort needs to cross Domestic Apron and cross the Main runway (01/19) to the Eastern Perimeter Rd or take the taxiways through to the Cross Runway (14/32). Conservative ETA at FCP 5 mins.															
21:12	ARO on scene liaises with the FC and establishes the Forward Command post. Depending on access and staffing 1 x AFP vehicle may also arrive on scene to the FCP. FCP and staging may be set up on Cross Runway or Perimeter Rd.														
21:13 **Windsor QFES One Pumper arrives at AIP next due is Kemp Place two pumpers 14-15 mins response times depending on route taken, then Taigum and Cannon Hill One Pumper each with 16 mins response times then Chermside QFES One Pumper 17-18 mins. Note all times provided by QFES Firecom are approximate from station no traffic delays.**															
21:15	First Convoy arrives at FCP														

Synopsis: At this point in time this incident has reached several pinch points and the ARFFRWG suggested timing of significant milestones has not been able to be reached. The Main Issues impacting this incident now are:

Task Resource Analysis: Brisbane ARFF (Cat 10 No DRV)

- The imminent arrival of supporting resources requires the Fire Commander to report to the Forward Command Post to assume the Operations Officer role of the Combat Authority and Hand Over the Overall Incident Commander role to the Senior Police Officer on scene, leaving only two officers on scene to control ARFFS operations.
- FC is the combat zone Safety Officer as well as the Operations Officer and forward Sector Commander that has the operations action plan in their head and this critical member is now required to leave the combat zone to brief other agencies.
- No GRN with common frequency to allow communications with the FCP or the Police IC to facilitate remote SITREP and Hand Over.
- The Support Agencies will need a detailed situation report on the status and priority of issues requiring attention.
- The Support Agencies will need a detailed safety briefing including no go areas and location of casualty clearance areas and control points.
- The two remaining officers in the combat zone: one internal and one external now have insufficient resources. Internal 1+2 to control a massive internal space with high fire load, three levels (2 decks & cargo) and multiple casualties. A second CABA team is readying to make entry. External Officer has 1+8 with a 9th firefighter in Tender 4 replenishing. Outside the safe span of control.
- Tender 3 is nearly empty.
- Tenders 1&2 are less than ¼ full and providing water to internal attack, back up line and 2 x FB10X branches mopping up.
- Second attack line and back up required for second CABA team.
- No casualty or survivor assistance has been rendered or even crowd control initiated.
- No Rapid Intervention Team is ready.
- No Second CABA team inside or Entry Control Officer appointed.
- No check of Avionics or cargo bays.
- No check of the upper deck, no safe external upper deck access or egress for firefighters.
- The arrival of the supporting services will assist with control the survivors and treatment of the casualties.
- The arrival of the Aerial will provide safe access and egress to Mid and Upper Decks. (+8-10mins from arrival 21:25 approx)
- The arrival of the Pumper will provide some water for Tender 1 to make it just above half. (2000litres)
- QFES Second Wave will provide 6 pumpers and 12,000 litres. (arriving on crash scene under escort sometime after 21:23)
- The arrival of the QFES officer and firefighters will allow for an RIT and an ECO to be set up.

Task Resource Analysis: Brisbane ARFF (Perth Model)

Time	Task (4 ULFV & 1DRV 3+11 crew)	T1 (FC) MFS	T1 (Dr) MFS	T1 (Op) MFS	T1 (Br) MFS	T2 (Dr) MFS	T2 (Op) MFS	T3 (SO) SFS	T3 (Dr) SFS	T3 (Op) SFS	T4 (Dr) FCC2	T4 (Op) FCC1	DRV (SO) MFS	DRV (Dr) MFS	DRV (Op) MFS
21:00	FCC/ATC Activate Crash Alarm											X			
	Crash response message broadcast over PA all crew respond.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3 minutes ARFFRWG: 3 Minutes Begin Discharge of Required Agent from First required Vehicle (Passed)															
21:01	4 ULFV & 1 DRV with 14 crew departed both stations MEX response times 45-75 secs.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
21:02	All vehicles on scene arrival, Tenders 1&2 take up tactical positions on nose primary and secondary monitor attack front quarters. Tenders 3&4 commence mobile operations working around the wings to the rear quarters and protect evacuation and slides with primary and secondary monitors. DRV positioned not to interfere with ULFV operations and pre-determined as CABA internal operations crew.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4 minutes ARFFRWG: Begin Discharge of required agent from all other required vehicles. (Passed) Establish Incident Command (ICS) and request additional resources. (Partial FC combat zone ARFFS only) Initiate access to aircraft cabin. (Passed) CABA crew 1 SO and 2 FF's from DRV can initiate getting ready in PPE and commence donning CABA, no ladder or attack/backup lines prepared at this time.															
21:04	1 x Aerodrome Reporting Officer (ARO) on scene ARO is the Airport Safety Officers. 1 x Aerodrome Reporting Officer at the Airside Inspection Point.														
21:04	FC, SO & 3X FFs out of vehicles (T1 & DRV) don PPE. FC continues size up. 1 X Br (T1) clear persons and injured to safety, support evacuation and slides. Combat (Hot) zone and casualty clearing zones nominated by FC. 1 X Br protected by monitor operators while clearing casualties and assisting evacuation, clearing passengers from the fireground. No CABA being worn (Rely on Foam Blanket for CF suppression)	X			X								X	X	X
5 minutes ARFFRWG, NFPA & ICAO RFFP-9: Begin interior aircraft rescue and firefighting. (Failed) Establish Rapid Intervention Team (RIT) (Failed) Not enough staff available to prepare ladder or attack lines to meet this objective. (DRV crew still completing donning PPE and CABA) Achieve 90% Knock Down of the critical area (ICAO/NFPA) in one minute (Passed)															

