1. The enclosed Standards Related Document, NATIONAL SRD – UNITED KINGDOM, which has been approved in conjunction with ATP-3.3.4.2 by the nations in the MCASB, is promulgated herewith.

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3. This publication shall be handled in accordance with C-M(2002)60.

Dr. Cihangir Aksit, TUR Civ
Director NATO Standardization Agency
1. **Introduction.** The UK has A330 Voyager KC2 and KC3 tanker types in-service with the RAF. The type designator distinguishes the different AAR equipment fits, details of which are contained in the tanker annex.

2. **Tanker Aircraft Type.**
   
a. **Voyager KC2 (KC-30B).** Annex A details the 2-point refuelling equipment fitted to Voyager KC2.

   b. **Voyager KC3 (KC-30C).** Annex A details the 3-point refuelling equipment fitted to Voyager KC3.

3. **National AAR Clearance Process.** See Annex B.

4. **AAR POCs.**
   
a. **POC for National SRD.**
   OC 2 Group STANEVAL
   Royal Air Force Brize Norton
   Carterton, Oxfordshire
   OX18 3LX
   UK
   Tel: +44 (0)1993 897941

   b. **POC for Tanker/Receiver Clearances.** As para 4a.

   c. **POC for STANEVAL.** As para 4a.

5. **National Annex Last Updated.** Dec 17

6. **Multinational Simultaneous AAR and AT Matrix Structure and Contents**

   **Colour Key:**

<table>
<thead>
<tr>
<th>PERMITTED</th>
<th>SUBJECT TO RESTRICTIONS (Case by case basis)</th>
<th>NOT PERMITTED</th>
</tr>
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</table>

December 2017
7. **SIMULTANEOUS EMPLOYMENT MATRIX FOR AAR PLATFORMS**

<table>
<thead>
<tr>
<th>NATIONAL</th>
<th>MULTI-NATIONAL</th>
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<tbody>
<tr>
<td>Simultaneous AAR whilst carrying passengers (Pax)</td>
<td>Simultaneous AAR whilst carrying your nations’ Pax</td>
</tr>
<tr>
<td>Simultaneous AAR whilst carrying cargo</td>
<td>Simultaneous AAR whilst carrying your nations’ cargo</td>
</tr>
<tr>
<td>Simultaneous AAR whilst carrying Dangerous Goods (DG) (AE)</td>
<td>Simultaneous AAR whilst carrying your nations’ DG cargo</td>
</tr>
<tr>
<td>Simultaneous AAR whilst carrying Aeromedical Evacuation</td>
<td>Simultaneous AAR whilst carrying your nations’ AE</td>
</tr>
<tr>
<td>Simultaneous AAR whilst carrying other nation’s Pax</td>
<td>Simultaneous AAR of other nation’s receivers whilst carrying your nations’ Pax</td>
</tr>
<tr>
<td>Simultaneous AAR whilst carrying other nation’s DG cargo</td>
<td>Simultaneous AAR of other nation’s receivers whilst carrying your nations’ DG cargo</td>
</tr>
<tr>
<td>Simultaneous AAR whilst carrying other nation’s AE</td>
<td>Simultaneous AAR of other nation’s receivers whilst carrying your nations’ AE</td>
</tr>
<tr>
<td>Simultaneous AAR whilst carrying other nation’s cargo</td>
<td>Simultaneous AAR of other nation’s receivers whilst carrying your nations’ cargo</td>
</tr>
<tr>
<td>Simultaneous AAR whilst carrying Dangerous Goods (DG)</td>
<td>Simultaneous AAR of other nation’s receivers whilst carrying your nations’ DG cargo</td>
</tr>
<tr>
<td>Simultaneous AAR whilst carrying Aeromedical Evacuation</td>
<td>Simultaneous AAR of other nation’s receivers whilst carrying your nations’ AE</td>
</tr>
</tbody>
</table>
8. **National Reservations.**
   
   a. **Management and Control of AAR Activity in UK Airspace.** See Annex C.
   
   b. **AAR Deployments.** See Annex D.
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<tr>
<th>PAGE NUMBERS</th>
<th>EFFECTIVE PAGES</th>
</tr>
</thead>
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<td>1</td>
<td>December 2017</td>
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<td>December 2017</td>
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<tr>
<td>3</td>
<td>December 2017</td>
</tr>
<tr>
<td>LEP-1</td>
<td>December 2017</td>
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</tbody>
</table>
ANNEX A TO NATIONAL SRD - UNITED KINGDOM

VOYAGER KC2/ KC3

Tanker Information

1. AAR Equipment.
   a. Wing Pod.
      
(1) **Description.** All Voyager aircraft can be equipped with 2 FRL 905E Wing Pods. The hose length that trails from the pod is approx 93.5 ft (28.5 m) with an internal bore of 2.2 in. The hose is black and is marked by a series of bands as shown in Appendix A1. The hose terminates in a MA-4 refuelling coupling and Sergeant Fletcher Drogue (SFD).

(2) **Basic Operation.** The refueling position inner limit is 68.5 ft (20.9 m) and the outer limit is 88.5 ft (27.0 m) hose extension, thus providing a fore and aft range of movement of 20 ft (6.1 m). The hose must be pushed in at least 5 ft (1.52 m), indicated by a solid green signal light, to start fuel flowing. If the inner limit is exceeded, the amber signal will begin to flash. Refer to Appendix A1 for appropriate receiver actions during AAR.

(3) **Simultaneous Contacts.** At the discretion of the Tanker Commander, receiver aircraft may be cleared to make simultaneous contacts on the wing pods.

(4) **Wing Pod Lighting.**

   (a) **Day AAR.** Red, amber and green signal lights are located on the sides of the wing pod tail-cone fairing: see Appendix A1. The lights are duplicated for redundancy and are clearly visible to the receiver pilot. The red (WARNING) signal lights are illuminated whenever the pods are not ready for receiver contact. The red lights also flash to signal breakaway; note, both left and right pods are controlled by a common breakaway switch in the cockpit. If a steady red light illuminates while a receiver is in contact then the receiver must make a normal disconnect.

