

Introduction

Much of the work on board the ARA involves using and managing racked instruments within the cabin. All of these involve electrical power, many have water or chemicals on board, some contain potentially flammable materials. This is not unique – many other things on board an aeroplane also contain these potential hazards.

For main aeroplane equipment, the flight crew have manuals and checklists that are designed to ensure that these are operated properly, and any failures or emergencies can be handled safely.

Scientific equipment is not essential to the safety of the flight and so checklists can be split. Those involving obtaining normal operations and scientific data acquisition can be flexible and of-course need to be, as an instrument is developed and the scientists operating it learn more about getting the best from their instrument. However, it must also be ensured that the emergency checklist is capable of ensuring that any failure (such as a fire, short circuit, wide circuit, or chemical/gas leak) cannot endanger the aeroplane or anybody on board it.

Emergency checklists therefore, are required on each rack – using a standard format, and which can be used by any competent person on board and provide a clear set of instructions for any likely emergency. This will be in two parts: one face covering the actions if anything goes wrong in the air, and the second covering actions if anything goes wrong whilst on the ground.

Using a rack safety sheet

Rack safety sheets will list any cleanup or safety equipment that must be available on the ground, and onboard during flight. Rack operators must always confirm that this is the case before starting up their rack.

If there is a fault on a rack that may be unsafe, the rack operator must immediately check the safety sheet for the fault that has occurred. The actions next to that must be carried out immediately.

If there is no rack operator, then the checklist should be followed by somebody else; the nearest person to the rack should inform the nearest of the CCM (Cabin Crew Member) or volunteer FTP (FAAM Trained Person) immediately, who will then either choose to carry out the checklist themselves, or instruct somebody else to do so as well as ensuring that other aircraft crew are informed as required. Other science crew members should be aware that CCMs and FTPs train regularly in dealing with emergencies on board and will be familiar with the safety sheets and onboard communication.

Following any such actions, the flight manager and CCM must be informed immediately (although they'll probably know already) they will if it is appropriate – which it usually is – inform the Captain.

Writing and getting approved a rack safety sheet

The responsibility for writing a rack safety sheet always rests with the rack owner. The sheet must be written before the rack is powered on board the aeroplane, and it must be approved – as shown by signatures on the header on both pages. FAAM can provide an example of a recently approved sheet which can be used as a template.

Approval must be by both FAAM (normally the Head of FAAM, deputised if required by the Technical Manager), and by Directflight Ltd (normally the Engineering Manager, deputised if required by the Operations Manager). Once it is approved, a copy must be attached to the rack and the document becomes an appendix to the rack TSSE (Technical Specification for Scientific Equipment), and then further approved by BAeS as part of their approval of the rack on the aeroplane and its TSSE.

The order is important, which is (1) writing, (2) approval by FAAM and DFL, (3) incorporation into TSSE, (4) approval by BAeS.

When writing the safety sheet authors must consider the following:

- Are the instructions simple and unambiguous
- Are actions proportionate?: whilst sometimes it might be necessary to disconnect all science power, often it will be possible just to shut down a single instrument or rack and continue a flight.
- Are different levels of failure considered? Overheating shouldn't usually, for example, be treated the same as a fire – similarly there's a difference between a funny smell and smoke.
- Is it obvious from the sheet where all the controls that need to be reached are? Do they need additional labelling, or do you need to add a photograph to the sheet (see Appendix A for an example).
- Can everything be reached? SSP circuit breakers, for example,

Document Control

- (1) A master, signed, copy of each sheet is held by FAAM.
- (2) A laminated A4 copy of each sheet will be secured in a visible position on each rack.
- (3) A folder containing A4 copies of each sheet will be held by Avalon Aero; this will have a list of document issue states in the front.

- (4) A folder containing electronic copies of each sheet are held by FAAM; uncontrolled copies of all or part of this folder may also be provided, if required, to other parties.

Authorised for use

DRAFT

GB Gratton
Head of FAAM
Date as header

Amendment Record

<u>Issue</u>	<u>AL</u>	<u>Date</u>	<u>Pages</u>	<u>Notes</u>
Draft A	0		NN	First consultation draft

References

APPENDIX-A – SAMPLE RACK DATA SHEET (not kept up to date)

<i>FAAM</i>		Facility for Airborne Atmospheric Measurements	
SCIENTIFIC EQUIPMENT SAFETY DATA SHEET			
Instrument: Core Chemistry Rack	Document version: 4	Dated: 3 May 2011	
This document is produced by: Dr Stéphane Bauguitte	And authorised by: For FAAM For Directflight		

Airborne or Doors Closed Hazards

<u>Event</u>	<u>Hazard to personnel</u>	<u>Hazard to aircraft</u>	<u>Actions to be carried out</u>	<u>Advise Captain?</u>	<u>Actions to recommend to Captain</u>
<u>Overheating / fumes</u>	Burns	Escalation to fire	1 If safe to do so follow emergency shutdown checklist below 2 If not contained, treat as fire / smoke	Y	
<u>Fire or smoke</u>	Burns / smoke inhalation	Spread of fire	Press red science power button above flight manager's station.	Y	Land ASAP
<u>Electric shock</u>	Burns / injury	N	If safe to do so follow emergency shutdown checklist below	N	
<u>Electrocution</u>	Risk of death	Electrical failure / airframe damage	Press red science power button above flight manager's station.	Y	Land ASAP
<u>Abnormal noise</u>	N	N	Follow emergency shutdown checklist below	N	
<u>Gas leak</u>	N	N	No action required – gasses are harmless.	N	

Quickly inform CCM and Flight Manager of all potentially hazardous events and actions. SATCOM will not work if science power is shut down, pilots can however arrange an HF phone link.

Cleanup and safety equipment that must be on board

None required.

(Molecular sieve and self-indicating silica gel are inert; they can be vacuumed.)

Emergency shutdown checklist - airborne

- | <u>Which control?</u> | <u>Do what?</u> |
|------------------------------------|--|
| 1. Core Chemistry SSP | Pull all 3 Sidewall Service Point Circuit Breakers |
| 2. PWRDIST (outboard forward face) | UPS off (Switch Down) |



RACK COPY (A4) / AVALON COPY (A4) / CABIN COPY (A5) / OTHER

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Doors Open Hazards

<u>Event</u>	<u>Hazard to personnel</u>	<u>Hazard to aircraft</u>	<u>Actions to be carried out</u>
<u>Overheating / fumes</u>	Burns	Escalation to fire	1 If safe to do so follow emergency shutdown checklist below 2 If not contained, treat as fire / smoke
<u>Fire or smoke</u>	Burns / smoke inhalation	Spread of fire	Press red science power button above flight manager's station.
<u>Electric shock</u>	Burns / injury	N	If safe to do so follow emergency shutdown checklist below
<u>Electrocution</u>	Risk of death	Electrical failure / airframe damage	Press red science power button above flight manager's station.
<u>Abnormal noise</u>	N	N	Follow emergency shutdown checklist below
<u>Gas leak</u>	N	N	No action required – gasses are harmless.

Avalon must be informed immediately of all potentially hazardous events on the ground.

Cleanup and safety equipment that must be available on ground

None required. If drier filter content is spilt (breakage) during pre-flight, note that molecular sieve and self-indicating silica gel are inerts; they can be vacuumed.

Emergency shutdown checklist - ground

- | <u>Which control?</u> | <u>Do what?</u> |
|------------------------------------|--|
| 1. Core Chemistry SSP | Pull all 3 Sidewall Service Point Circuit Breakers |
| 2. PWRDIST (outboard forward face) | UPS off (Switch Down) |