Task Resource Analysis: Brisbane ARFF (Perth Model)

Time	Task (4 ULFV & 1DRV 3+11 crew)	T1 (FC) MFS	T1 (Dr) MFS	T1 (Op) MFS	T1 (Br) MFS	T2 (Dr) MFS	T2 (Op) MFS	T3 (SO) SFS	T3 (Dr) SFS	T3 (Op) SFS	T4 (Dr) FCC2	T4 (Op) FCC1	DRV (SO) MFS	DRV (Dr) MFS	DRV (Op) MFS
21:05	QPS Hendra Police Station arrive at the Airside Inspection Point. 1 senior officer, 4 constables and 3 cars. AFP arrival at the Airside Inspection Point 3x police cars 5 staff.														
21:05	FC completes full size up and establishes control point to the combat area. Nominates sectors: Internal CABA, Forward and Rear sectors SO in DRV Internal Sector SO in T3 Rear Sector, FC Forward Sector commanders. FC assumes the Fireground Safety Officer and initial IC Role.	X						X					X		
21:05	Operators Tender 1&2 out of vehicle don PPE run attack line for CABA Operations. DRV Driver & Operator in CABA acquire ladder for entry L1 door, SO DRV in CABA prepares TIC and Control Board/Timer Sit Rep to FC			X			X						X	X	X
21:05	Drivers T1,2,3 &4 Operators T3&4 continue to operate primary and secondary monitors. SO T3 controls T3&4 mobile ops at rear sector. Sitrep to FC.		X			X		X	X	X	X	X			
21:06	2x Operators T3&T4 out of vehicle to assist casualty clearance, slides and passenger support evacuation from danger area.									X		X			
6 mins ARFFRWG: Initiate Second Access to aircraft cabin. (Failed) Establish second interior aircraft rescue and firefighting team. (Failed) Establish emergency medical services. (Failed) Establish water supply. (Failed) ARFFS has no water supply arrangements minimum agent quantities carried and then rely on a shuttle of water from a designated hydrant that meets 30lps output. (ICAO/NFPA) All Fire in practical critical area extinguished 1 min after control achieved. (Failed)															
21:06	QAS North Gate Arrive at the Airside Inspection Point. 2 Ambulances, 1 Senior Officer Vehicle, 5 paramedics.														
21:06	First CABA fire attack and rescue team donned and commenced starting up. Ladder and attack line ready at L1, CABA team nominated Internal sector SO DRV in charge. 90% external knockdown/control achieved. Ready to make entry.												X	X	X
21:06	Initiate back up line for L1 attack line.			X			X								
21:06	All vehicles return back to Tactical positions on the nose of the aircraft. Tender 4 nearly empty. Tender 3 less than ¼ tank.		X			X			X		X				

Task Resource Analysis: Brisbane ARFF (Perth Model)

Time	Task (4 ULFV & 1DRV 3+11 crew)	T1 (FC) MFS	T1 (Dr) MFS	T1 (Op) MFS	T1 (Br) MFS	T2 (Dr) MFS	T2 (Op) MFS	T3 (SO) SFS	T3 (Dr) SFS	T3 (Op) SFS	T4 (Dr) FCC2	T4 (Op) FCC1	DRV (SO) MFS	DRV (Dr) MFS	DRV (Op) MFS
	Tenders 1&2 just on ¼ tank. Drivers Sit Rep to FC, DRV can supply extra 2000 litres to T3.														
21:06	FC orders 2 x FB10x lines from Tenders 1&2. Tender 3 SO to organise attack stubborn fire/hot spot around U/C port side, secondary monitor/DCP/Attack line CABA sets required (Carbon Fibres risks)	X						X	X	X					
21:07	QFES Hendra arrive at the Airside Inspection point. 1 Aerial, 1 Pumper, 6 Firefighters. (2000 litres water 120 litres RF6 Foam)														
21:07	Tender 4 with driver only sent to SFS for replenishment of water. (Note against driving SOP)										X				
21:07	First CABA team (1SO & 2FF DRV) open the L1 door, hose aloft and tie off hose and ladder, make entry L1, fire and heavy smoke present. SitRep to FC. Stage One CABA control board in use. (T1 Dr to complete tallies and time out sit rep to FC)	X	X										X	X	X
21:08	ARO at Airside Inspection point briefs the first arriving support crews in preparation for escort. Form up convoy and supported by AFP with Airside roads drivers permit.														
8 minutes ARFFRWG: Establish third interior aircraft rescue firefighting team. (Failed) Establish second rapid intervention team. (Failed) Resupply required ARFF Vehicles. (Failed) Provide Stationary vertical access to aircraft. (Failed)															
21:08	QAS Kedron Park arrive at the Airside Inspection Point and join first convoy. 2 Ambulances 4 Paramedics														
First arriving support teams at AIP consists of: 1 Pumper 1 aerial (6 firefighters) 3 QPS police cars (5 QPS officers) 5 ambulances (9 paramedics) 3 AFP cars (7 AFP Officers)															
21:08	Second ARFF CABA team ordered to don sets. Dedicated ECO now required.				X							X			
21:09	Casualties removed to doorway L1 R1 by Internal sector CABA crew														