   (b) **Night AAR.** The intensity of the coloured overt lights can be adjusted. The red lights will illuminate at 100% intensity in the event of a pod fault. The drogue has NVG compatible LED lighting powered by a small air driven generator in the coupling.

   (c) **Covert Lights.** The wing pods are each fitted with 2 sets of
covert infra-red signal lights for covert operations and for night vision equipment compatibility. For details on the sequencing of the covert system refer to Appendix A1.

(5) **Wing Pod Markings.** Black and white reference lines are provided on each wing pod and on the underside of the wing: one line is painted on each side of each wing pod on the underside of the wings and a third line is located on the bottom of each wing pod that is used as a centreline for receiver aircraft alignment.

b. **Fuselage Refueling Unit (FRU).**

(1) **Description.** 7 Voyager aircraft can be equipped with the 1FRL805E FRU. The hose length that trails from the FRU is approx 93.5 ft (28.5 m) with an internal bore of 2.8 in. The hose is black and is marked by a series of white bands as shown in Appendix A1. The hose terminates in a MA-4 refuelling coupling and a High Speed Variable Drag Drogue (HSVDD).

(2) **Basic Operation.** The refueling position inner limit is 68.5 ft (20.9 m) and the outer limit is 88.5 ft (27.0 m) hose extension, providing a fore and aft range of movement of 20 ft (6.1 m). The hose must be pushed in at least 5 ft (1.52 m), indicated by a solid green signal light, to start the fuel flowing. If the inner limit is exceeded, the amber signal light flashes. Refer to Appendix A1 for the appropriate receiver actions.

(3) **FRU Lighting.**

(a) **Day AAR.** Pairs of red, amber and green signal lights are located on the rear upper side of the FRU fairing, see Appendix A1. The red (WARNING) signal lights are illuminated whenever the FRU is not ready for receiver contact. The red lights also flash to signal breakaway. If a steady red light illuminates while a receiver is in contact, then the receiver must make a normal disconnect.

(b) **Night AAR.** The intensity of the coloured overt lights can be adjusted. The red lights will illuminate at 100% intensity in the event of an FRU fault. The drogue has NVG compatible LED lighting provided by a small air driven generator in the coupling. There is a separate hose illumination light to assist the receiver crew in assess the hose position when in contact.

(c) **Covert Lights.** The FRU is fitted with 2 sets of covert infra-red signal lights for covert operations and night vision equipment compatibility. For details on the sequencing of the covert system refer to Appendix A1. The overt and covert light systems are mutually exclusive.

(4) **FRU Markings.** Black and white reference lines are provided on
the underside of the fuselage: the lines are painted forwards from the FRU and are used as a centreline for receiver aircraft alignment.

2. **Refueling Altitude/Level and Speeds.**
   a. **SFD.**
      
      (1) **Height.** 2000(AGL) - 35000 ft.
      
      (2) **Speed.** (KIAS/M) 260 – 325/0.86
   
   b. **HSVDD.**
      
      (1) **Height.** 2000(AGL) – 35000 ft
      
      (2) **Speed.** (KIAS/M) 180 – 325/0.86

3. **Maximum Transferrable Fuel.** The maximum total fuel is 109 tonnes (240,000 lb). Transferrable fuel is dependent on sortie duration: approx 75 tonnes (165,000 lb) would be available for transfer during a 4 hr refuelling mission, assuming a Voyager fuel burn rate of 6 tonnes/hr (13,220 lb/hr).

4. **AAR Fuel Transfer Rate.** The Voyager transfers fuel at the following rates:
   a. **Wing Pods.** 1250 kg/min (2750 lb/min or 420 US gal/min).
   b. **FRU.** 1800 kg/min (3960 lb/min or 600 US gal/min).

5. **Regulated Fuel Pressure.** Fuel is delivered to the receiver at a regulated pressure of 3.5 ± 0.35 bars (50 ± 5 psi).

6. **Fuel Types Available for AAR**
   a. **Primary Fuel.** F34 (JP-8).

7. **Aircraft Lighting.** The Voyager has an extensive array of aircraft lights, adjustable for brilliance, together with formation station keeping lights and infra-red illuminators. During night AAR, infra-red cameras and lighting sources are employed. Refer to Appendix A1

8. **Mark Facilities.** In an emergency, the Voyager aircraft can fuel dump in order to mark.
9. **RV Aids.** The Voyager has the following radio, navigation, and RV aids:

   a. VHF, UHF and HF radios (Radio Relay on V/UHF), SATCOM and CPDLC/ACAS.
   
   b. VOR, TACAN, ADF, INS, GPS, and weather radar.
   
   c. UDF, A/A TACAN (bearing and DME), ETCAS, IFF and Link 16.

10. **Fuel Load** (ISA, 10,000' runway, 1500' MSL) – 109 tonnes (240,000 lb).

11. **Fuel Load** (ISA +10°, 10,000' runway, 1500' MSL) – 109 tonnes (240,000 lb).

12. **Average Fuel Burn Rate** - 6 tonnes/ hr (13,220 lb/hr).

13. **Nominal Average Reserve** - 5 tonnes.

14. **Tanker Dimensions.** The Voyager is 57.5 m (188 ft) long with a wingspan of 60.3 m (197 ft) as detailed in Appendix A1.