Task Resource Analysis: Brisbane ARFF (Perth Model)

Time	Task (4 ULFV & 1DRV 3+11 crew)	T1 (FC) MFS	T1 (Dr) MFS	T1 (Op) MFS	T1 (Br) MFS	T2 (Dr) MFS	T2 (Op) MFS	T3 (SO) SFS	T3 (Dr) SFS	T3 (Op) SFS	T4 (Dr) FCC2	T4 (Op) FCC1	DRV (SO) MFS	DRV (Dr) MFS	DRV (Op) MFS
21:10	First Convoy of support services departs the Airside Inspection Point under escort. Note Windsor QFES Stn next available with 13 min response times.														
Distance from Chloris St Airside Inspection Point (AIP) to crash site is 3.5km in a direct line. Convoy under escort needs to cross Domestic Apron and cross the Main runway (01/19) to the Eastern Perimeter Rd or take the taxiways through to the Cross Runway (14/32). Conservative ETA at FCP 5 mins.															
21:12	ARO on scene liaises with the FC and establishes the Forward Command post. Depending on access and staffing 1 x AFP vehicle may also arrive on scene to the FCP. FCP and staging may be set up on Cross Runway or Perimeter Rd.														
21:13 **Windsor QFES One Pumper arrives at AIP next due is Kemp Place two pumpers 14-15 mins response times depending on route taken, then Taigum and Cannon Hill One Pumper each with 16 mins response times then Chermside QFES One Pumper 17-18 min response. Note all times provided by QFES Firecom are approximate from station no traffic delays.**															
21:15	First Convoy arrives at FCP														

Synopsis: At this point in time this incident has reached several pinch points and the ARFFRWG suggested timing of significant milestones has not been able to be reached. The Main Issues impacting this incident now are:

- The imminent arrival of supporting resources requires the Fire Commander to report to the Forward Command Post to assume the Operations Officer role of the Combat Authority and Hand Over the Overall Incident Commander role to the Senior Police Officer on scene, leaving only two officers on scene to control ARFFS operations.
- FC is the combat zone Safety Officer as well as the Operations Officer that has the operations action plan in their head and this critical member is now required to leave the combat zone to brief other agencies.

Task Resource Analysis: Brisbane ARFF (Perth Model)

- No GRN with common frequency to allow communications with the FCP or the Police IC to facilitate remote SITREP and Hand Over.
- The Support Agencies will need a detailed situation report on the status and priority of issues requiring attention.
- The Support Agencies will need a detailed safety briefing including no go areas and location of casualty clearance areas and control points.
- The two remaining officers in the combat zone: one internal and one external now have insufficient resources. Internal 1+2 to control a massive internal space with high fire load, three levels (2 decks & cargo) and multiple casualties. A second CABA team is readying to make entry. External Officer has 1+8 with a 9th firefighter in Tender 4 replenishing. Outside the safe span of control.
- Tender 3 is nearly empty.
- DRV is now able to supply extra 2000 litres of agent and better facilitates the initial CABA internal attack crew gaining entry.
- Tenders 1&2 are less than ¼ full and providing water to internal attack, back up line and 2 x Fb10x branches mopping up.
- Second attack line and back up required for second CABA team.
- No casualty or survivor assistance has been rendered or even crowd control initiated.
- No Rapid Intervention Team is ready.
- No Second CABA team inside or Entry Control Officer appointed.
- No check of Avionics or cargo bays.
- No check of the upper deck, no safe external upper deck access or egress for firefighters.
- The arrival of the supporting services will assist with control of the survivors and treatment of the casualties.
- The arrival of the Aerial will provide safe access and egress to Mid and Upper Decks. (+8-10mins from arrival 21:25 approx)
- The arrival of the Pumper will provide some water for Tender 1 to make it just above half. (2000litres)
- QFES Second Wave will provide 6 pumpers and 12,000 litres. (arriving on crash scene under escort sometime after 21:23)
- The arrival of the QFES officer and firefighters will allow for an RIT and an ECO to be set up.

Task Resource Analysis: Brisbane ARFF Cat 10 DRV (4+13)