15. **Receiver Clearances.** Please see Annex B for receiver and tanker clearances and compatibility.
Figure A1-1 – Voyager Wing Markings / Pod Signal Lights

AMBER
GREEN
RED
AMBER
GREEN
### Figure A1-2 – Voyager Wing Pod Signal Lights

<table>
<thead>
<tr>
<th>Receiver Position</th>
<th>Overt</th>
<th>IR-Covert</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NOT IN CONTACT</strong></td>
<td><strong>IN CONTACT</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Breakaway</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Mandatory instruction: Carry out procedure described in ATP-3.3.4.2 for Breakaway. After the FLASHING RED (overt) or FLASHING 3-Light (IR-covert) signal has been displayed for 10 seconds, the signal should revert to RED ON or 3 Light ON until the tanker crew resumes normal operations. | Breakaway
Mandatory instruction: Carry out procedure described in ATP-3.3.4.2 for Breakaway. After the FLASHING RED (overt) or FLASHING 3-Light (IR-covert) signal has been displayed for 10 seconds, the signal should revert to RED ON or 3-Light ON until the tanker crew resumes normal operations. | RED | AMBER | GREEN | TOP | CENTRE | BOTTOM |
| **Maintain Astern**      |             |            |
| Tanker not yet ready to refuel receiver. Receiver should remain in Astern Position. May also indicate a pod fault. | Disconnect
Mandatory instruction: Non-emergency disconnect. Receiver is to carry out a normal Disconnect and either:
Radio Procedures: follow crew instructions; Radio Silent: move to Echelon position. May also indicate a pod fault. Exceeded the hose outer limit >10 sec. Too close < 33ft. | ON | OFF | OFF | ON | ON | ON |
| **Clear Contact**        |             |            |
| Tanker ready for receiver to make Contact. Receiver should make Contact with drogue. | Move forward into refuelling range
Hose is aft of refuelling range. Receiver should continue to push hose in to enter refuelling range. Fuel flow stops. | OFF | ON | OFF | OFF | ON | ON |
<table>
<thead>
<tr>
<th>Not Applicable</th>
<th>Receiver is in refuel range and fuel flow is more than 50 US gal per min. Receiver should: Radio Procedures: await instruction to Disconnect; Radio Silent: maintain position or Disconnect.</th>
<th>OFF</th>
<th>OFF</th>
<th>ON</th>
<th>OFF</th>
<th>OFF</th>
<th>ON</th>
</tr>
</thead>
</table>
| Not Applicable | **Too Close – Move Aft**  
Mandatory instruction: move aft immediately. Receiver is forward of the refuelling range and is too close to the tanker. Fuel flow stops. | OFF | FLASH | OFF | OFF | FLASH | FLASH |
| Not Applicable | **Clear to disconnect as required**  
Receiver is in refuel range but fuel flow is less than 50 US gal per min.  
Radio Procedures: await instruction from tanker crew; Radio Silent: maintain position or disconnect when ready. Receiver pilot should determine reason for low fuel flow as either:  
a. Tanks are full.  
b. Receiver switch selections incorrect.  
c. Soft Contact.  
d. Dry Contact. | OFF | OFF | FLASH | OFF | OFF | FLASH |
| Maintain Astern | **Disconnect**  
Follow MSO instructions, pod malfunction or power loss. | OFF | OFF | OFF | OFF | OFF | OFF |
Figure A1-3 – Voyager Wing Pod Hose Markings

Figure A1-4 – Voyager Exterior Lighting
Figure A1-5 – Voyager AAR Lighting

Figure A1-6 – Voyager Dimensions
Figure A1-7 Voyager POD Fairing and Hose Combinations

Configuration A:
Old fairing + Old hose

Configuration C:
New fairing + Old hose

Reference point for old hose

FAIRING F57EA4800 004

0.6 ft
Notes:

1. All AAR wing pods will have the same uniform grey colour scheme.
2. **Configuration A** – Old Fairing and Old Hose. Represents the current in-service standard.
3. **Configuration B** – Old Fairing and New Hose. This configuration will be seen once the current limited stock of old hoses has been depleted and aircraft still with the old fairing fitted will have damaged or worn old hoses replaced with new ones. This has been seen once in flight test during the May 13 test of the Robust Short HSVDD, but assessment of the performance of the hose/fairing combination was not a specific aim of the test sortie.
4. **Configuration C** – New Fairing and Old Hose. This configuration may occur if an aircraft originally fitted with a new hose and new fairing suffers hose damage and there are only spare old hoses available to be fitted. This configuration will be the least likely to be seen in-service.
5. **Configuration D** – New Fairing and New Hose. This configuration is entering service and will become the standard configuration.
Figure A1-8 – Voyager Centre-Line Markings / FRU Signal Lights
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<thead>
<tr>
<th>PAGE NUMBERS</th>
<th>EFFECTIVE PAGES</th>
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<tbody>
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<td>A-1 to A-4</td>
<td>Dec 17</td>
</tr>
<tr>
<td>A1-1 to A1-8</td>
<td>Dec 17</td>
</tr>
<tr>
<td>LEP A-1</td>
<td>Dec 17</td>
</tr>
</tbody>
</table>
1. **Introduction.** The table below lists aircraft which are technically compatible with the Voyager KC2/KC3 refuelling equipment. The clearances are issued on the basis of mechanical compatibility between the Pod and FRU refuelling drogue/receptacles, and the nozzle/mast of the receiver aircraft. Refer to NATO STANAG 3447 for further details. Any modification to receiver aircraft which may affect the mechanical compatibility is to be notified to UK POC.

**Table B-1 Voyager/UK Receiver Compatibility**

<table>
<thead>
<tr>
<th>RECEIVER</th>
<th>POD</th>
<th>FRU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tornado GR4/4A</td>
<td>✓</td>
<td>✓*</td>
</tr>
<tr>
<td>Typhoon T Mk 3</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Typhoon FGR Mk 4</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>RAF C130J Mk 4/5</td>
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<td>✓</td>
</tr>
<tr>
<td>RAF E-3D</td>
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<td>✓</td>
</tr>
</tbody>
</table>

*UK Tornado GR4/4A RTS does not permit AAR against the FRU*
1. The receiver aircraft listed below are cleared, through STANAG 3447, on the basis of mechanical compatibility. Receivers fitted with the MA-2 probe should be compatible with the Voyager Pod/FRU receptacle.

### Table B1-1 Voyager to Non-UK Military Receiver Clearance Matrix

<table>
<thead>
<tr>
<th>AIRCRAFT</th>
<th>POD</th>
<th>FRU</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Category 2 Aircraft iaw SRD 1</strong></td>
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</tr>
<tr>
<td>EF2000 All Marks</td>
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<td>✓</td>
</tr>
<tr>
<td>EA/F18</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Tornado All Marks</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>F35B</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>C-130J Mk4</td>
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<td>✓</td>
</tr>
<tr>
<td>C-130J Mk5</td>
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<td>✓</td>
</tr>
<tr>
<td>AV-8B</td>
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</tr>
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<td>Rafale</td>
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<td>✓</td>
</tr>
<tr>
<td>E3D/F AEW</td>
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<td>✓</td>
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<td><strong>Category 1 Aircraft iaw SRD 1</strong></td>
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</tr>
<tr>
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<td>✓</td>
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<tr>
<td>F-5</td>
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<tr>
<td>Hawk</td>
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</tr>
<tr>
<td>Jaguar</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>JAS-39 Gripen</td>
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<td>✓</td>
</tr>
<tr>
<td>Mirage 50, F1</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>V-22 Osprey</td>
<td>X</td>
<td>✓</td>
</tr>
</tbody>
</table>
NOTE

SRD 1 to ATP 3.3.4.2 defines 3 clearance categories.

Category 1. Issued when there is little or no evidence of technical compatibility between the tanker aircraft and the receiver aircraft.

Category 2. Issued when some technical assessment has been carried out, but a Technical Compatibility Assessment is incomplete. Operational procedures, training and receiver maintenance standards are not assured.

Category 3. Issued when a Technical Compatibility Assessment has been completed and operational procedures, training standards and receiver maintenance standards are all assured.

For AAR without Cat 3 clearance, the following risk mitigation measures are provided as guidance to Commanders.

Unassured Technical Compatibility (Category 1):

i. Making and breaking contact should be straight and level only;
ii. In the absence of receiver guidance, conduct AAR at FL200 and 275 KIAS;
iii. Enhanced Join call: “Confirm nose cold / switches safe” to mitigate unassessed emissions risk;
iv. Use only one hose for unknown receivers to protect capability to known receivers by preserving other hose.

Unknown or non-compliance with ATP 3.3.4.2 Procedures or SRD2 Training Standards:

i. Enhanced RV Call: “Maintain 1,000 ft below, 1nm in trail until visual and cleared to join”;
ii. Enhanced Join call: “Confirm nose cold / switches safe” “Clear join echelon left”;
iii. Enhanced Leave call: “Cleared to leave, climbing 1,000 ft above the tanker(s) until clear”;
iv. Call all turns;
v. No simultaneous contacts;
vi. No simultaneous movement around the tanker;
vii. Brief Loss of Visual Plan;
viii. No mixed receiver type/nation unless Day / VMC only.
1. **Introduction.** This matrix constitutes the current full (Cat 3) and OEC/CLE (Cat 1) UK receiver clearances on Foreign Military and Non-Military Tankers. A clearance listed in this table indicates that a technical assessment has been reviewed between both Tanker/Receiver and that a technical agreement has been signed between the UK and the National/Non-Military owner of the Tanker.

**Table B2-1 UNITED KINGDOM Receivers/Foreign Military and Non-Military Tankers Technical Clearance Matrix**

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>AIRCRAFT</th>
<th>Tornado GR4/4A</th>
<th>Typhoon</th>
<th>RJ-135W</th>
<th>E-3D</th>
</tr>
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<tbody>
<tr>
<td>USA</td>
<td>USAF KC 135 Boom</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>USA</td>
<td>USAF KC 135 BDA</td>
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<td></td>
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<tr>
<td>USA</td>
<td>USAF KC 135 Wing Stations</td>
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<td></td>
</tr>
<tr>
<td>USA</td>
<td>USAF KC 10A Boom</td>
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<td>✓</td>
<td>✓</td>
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<tr>
<td>USA</td>
<td>USAF KC 10A HDU Station</td>
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<td>✓</td>
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<td>USA</td>
<td>USAF KC 10A Wing Stations</td>
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<tr>
<td>USA</td>
<td>USMC KC-130J</td>
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<tr>
<td>Australia</td>
<td>RAAF KC30A Pods</td>
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<td>✓</td>
<td>✓</td>
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<tr>
<td>Australia</td>
<td>RAAF KC30A Pods</td>
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<td></td>
<td>✓</td>
<td>✓</td>
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</tbody>
</table>
Table B2-1 UNITED KINGDOM Receivers/Foreign Military and Non-Military Tankers Technical Clearance Matrix continued- (Inc OEC/Cat 1 and CLE/Cat 2)

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<th>COUNTRY</th>
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<th>Tornado GR4/4A</th>
<th>Typhoon</th>
<th>RJ-135W</th>
<th>E-3D</th>
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<tbody>
<tr>
<td>USA Commercial</td>
<td>Omega KC707</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>France</td>
<td>FAF C-135FR BDA</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>France</td>
<td>FAF C 135FR Wing Stations</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>France</td>
<td>FAF C-135FR Boom</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
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<tr>
<td>Saudi Arabia</td>
<td>RSAF KC 130H Wing Pod only</td>
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</tr>
<tr>
<td>Canada</td>
<td>RCAF CC130 H(T)</td>
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<tr>
<td>Canada</td>
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<tr>
<td>Italy</td>
<td>IAF B767 Wing Stations/HDU</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Italy</td>
<td>IAF B767 Boom</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spain</td>
<td>SAF KC130H</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Germany</td>
<td>GAF A310 Wing Stations</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Netherlands</td>
<td>RNethAF KDC-10 Boom</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>
APPENDIX B3 – ANNEX B TO NATIONAL SRD – UNITED KINGDOM
VOYAGER – AAR RECEIVER INFORMATION

1. AAR Mission Planning and In flight Data. The following information is to be used in conjunction with the additional information listed in Appendix B5. This Appendix publishes AAR planning data for all receiver aircraft with AAR compatibility assessment. The tables below list the fuel types used by RAF aircraft and fuels which are acceptable to RAF receivers.