Time	Task (4 ULFV & 1DRV 4+13 crew)	T1 (FC) MFS	T1 (Dr) MFS	T1 (Op) MFS	T1 (Br) MFS	T2 (SO) MFS	T2 (Dr) MFS	T2 (Op) MFS	T2 (Br) MFS	T3 (SO) SFS	T3 (Dr) SFS	T3 (Op) SFS	T4 (Br) MFS	T4 (Dr) FCC2	T4 (Op) FCC1	DRV (SO) MFS	DRV (Dr) MFS	DRV (Op) MFS
21:00	FCC/ATC Activate Crash Alarm														X			
	Crash response message broadcast over PA all crew respond.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3 minutes ARFFRWG: 3 Minutes Begin Discharge of Required Agent from First required Vehicle (Passed)																		
21:01	4 ULFV & 1 DRV with 17 crew departed both stations MEX response times 45-75 secs.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
21:02	All vehicles on scene arrival, Tenders 1&2 take up tactical positions on nose primary and secondary monitor attack front quarters. Tenders 3&4 commence mobile operations working around the wings to the rear quarters and protect evacuation and slides with primary and secondary monitors. DRV positioned not to interfere with ULFV operations and pre-determined as CABA internal operations crew.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4 minutes ARFFRWG: Begin Discharge of required agent from all other required vehicles. (Passed) Establish Incident Command (ICS) and request additional resources. (Passed) FC has 3 SO's to use as sector commanders and concentrate on overall size up and action plan. Initiate access to aircraft cabin. (Passed) CABA crew 1 SO and 2 FF's from DRV can initiate getting ready in PPE and commence donning CABA. Ladder and attack lines can also be prepared at this time using the 3 Branch Persons. Note: Current ARFFS practice does not include the 5 mins entry time criteria. ARFFS staff would need to include this as part of their training and practice it regularly to become proficient in meeting this timing however if practiced it is achievable.																	
21:04	3 x Branch Persons out Don PPE report to FC available to provide attack line, Ladder and to support Evacuation from T1. DRV crew Ready to Don PPE and CABA as initial internal attack.	X			X				X				X			X	X	X
21:04	1 x Aerodrome Reporting Officer (ARO) on scene ARO is the Airport Safety Officers. 1 x Aerodrome Reporting Officer at the Airside Inspection Point.																	

Time	Task (4 ULFV & 1DRV 4+13 crew)	T1 (FC) MFS	T1 (Dr) MFS	T1 (Op) MFS	T1 (Br) MFS	T2 (SO) MFS	T2 (Dr) MFS	T2 (Op) MFS	T2 (Br) MFS	T3 (SO) SFS	T3 (Dr) SFS	T3 (Op) SFS	T4 (Br) MFS	T4 (Dr) FCC2	T4 (Op) FCC1	DRV (SO) MFS	DRV (Dr) MFS	DRV (Op) MFS
21:04	FC continues size up. 3 X Br (T1) Preparing Attack line (1 line 3 lengths, 38mm, TFT Mid-Matic) and 7m ladder for internal firefighting and rescue crew. Combat (Hot) zone and casualty clearing zones all nominated by FC. 3 X Br protected by monitor operators while erecting ladder and laying attack line. No CABA being worn at this point relying on Foam Blanket for CF suppression and remaining out of smoke.	X			X				X				X						
5 minutes ARFFRWG, NFPA & ICAO RFFP-9: Begin interior aircraft rescue and firefighting. (Partial) Establish Rapid Intervention Team (RIT) (Failed) Not enough staff available to prepare ladder, attack lines, support mobile monitor operations and to meet this RIT objective. (DRV crew completed donning PPE and CABA) Achieve 90% Knock Down of the critical area (ICAO/NFPA) in one minute (Passed)																		
21:05	QPS Hendra Police Station arrive at the Airside Inspection Point. 1 senior officer, 4 constables and 3 cars. AFP arrival at the Airside Inspection Point 3x police cars 5 staff.																	
21:05	FC completes full size up and establishes control point to the combat area. Nominates sectors: Internal CABA, Forward and Rear sectors SO in DRV Internal Sector, SO in T3 Rear Sector, SO in T2 Forward Sector commanders. FC assumes the Fireground Safety Officer and initial IC Role.	X				X				X						X		

Task Resource Analysis: Brisbane ARFF Cat 10 DRV (4+13)