Table B3-1 Fuel Types

<table>
<thead>
<tr>
<th>NATO Code</th>
<th>UK Joint Services Designation</th>
<th>UK Spec (Def-Stan)</th>
<th>US Code</th>
<th>US Spec</th>
<th>Civilian Designation</th>
<th>Freezing Point</th>
<th>Wide Cut</th>
</tr>
</thead>
<tbody>
<tr>
<td>F34</td>
<td>AVTUR/FSII</td>
<td>91-87(^1)</td>
<td>JP-8</td>
<td>MIL-DTL-83133G</td>
<td>-</td>
<td>-47°C</td>
<td></td>
</tr>
<tr>
<td>F40</td>
<td>AVTAG/FSII</td>
<td>91-88</td>
<td>JP-4</td>
<td>MIL-DTL-5624U</td>
<td>-</td>
<td>-58°C</td>
<td>Yes</td>
</tr>
<tr>
<td>F44</td>
<td>AVCAT/FSII</td>
<td>91-86</td>
<td>JP-5</td>
<td>MIL-DTL-5624U</td>
<td>-</td>
<td>-46°C</td>
<td></td>
</tr>
<tr>
<td>F35</td>
<td>AVTUR</td>
<td>91-91(^2)</td>
<td>JP-1</td>
<td>MIL-DTL-83133G</td>
<td>Jet A-1(^3)</td>
<td>-47°C</td>
<td></td>
</tr>
<tr>
<td>F24</td>
<td>-</td>
<td>-</td>
<td></td>
<td>ASTM D6615</td>
<td>Jet A/FSII</td>
<td>-40°C</td>
<td></td>
</tr>
<tr>
<td>-</td>
<td>AVTAG</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Yes</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td>ASTM D1655-08a</td>
<td>Jet A</td>
<td>-40°C</td>
<td></td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td>ASTM D6615-06</td>
<td>Jet B</td>
<td>-50°C</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Notes:

1. To DEF STAN 91-87 excluding the provisions of Annex C.
2. To DEF STAN 91-87 excluding the provisions of Annex C.
3. Jet A-1 is equivalent to F35. Civilian suppliers may have Jet A-1 with FSII, which is equivalent to F34, but this must be confirmed with the supplier at that specific airfield. Jet A-1 with FSII may be annotated in FLIPs as Jet A-1+ or Jet A-1*.  

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### Table B3-2 Receiver Fuels

<table>
<thead>
<tr>
<th>RECEIVER</th>
<th>F34</th>
<th>F40</th>
<th>F44³</th>
<th>F35/ Jet A-1</th>
<th>AVTAG</th>
<th>Jet A</th>
<th>Jet B²</th>
<th>F24</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-130J</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>E3-D Sentry</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Tornado GR4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Typhoon</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

**Notes:**

1. The receiver fuels list is for information only and the receiver aircraft document set remains the authority document.
2. Jet B is not strictly equivalent to AVTAG as it has a different freezing point.
3. Tornado is cleared F-44 under CLE (Cat 2)
4. The receiver is to be informed prior to conducting AAR if the fuel to be transferred is less than 95% F34.
Table B3-3 AAR Mission Planning Data (VOYAGER/PODS/FRU).

<table>
<thead>
<tr>
<th>TYPE RCVR</th>
<th>BUDDY CRUISE IAS / MACH</th>
<th>OPTIMUM AAR ALT / IAS / MACH</th>
<th>CLOSURE RATE (FPS)</th>
<th>PROBE LIMIT MACH</th>
<th>UHF</th>
<th>VHF</th>
<th>HF</th>
<th>A/A TACAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tornado GR4</td>
<td>N/A</td>
<td>200 / 280 / 0.85</td>
<td>1-4</td>
<td>0.87</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Typhoon</td>
<td>N/A</td>
<td>200 / 280 / 0.85</td>
<td>1-4</td>
<td>0.85</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>C-130J Mk 4</td>
<td>N/A</td>
<td>160 / 220 / 0.58</td>
<td>1-4</td>
<td>0.58</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>C-130J Mk 5</td>
<td>N/A</td>
<td>160 / 210 / 0.58</td>
<td>1-4</td>
<td>0.58</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>E-3D Sentry</td>
<td>N/A</td>
<td>Below 290 /260 /0.66</td>
<td>1-4</td>
<td>0.78</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
## COMMON WARNINGS, CAUTIONS AND NOTES

1. **WARNINGS, CAUTIONS and NOTES.** The following WARNINGS, CAUTIONS and NOTES are common to all receiver aircraft and must be read in conjunction with the receiver-specific information published in the appropriate paragraph Appendix B5 to this Annex.

<table>
<thead>
<tr>
<th></th>
<th>![WARNING]</th>
<th>![CAUTION]</th>
<th>![NOTE]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WARNING</strong> – Due to the Voyager’s marked dihedral wing, there is a possibility of receiver disorientation in turns when no clearly defined horizon is present.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CAUTION</strong> – When in flight visibility precludes the receiver pilot from maintaining visual contact with the Voyager fuselage from the echelon position refuelling must be limited to single hose operation.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NOTE</strong> – The maximum bank angle during AAR using wing Pods is 30° day/night and 20° when making contact at night or in IMC. The maximum bank angle during AAR using FRU is 20°.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX B5 – ANNEX B TO NATIONAL SRD – UNITED KINGDOM

RECEIVER SPECIFIC AAR INFORMATION

NOT ISSUED
LIST OF EFFECTIVE PAGES TO ANNEX B – NATIONAL SRD – United Kingdom

<table>
<thead>
<tr>
<th>PAGE NUMBERS</th>
<th>EFFECTIVE PAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-1</td>
<td>Dec 17</td>
</tr>
<tr>
<td>B1-1</td>
<td>Dec 17</td>
</tr>
<tr>
<td>B2-1 to B2-2</td>
<td>Dec 17</td>
</tr>
<tr>
<td>B3-1 to B3-3</td>
<td>Dec 17</td>
</tr>
<tr>
<td>B4-1</td>
<td>Dec 17</td>
</tr>
<tr>
<td>B5-1</td>
<td>Dec 17</td>
</tr>
<tr>
<td>LEP B-1</td>
<td>Dec 17</td>
</tr>
</tbody>
</table>

LEP B-1

December 2017
ANNEX C TO NATIONAL SRD – UNITED KINGDOM

MANAGEMENT AND CONTROL OF AAR ACTIVITY

1. **Introduction.** AAR within UK airspace is the subject of formal agreement between airspace users and managers. The agreed procedures for co-ordination and interaction are contained in the Control of AAR Activity section in this annex, which is to be adhered to by all aircrew and all controllers participating in AAR. The authority for amendment of the AARA Controlling Unit and Notification List is vested in HQ AIR ATM in consultation with 2 Gp AM FHQ (A3/5).

**Control of AAR Activity in UK Airspace.**

2. **General.** The majority of AAR in UK airspace takes place within a formal AARA under service from ATCRU/ASACS units. These AARAs have the status of National Airspace Reservation and although non-deviating status is not normally awarded, AAR formations have relative freedom from normal procedural ATC constraints and other airspace users under the control of an ATC or ASACS unit are coordinated to avoid AAR traffic. The location and dimensions of AARAs are detailed in UK Military AIP Vol 1 ENR. AAR exercises are normally promulgated in advance and the relevant airspace is notified to other agencies. Detailed information on AARAs, booking procedures, controlling units and notification lists are contained in the UK Military AIP Vol 1. AAR formations may operate outside of notified AARAs at the discretion of the tanker captain.

a. **Tactical AARAs.** Operational considerations may dictate the need to set up a tactical AARA (ie outside the established AARAs). All units which may provide an air traffic service in the relevant airspace are to be informed by the controlling unit as soon as possible and preferably before the activity commences. AUS cannot co-ordinate short-notice tactical AARAs but must be advised immediately they are implemented. Furthermore, if an AARA which has been pre-notified and booked through AUS is changed, then the control authority must inform AUS. Outside formal AARAs, an AAR formation will not necessarily enjoy the freedom to fly varied tracks and may be subject to ATC traffic avoidance requirements. Tanker captains are to comply with the normal Rules of the Air unless their AAR formation has specific dispensation from the controlling ATCRU/ASACS.

b. **AAR Over Land.** Planned over land AAR in the UK associated with operations, exercises and AAR deployments is authorised by DCOS Ops, HQ 2 Gp by the issue of the appropriate operation order or AAR route brief, or in accordance with other nations National Instructions. Before planning sorties for essential routine AAR training over the UK land mass, the Tanker Planner is also to obtain the authority of DCOS Ops, HQ 2 Gp. Tanker captains may carry out impromptu AAR over land if compelling operational or flight safety reasons...
arise which outweigh the element of risk; as many aspects of AAR as possible are to be carried out over water or sparsely populated areas. In all cases of unplanned overland AAR, DCOS Ops, HQ 2 Gp is to be notified as soon as is reasonable practical after the event: such notification should include details of justification; time, location and altitude of the AAR; callsigns and types of tankers and receivers; and the home bases for the tankers and receivers. Non-British Military overland AAR is to be approved by the CAA.

c. **Airspace Co-ordination Notification.** For certain sorties, particularly those involving large numbers of aircraft or in complex airspace, AUS may issue an Airspace Co-ordination Notification (ACN). If so requested by the sponsor, this may afford a ‘non-deviating status’ to AAR formations operating in regulated airspace.

d. **Control Procedures.** The procedures for the control of RAF tankers, detailed at Appendix C1, are also to be employed when controlling tankers of other nations, with the exception of USAF operations. The special requirements of USAF AAR are detailed at Appendix C2. The following general points apply to all AAR activity.

1. During AAR there is a high workload for both tanker and receiver; thus, controllers are to keep RT transmissions and turns to the minimum practical. Furthermore, controllers are to note that any turns undertaken by an AAR formation may be slower and of a wider radius than normal.

2. When the tanker is planned to refuel more than one receiver, the activity is to be controlled from a dedicated console using an ATCRU/ASACS control frequency. In addition, there are 3 ‘boom’ frequencies allocated for AAR formations in UK airspace listed in Appendix C1, Table C1-2. The use of a boom frequency is at the discretion of the tanker captain.

3. The Tanker Controller is to ascertain the level at which AAR is to be carried out using the method described in Appendices C1 and C2. The tanker is then to be allocated a block of airspace, 1000 ft above and 2000 ft below the AAR level. When coordinating with other controllers, the Tanker Controller is to ensure that standard separation is achieved above or below the limits of the block. The AAR formation may manoeuvre vertically within the allocated block at the discretion of the tanker captain. Laterally, the tanker may be provided with radar vectors or may elect to self-navigate. A tanker formation operating in Class G airspace may operate outside the nominated AARA but should notify the controller of its intentions.

4. There may be occasions, such as radio silent RVs, when these procedures cannot be applied. In such circumstances, the tanker captain is to ensure that the requirements of the AAR formation are pre-notified.

5. The Tanker Controller is to ensure that the following information is
passed to the Fighter Allocator or Supervisor of all ATC and ASACS units operating in the vicinity of the AAR activity:

(a) Tanker squawk.

(b) Blocked levels.

(c) Controlling console number.