Time	Task (4 ULFV & 1DRV 4+13 crew)	T1 (FC) MFS	T1 (Dr) MFS	T1 (Op) MFS	T1 (Br) MFS	T2 (SO) MFS	T2 (Dr) MFS	T2 (Op) MFS	T2 (Br) MFS	T3 (SO) SFS	T3 (Dr) SFS	T3 (Op) SFS	T4 (Br) MFS	T4 (Dr) FCC2	T4 (Op) FCC1	DRV (SO) MFS	DRV (Dr) MFS	DRV (Op) MFS
21:05	Operators Tender 1&2 out of vehicle don PPE run foam hand line (1 line, 2 lengths 50mm) for FB10X. (also available as back up line) DRV SO, Driver & Operator in CABA safety checks, prepares TIC and Control Board/Timer Sit Rep to FC begin entry. Mid deck smoke showing visible, fire tail end, smoke venting out open exits.			X				X								X	X	X
21:05	Drivers T1,2,3 &4 Operators T3&4 continue to operate primary and secondary monitors. SO T3 controls T3&4 mobile ops at rear sector. Sitrep to FC.		X				X			X	X	X		X	X			
21:06	2x Operators T3&T4 out of vehicles to provide second CABA team.											X			X			
6 mins ARFFRWG: Initiate Second Access to aircraft cabin. (Partial) Establish second interior aircraft rescue and firefighting team. (Partial) Establish emergency medical services. (Failed) Establish water supply. (Failed) ARFFS has no water supply arrangements minimum agent quantities carried and then rely on a shuttle of water from a designated hydrant that meets 30lps output. (ICAO/NFPA) All Fire in practical critical area extinguished 1 min after control achieved. (Failed)																		
21:06	QAS North Gate Arrive at the Airside Inspection Point. 2 Ambulances, 1 Senior Officer Vehicle, 5 paramedics.																	
21:06	First CABA fire attack and rescue team made entry commenced rescue and firefighting at L1, CABA team nominated Internal sector SO DRV in charge.															X	X	X
21:06	Initiate back up line as second attack line for L1.			X				X										
Time	**Task (4 ULFV & 1DRV 4+13 crew)**	**T1 (FC) MFS**	**T1 (Dr) MFS**	**T1 (Op) MFS**	**T1 (Br) MFS**	**T2 (SO) MFS**	**T2 (Dr) MFS**	**T2 (Op) MFS**	**T2 (Br) MFS**	**T3 (SO) SFS**	**T3 (Dr) SFS**	**T3 (Op) SFS**	**T4 (Br) MFS**	**T4 (Dr) FCC2**	**T4 (Op) FCC1**	**DRV (SO) MFS**	**DRV (Dr) MFS**	**DRV (Op) MFS**
21:06	All vehicles return back to Tactical positions on the nose of the aircraft. Tender 4 nearly empty. Tenders 1,2&3 also under ¼ tank. Drivers Sit Rep to FC, DRV can supply extra 2000 litres to T1 to supplement internal firefighting operations.		X				X				X			X				
21:06	FC orders second FB10x hand line from Tender 2. Tender 3 SO to organise attack stubborn fire/hot spot around U/C port side, secondary monitor/DCP/Attack line. FC nominates Safety zones set up for firefighters in CABA sets only required for Carbon Fibres risks.	X		X				X		X	X	X						
21:07	QFES Hendra arrive at the Airside Inspection point. 1 Aerial, 1 Pumper, 6 Firefighters. (2000 litres water 120 litres RF6 Foam)																	
21:07	Tender 4 with driver only sent to SFS for replenishment of water. (Note against driving SOP) Approx time 17 mins see report.													X				
21:07	Second CABA team (2FF) make entry at the L1 door, hose aloft and tie off hose and ladder, make entry L1, fire and heavy smoke present. SitRep to FC. Stage One CABA control board in use. (T1 Dr to complete tallies and time out sit rep to FC)	X	X															
21:08	ARO at Airside Inspection point briefs the first arriving support crews in preparation for escort. Form up convoy and supported by AFP with Airside roads drivers permit.																	

Task Resource Analysis: Brisbane ARFF Cat 10 DRV (4+13)

Time	Task (4 ULFV & 1DRV 4+13 crew)	T1 (FC) MFS	T1 (Dr) MFS	T1 (Op) MFS	T1 (Br) MFS	T2 (SO) MFS	T2 (Dr) MFS	T2 (Op) MFS	T2 (Br) MFS	T3 (SO) SFS	T3 (Dr) SFS	T3 (Op) SFS	T4 (Br) MFS	T4 (Dr) FCC2	T4 (Op) FCC1	DRV (SO) MFS	DRV (Dr) MFS	DRV (Op) MFS
8 minutes ARFFRWG: Establish third interior aircraft rescue firefighting team. (Failed) Establish second rapid intervention team. (Failed) Resupply required ARFF Vehicles. (Failed) Provide Stationary vertical access to aircraft. (Failed)																		
21:08	QAS Kedron Park arrive at the Airside Inspection Point and join first convoy. 2 Ambulances 4 Paramedics																	
First arriving support teams at AIP consists of: 1 Pumper 1 aerial (6 firefighters) 3 QPS police cars (5 QPS officers) 5 ambulances (9 paramedics) 3 AFP cars (7 AFP Officers)																		
21:08	Second ARFF CABA team ordered to don sets. Dedicated Entry Control Officer now required.							X							X			
21:09	Casualties removed to doorway L1 R1 by Internal sector CABA crew																	
21:10	First Convoy of support services departs the Airside Inspection Point under escort. Note Windsor QFES Stn is next available with 13 min response times.																	
Distance from Chloris St Airside Inspection Point (AIP) to crash site is 3.5km in a direct line. Convoy under escort needs to cross Domestic Apron and cross the Main runway (01/19) to the Eastern Perimeter Rd or take the taxiways through to the Cross Runway (14/32). Conservative ETA at FCP 5 mins.																		
21:12	ARO on scene liaises with the FC and establishes the Forward Command post. Depending on access and staffing 1 x AFP vehicle may also arrive on scene to the FCP. FCP and staging may be set up on Cross Runway or Perimeter Rd.																	
21:13 Windsor QFES One Pumper arrives at AIP next due is Kemp Place two pumpers 14-15 mins response times depending on route taken, then Taigum and Cannon Hill One Pumper each with 16 mins response times then Chermside QFES One Pumper 17-18 min response. Note all times provided by QFES Firecom are approximate from station no traffic delays.																		
21:15	First Convoy arrives at FCP																	
21:17	6 QFES Pumpers arrive at AIP (24 firefighters, 12,000 Litres Water, 720 Litres of RF6)																	

Synopsis: At this point in time this incident has passed or encountered partial pinch points with the ARFFRWG suggested timing of significant milestones having mainly been able to be reached. The Main Issues impacting this incident now are:

- FC to hand over Operations, action planning and priorities to one of the 3 SO's on the combat zone.
- FC has to leave the combat zone to brief other agencies and hand over as the Initial Incident Controller to the Police Incident Controller.
- No GRN with common frequency to allow communications with the FCP or the Police IC to facilitate remote SITREP and Hand Over.
- No direct communications with the AIP to update the briefing to arriving emergency services.
- The Support Agencies will need a detailed situation report on the status and priority of issues requiring attention in the combat zone.
- The Support Agencies will need a detailed safety briefing including no go areas and location of casualty clearance areas, evacuee's and control points.
- Tender 3 is nearly empty.
- DRV is able to supply extra 2000 litres of agent and better facilitates the initial CABA internal attack crew gaining entry.
- Tenders 1&2 are less than ¼ full and providing water to internal attack, back up line and 2 x Fb10x branches mopping up.
- Still relying on ladders with possible multiple rescued casualties to remove from danger
- No casualty or survivor assistance has been rendered or even crowd control initiated.
- No Rapid Intervention Team is ready.

Task Resource Analysis: Brisbane ARFF Cat 10 DRV (4+13)

- No dedicated Entry Control Officer appointed.
- No check of Avionics or cargo bays.
- Second CABA team to check the upper deck, no safe external upper deck access or egress for firefighters. Note slide can be used as escape route for CABA teams but should be nominated prior to entry as escape path. Second ladder access required.
- The arrival of the supporting services will assist with control of the survivors and treatment of the casualties.
- The arrival of the Aerial will provide safe access and egress and rescue to Mid and Upper Decks. (+8-10mins from arrival 21:25 approx)
- The arrival of the QFES Pumper will provide some water for Tender 1 to make it just above half. (2000litres)
- QFES Second Wave will provide 6 pumpers and 12,000 litres. (arriving on crash scene under escort sometime after 21:23)
- The arrival of the QFES officer and firefighters will allow for an RIT and an ECO to be set up. If QFES allow integrated teams. Note SAMFB will not allow mixed CABA teams/duties due safety considerations.

Task Resource Analysis: Brisbane ARFF (NFPA 15 + TRA)

Time	Task (4xULFV, 1xDRV, 1xASV, 1xICV) (6+13)	FCP (Ins) MFS	T1 (FC) MFS	T1 (Dr) MFS	T1 (Op) MFS	T2 (SO) MFS	T2 (Dr) MFS	T2 (Op) MFS	T3 (SO) SFS	T3 (Dr) SFS	T3 (Op) SFS	T4 (SO) SFS	T4 (Dr) SFS	T4 (Op) SFS	DRV (SO) MFS	DRV (Dr) MFS	DRV (Op) MFS	DRV (Br) MFS	ASV (Dr) SFS	ASV (Op) SFS
21:00	FCC/ATC Activate Crash Alarm (Dedicated Watchroom Attendant)																			
	Crash response message broadcast over PA all crew respond.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3 minutes ARFFRWG: 3 Minutes Begin Discharge of Required Agent from First required Vehicle (Passed)																				
21:01	7 vehicles 19 crew depart both Fire Stations East and West	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
21:02	All vehicles on scene arrival, Tenders 1&2 take up tactical positions on nose front quarters, mobile operations if required. Tenders 3&4 commence mobile operations. Rear quarters and protect evacuation and slides.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4 minutes ARFFRWG: Begin Discharge of required agent from all other required vehicles. (Passed) Establish Incident Command (ICS) and request additional resources. (Passed) Inspector to size up incident and set up FCP in appropriate location, use GRN to provide support services with an update/sitrep. FC Operations Officer in charge at the Combat zone ARFFS only. Initiate access to aircraft cabin. (Passed) DRV crew pre-planned for CABA operations. ULFV's free to use Mobile Operations. ASV to dock with unopened exit and prepare for CABA Crew entry and fire attack.																				
21:04	1 x Aerodrome Reporting Officer (ARO) on scene ARO is the Airport Safety Officers.																			

Task Resource Analysis: Brisbane ARFF (NFPA 15 + TRA)

Time	Task (4xULFV, 1xDRV, 1xASV, 1xICV) (6+13)	FCP (Ins) MFS	T1 (FC) MFS	T1 (Dr) MFS	T1 (Op) MFS	T2 (SO) MFS	T2 (Dr) MFS	T2 (Op) MFS	T3 (SO) SFS	T3 (Dr) SFS	T3 (Op) SFS	T4 (SO) SFS	T4 (Dr) SFS	T4 (Op) SFS	DRV (SO) MFS	DRV (Dr) MFS	DRV (Op) MFS	DRV (Br) MFS	ASV (Dr) SFS	ASV (Op) SFS
	1 x Aerodrome Reporting Officer at the Airside Inspection Point.																			
21:04	FC out of vehicle don PPE complete size up. 3 X DRV crew don PPE and don & start up CABA ready to make entry. Use TIC. Combat area and casualty clearing zones nominated by FC. Air stairs(ASV) crew x 2 docks at unopened port exit. Using quick-lay packs or hose reel from the ASV platform runs out attack line. Sectors Forward (SO T2) and Rear (SO T3) nominated Sector Commanders. 1 x DRV crew sent to assist evacuation from starboard slides and direct passengers to safety. No CABA (Rely on Foam Blanket for CF suppression)		X						X						X	X	X	X	X	X
5 minutes ARFFRWG, NFPA & ICAO RFFP-9: Begin interior aircraft rescue and firefighting. (Passed) Establish Rapid Intervention Team (RIT) (Failed) Achieve 90% Knock Down of the critical area (ICAO/NFPA) in one minute (Passed)																				