(6) When an AARA is being used, the list of units to be notified is detailed in the UK Military AIP. In addition, all notified units are to be advised when the AAR activity has ceased.

e. RT Phraseology. RT phraseology for use by controllers during AAR activity is detailed in Annex C Figure C1-1.

f. RT Procedures. Tanker captains are to call all turns when receivers are in formation to allow for deconfliction with uncoordinated traffic by the Tanker Controller. When radio silent procedures are in force such calls are not necessary and controllers are to be aware the tanker may turn without prior warning.

g. AAR Silent Procedures. To reduce RT on routine receiver training sorties, AAR silent procedures may be used. After the receiver has been sent astern, the tanker captain may order ‘continue on the lights’. The receiver is to acknowledge this call and continue with the light signals given in Annex A Appendix A1. The receiver may request full RT at any time. AAR silent procedures apply only to making contact and disconnecting. When receiving is complete the receiver is to call astern, at which point normal RT is resumed.

h. Emergency Procedures. In the event of any emergency, the tanker captain is to retain control of the formation. For a receiver emergency/malfunction, the tanker captain is to seek the advice of the receiver leader and decide on the best course of action. The tanker is to accompany the receiver(s) to a diversion airfield if the receiver leader considers this to be desirable. Controllers are to be aware that, under certain circumstances, it may be necessary for the tanker and receivers to carry out a breakaway, detailed in ATP-3.3.4.2, and that aircraft may use the full extent of the allocated block of airspace.

i. Tanker Controller Qualification. A military area radar controller is to be given specific training prior to controlling AAR activity. Any Limited Combat Ready ASACS controller may control AAR activity.

j. Fuel types. Most receivers can use a variety of fuel types; however the use of certain fuels in some aircraft imposes post-flight engineering and fuel loading considerations or in-flight restrictions. The normal fuel carried by RAF tankers is F34; if fuel other than F34 is to be transferred, the tanker captain is to
inform the receiver crew.

3. **Management of UK AAR Assets.** UK AAR assets are managed to reconcile tanker availability to receiver requirements. Liaison between tanker and receiver agencies is progressively devolved down the command chain as the date of the proposed tasking approaches.

   a. **Tanker Bids.** Bids are to be submitted by task sponsors to the AAR Cell (Bid Manager) at RAF Brize Norton. The tanker tasking is then apportioned to the approved tasks by the AAR Cell in consultation with DSCOM. The subsequent planning and resource allocation depends upon the nature of the AAR task.

   b. **AAR Deployments.** The framework for the control, planning and management of AAR supported deployments is described in HQ AIR Op Order 029/11 Overseas Deployments Using AAR. The AAR Cell formulates and publishes the AAR route briefs for these deployments; however, the receiver unit (or its Gp sponsor) is responsible for providing the planning data required to construct the route brief.

4. **Routine Weekly Tasking.** Receiver units bid to the AAR Cell, FS AARC (Tanker Planner), who co-ordinates the daily requirement for the following week against tanker availability. All bids are to be submitted 3 weeks in advance of the task week. Subsequent detailed planning is carried out by the Tanker Planner, liaising directly with receiver stations and appropriate control agencies. The Tanker Planner will then publish the Summary of Tanker Sorties for the week's planned tasks. Subsequently, the lead CRC allocates ATCRU/ASACS control. Further liaison and co-ordination is carried out by the Tanker Planner until the sorties are flown. At the pre-flight planning stage, tanker crews may confirm final details through the AAR Cell, SNCO AARC (Voyager Ops) or by direct contact Appendix C1 Table C1-2.
APPENDIX C1 - ANNEX C TO NATIONAL SRD – UNITED KINGDOM

CONTROL OF TANKERS IN UK AIRSPACE

1 Rendezvous Procedures

a. **Pre-brief.** As part of the standard sortie brief, the details listed below are normally available to the ASACS unit within whose area of responsibility the AAR will take place. A military ATCRU tasked with providing a service to RAF aircraft engaged in AAR should obtain the information from the tanker flight plan or Tanker Plans at RAF Brize Norton. The tanker captain should be asked to pass these details using RT only if the information cannot be obtained from the tasking agency.

   1. Types and callsigns of tankers and receivers.
   2. RV procedures.
   3. ARCTs.
   4. AARAs required.
   5. AAR levels required.

b. **RV Type.** ATC or ASACS controller may be required to vector the tanker and receivers to achieve an RV A (Anchor RV). Alternatively, the tanker and receiver may use airborne internal aids to achieve a rendezvous. RVs B, C, D (Point Parallel), E (Timing), F and G (En-route) all refer to different types of internal aids procedures and are described in ATP-3.3.4.2 (ATP 56). During these procedures, pilots may ask for assistance in achieving the RV. However, unless such assistance is requested, controller responsibility during these RVs is limited to the provision of an ATS appropriate to the airspace status.

c. **Communications.** All receivers are to be controlled on the tanker control frequency until visual acquisition of the tanker has been achieved. When necessary, receivers may be controlled by another console, provided that a handover to the Tanker Controller is accomplished before closing to within 10 nm of the tanker. Controllers should be aware that certain internal-aids RV procedures require the tanker and receiver to be on the same frequency at extended range. Once the receiver is on the tanker control frequency, the tanker will make an RV Initial Call.

d. **Boom Frequencies.** There are 3 frequencies allocated for UK AAR towline use shown in Appendix C1 Table C1-2., available at the discretion of the tanker captain.

e. **Lighting.** Tanker High Intensity Strobe Lights (HISLs) are to be switched off before receivers join to close formation; the anti-collision beacon can be switched off at the receiver’s request. All tanker flood lights are to be on and at full brilliance during the RV and receiver join; these are dimmable at the receiver’s request.
f. **Tanker State Message.** To aid CRC management and improve training value whilst tankers are operating with ASACS units, tankers are to pass a Tanker State Message when requested by the tanker controlling authority. If an update on the transferable fuel is required, the CRC should ask the tanker captain for a ‘Foxtrot’, not a repeat of the complete state. The tanker state message comprises 4 elements:

1) **Transferable Fuel.** Transferable fuel is defined in ATP 3.3.4.2 (ATP-56). It is important for ground controllers to appreciate that this is the quantity of fuel available for AAR at the time of the tanker’s response. Available fuel will diminish with time as the tanker subsequently burns and transfers fuel. Forward planning by the CRC on the utility of airborne tankers during operations/exercises is therefore based on a transferable fuel state, acquired at a given time, adjusted by knowledge of tanker fuel burn rate and forecast receiver requirements. Other than for routine tasks, where transferable fuel may be given in clear, tanker crews are to encrypt fuel quantities using NUCO. In certain scenarios it may be necessary to conceal that AAR is being used, in which event the appropriate NAMAT code groups are to be used by the CRC to ascertain transferable fuel.