Task Resource Analysis: Brisbane ARFF (NFPA 15 + TRA)

Time	Task (4xULFV, 1xDRV, 1xASV, 1xICV) (6+13)	FCP (Ins) MFS	T1 (FC) MFS	T1 (Dr) MFS	T1 (Op) MFS	T2 (SO) MFS	T2 (Dr) MFS	T2 (Op) MFS	T3 (SO) SFS	T3 (Dr) SFS	T3 (Op) SFS	T4 (SO) SFS	T4 (Dr) SFS	T4 (Op) SFS	DRV (SO) MFS	DRV (Dr) MFS	DRV (Op) MFS	DRV (Br) MFS	ASV (Dr) SFS	ASV (Op) SFS
21:05	QPS Hendra Police Station arrive at the Airside Inspection Point. 1 senior officer, 4 constables and 3 cars. AFP arrival at the Airside Inspection Point 3x police cars 5 staff.																			
21:05	FC completes full size up and establishes control point to the combat area. FC assumes the Fireground Safety Officer and provides SitRep to the Inspector at the FCP IC Role.	X	X																	
21:05	Operators Tender 1&2 out of vehicle don PPE and provide feed length into ASV. SO T2 dons PPE and organises Foam Branches and back up lines and passenger clearance to forward sector. 1 x DRV crew.				X	X		X										X		
21:05	Drivers T1,2,3 &4 Operators T3&4 continue to operate primary and secondary monitors. Maintain scene safety and prevent reignition. SO T3			X			X			X	X	X	X	X						

Task Resource Analysis: Brisbane ARFF (NFPA 15 + TRA)

Time	Task (4xULFV, 1xDRV, 1xASV, 1xICV) (6+13)	FCP (Ins) MFS	T1 (FC) MFS	T1 (Dr) MFS	T1 (Op) MFS	T2 (SO) MFS	T2 (Dr) MFS	T2 (Op) MFS	T3 (SO) SFS	T3 (Dr) SFS	T3 (Op) SFS	T4 (SO) SFS	T4 (Dr) SFS	T4 (Op) SFS	DRV (SO) MFS	DRV (Dr) MFS	DRV (Op) MFS	DRV (Br) MFS	ASV (Dr) SFS	ASV (Op) SFS
	controls T3&4 mobile ops rear sector. Sitrep to FC.																			
21:05	First CABA fire attack and rescue team donned and started up. CABA team nominated Internal sector SO in charge. Make entry to control environment.														X	X	X			
21:05	Initial Attack line charged under control off ASV at L1 for mid deck entry.																		X	X
6 mins ARFFRWG: Initiate Second Access to aircraft cabin. (Passed) Establish second interior aircraft rescue and firefighting team. (Passed) Establish emergency medical services. (Failed) Establish water supply. (Failed) ARFFS has no water supply arrangements minimum agent quantities carried and then rely on a shuttle of water from a designated hydrant that meets 30lps output. ARFFS has no dedicated EMS all firefighters engaged in firefighting and rescue activities, once control is achieved ARFFS members can provide EMS. All Fire in practical critical area extinguished 1 min after control achieved. (Passed)																				
21:06	T4 SO dons PPE and sets up ECO, CABA Stage 2 control board, second CABA team (T1 Op & DRV Br) and rehab using the forward sector crew.				X			X				X						X		
21:06	QAS North Gate Arrive at the Airside Inspection Point. 2 Ambulances, 1 Senior Officer Vehicle, 5 paramedics.																			
21:06	All vehicles back to Tactical positions on the nose of			X						X			X	X						

Task Resource Analysis: Brisbane ARFF (NFPA 15 + TRA)

Time	Task (4xULFV, 1xDRV, 1xASV, 1xICV) (6+13)	FCP (Ins) MFS	T1 (FC) MFS	T1 (Dr) MFS	T1 (Op) MFS	T2 (SO) MFS	T2 (Dr) MFS	T2 (Op) MFS	T3 (SO) SFS	T3 (Dr) SFS	T3 (Op) SFS	T4 (SO) SFS	T4 (Dr) SFS	T4 (Op) SFS	DRV (SO) MFS	DRV (Dr) MFS	DRV (Op) MFS	DRV (Br) MFS	ASV (Dr) SFS	ASV (Op) SFS
	the aircraft. Tender 4 nearly empty. Tender 3 less than ¼ tank. Tenders 1&2 just on ¼ tank.																			
21:06	Back up line and 2 x FB10X lines ordered from Tenders 1&2. Tender 3 to attack stubborn fire/hot spot around U/C port side, secondary monitor /DCP/TFT Attack line CABA sets required (Carbon Fibres) Assist hose into aircraft for CABA crew.		X									X	X	X					X	X
21:06	Second CABA crew with second attack line off ASV make entry L1. Using internal stair case check extension into upper deck. Sitrep to FC upper deck clear no smoke.		X		X													X	X	X
21:07	QFES Hendra arrive at the Airside Inspection point. 1 Aerial, 1 Pumper, 6 Firefighters. (2000 litres water 120 litres RF6 Foam)																			
21:07	Tender 4 with driver only sent to SFS for replenishment of water. (against SOP)		X										X							

Task Resource Analysis: Brisbane ARFF (NFPA 15 + TRA)

Time	Task (4xULFV, 1xDRV, 1xASV, 1xICV) (6+13)	FCP (Ins) MFS	T1 (FC) MFS	T1 (Dr) MFS	T1 (Op) MFS	T2 (SO) MFS	T2 (Dr) MFS	T2 (Op) MFS	T3 (SO) SFS	T3 (Dr) SFS	T3 (Op) SFS	T4 (SO) SFS	T4 (Dr) SFS	T4 (Op) SFS	DRV (SO) MFS	DRV (Dr) MFS	DRV (Op) MFS	DRV (Br) MFS	ASV (Dr) SFS	ASV (Op) SFS
21:07	First CABA team SitRep to FC. Fire located establishing control Casualties onboard.		X												X	X	X			
21:08	ARO at Airside Inspection point briefs the first arriving support crews in preparation for escort. Form up convoy and supported by AFP with Airside roads drivers permit.																			
8 minutes ARFFRWG: Establish third interior aircraft rescue firefighting team. (Failed) Establish second rapid intervention team. (Failed) Resupply required ARFF Vehicles. (Failed) Provide Stationary vertical access to aircraft. (Passed)																				
21:08	QAS Kedron Park arrive at the Airside Inspection Point and join first convoy. 2 Ambulances 4 Paramedics																			
First arriving support teams at AIP consists of: 1 Pumper 1 aerial (6 firefighters) 3 QPS police cars (5 QPS officers) 5 ambulances (9 paramedics) 3 AFP cars (7 AFP Officers)																				
21:08	ARFF CABA RIT ordered to don sets.			X				X						X						
21:09	Casualties removed to doorway L1 R1 by Internal sector assisted down ASV stairs.														X	X	X		X	X
21:10	First Convoy of support services departs the																			

Task Resource Analysis: Brisbane ARFF (NFPA 15 + TRA)

Time	Task (4xULFV, 1xDRV, 1xASV, 1xICV) (6+13)	FCP (Ins) MFS	T1 (FC) MFS	T1 (Dr) MFS	T1 (Op) MFS	T2 (SO) MFS	T2 (Dr) MFS	T2 (Op) MFS	T3 (SO) SFS	T3 (Dr) SFS	T3 (Op) SFS	T4 (SO) SFS	T4 (Dr) SFS	T4 (Op) SFS	DRV (SO) MFS	DRV (Dr) MFS	DRV (Op) MFS	DRV (Br) MFS	ASV (Dr) SFS	ASV (Op) SFS
	Airside Inspection Point under escort.																			
Distance from Chloris St Airside Inspection Point (AIP) to crash site is 3.5km in a direct line. Convoy under escort needs to cross Domestic Apron and cross the Main runway (01/19) to the Eastern Perimeter Rd or take the taxiways through to the Cross Runway (14/32). Conservative ETA at FCP 5 mins.																				
21:12	ARO on scene liaises with the Insp at the Forward Command post. Depending on access and staffing 1 x AFP vehicle may also arrive on scene to the FCP. FCP and staging may be set up on Cross Runway or Perimeter Rd. Control evacuated Passengers.	X																		
21:13 **Windsor QFES One Pumper arrives at AIP next due is Kemp Place two pumpers 14-15 mins response times depending on route taken, then Taigum and Cannon Hill One Pumper each with 16 mins response times then Chermside QFES One Pumper 17-18 mins. Note all times provided by QFES Firecom are approximate from station no traffic delays.**																				
21:15	First Convoy arrives at FCP																			

Synopsis: At this point in time this incident has achieved most of the suggested timing the ARFFRWG listed as significant milestones:

- The imminent arrival of supporting resources has the Forward Command Post already established and functioning.

Task Resource Analysis: Brisbane ARFF (NFPA 15 + TRA)

- FC has assumed the Operations Officer role of the Combat Authority sufficient officers are on scene to safely control ARFFS operations.
- FC is the combat zone Safety Officer as well as the Operations Officer.
- GRN with common frequency allows Inspector direct communications with the Police IC to facilitate SITREP enroute.
- Dedicated FCC (Watchroom operator) allows for more effective ARFFS comms, ICS support maintaining incident log and recall of required ARFFS crew & resources.
- Tender 3 is nearly empty resupply of water is an issue larger vehicles or water tanker should be considered. (13-16 min refill cycle)
- Tenders 1&2 are less than ¼ full and providing water to internal attack, back up line and 2 x FB10X branches mopping up.
- No casualty or survivor assistance has been rendered.
- No check of Avionics or cargo bays.
- The arrival of the supporting services will assist with control of the survivors and treatment of the casualties.
- The arrival of the QFES Aerial will provide a second safe access and egress to Mid and Upper Decks. (+8-10mins from arrival 21:25 approx)
- The arrival of the Pumper will provide some water for Tender 1 to make it just above half. (2000litres)
- QFES Second Wave will provide 6 pumpers and 12,000 litres. (arriving on crash scene under escort sometime after 21:23)
- The arrival of the QFES officer and firefighters will allow for relief of ARFFS CABA crews to rehab.