2) **Serviceable Hoses.** The possible variations of serviceable hoses are:

   1. 3 hoses.
   2. 1 wing hose plus centreline.
   3. 2 wing hoses.
   4. 1 wing hose.
   5. Centreline.
   6. *Not used.*
   7. No hoses (available for comms, automatic radio relay etc).

3) **Receiver Qualification.** RAF Voyager aircraft are not receiver capable.

   1-6 *Not used.*
   7. Not receiver capable.

4) **Automatic Radio Relay Capability.**

   1. Automatic radio relay capable.
   2. Automatic radio relay incapable.

g. **Angles of Bank.** Tankers may use up to 30° AOB for turns during AAR with FJ receivers. Tanker AOB is to be restricted to 20° AOB when large multi-engine aircraft
are in echelon, joining to echelon or refuelling. If a greater AOB is required, large aircraft are to be placed in line astern formation when up to 30° AOB may be used. Receiver pilots may request lesser AOB at any time.

h. **Rendezvous.** For an RV A (Anchor RV), the receivers are to be vectored to a position 1 to 2 nm behind the tanker. The first receiver (or formation) that will join is to be instructed to fly at a level 1000 ft below the tanker. Subsequent receivers are to be vertically displaced 1000 ft below receiver formations that are closer to the tanker. The use of a discrete boom frequency for AAR will prevent the Tanker Controller from hearing receivers joining the tanker and commencing AAR. In this case, the controller must be advised by the tanker captain that the joining level has been vacated before subsequent receivers can be cleared to that level.

i. **A/A TACAN.** EMCON permitting, maximum use should be made of A/A TACAN. Irrespective of equipment fit, all receivers should select the appropriate A/A TACAN channel during RVs, even if visual, as the range countdown provides the tanker crew with valuable cues for internal and formation management.

j. **Join.** There is no requirement for ATC/ASACS to ask the tanker captain for permission for a receiver to join. Normally, the tanker pilot will clear the receiver to join after visual contact has been declared. The tanker pilot may allow the receiver to complete a join from any level provided that SA is assured. If the tanker pilot has not taken control of the join, the Tanker Controller may only release the receiver to the tanker’s boom frequency (if one is in use) or allow the receiver to reduce the vertical separation if the receiver has visually acquired the tanker, and the receiver is at the correct joining level. The receiver must confirm “nose cold, switches safe” before joining.

k. **CONVEX Procedures.**

   (1) **Contacts/ Disconnects.** In accordance with ATP-3.3.4.2 (ATP 56), UK Receivers are to make all contacts/disconnects in straight and level flight unless the receiver supervisory pilot requests otherwise.

   (2) **Passenger carriage.** Passengers are not to be carried on CONVEX flights unless a receiver AAR Instructor occupies one of the pilot seats.

2 **Departure Procedures.** After AAR, receivers normally depart by climbing to 1000 feet above the tanker formation. The tanker captain may permit the receiver to depart level or in a descent but is to co-ordinate the receiver’s departure requirements with the Tanker Controller. The receiver is to establish 2-way contact with the Tanker Controller before departing from the tanker’s block.
### Table C1-1 Phraseology for the Control of AAR

<table>
<thead>
<tr>
<th>Circumstances</th>
<th>Phraseology</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CONTROLLER TO TANKER</strong></td>
<td></td>
</tr>
<tr>
<td>All Tankers</td>
<td></td>
</tr>
<tr>
<td>1 AAR with receivers on discrete frequency not monitored by Tanker Controller. Tanker captain has not advised that the joining level has been vacated and subsequent receivers are approaching the tanker.</td>
<td>Is FL…. clear?</td>
</tr>
<tr>
<td>2 Tanker pre-brief.</td>
<td>Receivers will be transferred to your control at FL …. Report when receivers vacate that level.</td>
</tr>
<tr>
<td>3 To determine departure requirements of receivers under control of tanker captain.</td>
<td>What are the departure requirements of (callsign)?</td>
</tr>
<tr>
<td><strong>CONTROLLER TO RECEIVERS</strong></td>
<td></td>
</tr>
<tr>
<td>4 Receivers for AAR with any tanker.</td>
<td>After refuelling, climb 1000 ft above the tanker, maintain position near the tanker, contact (unit) on (freq).</td>
</tr>
<tr>
<td>5 All receivers for AAR with any tanker using a discrete AAR frequency.</td>
<td>The tanker frequency is …. Do not change until instructed.</td>
</tr>
<tr>
<td>6 All receivers for AAR with any tanker.</td>
<td>(Tanker callsign) is at FL …. in position (clock code and range from receiver may be used), heading ….</td>
</tr>
<tr>
<td>7 All receivers for AAR with any tanker.</td>
<td>Report visual with (tanker callsign).</td>
</tr>
<tr>
<td>8 Visual with RAF tanker.</td>
<td>Squawk standby, contact (tanker callsign). (When appropriate, frequency or TAD may be specified).</td>
</tr>
</tbody>
</table>

### Table C1-2 UK AAR & NATO Europe Boom Frequencies

<table>
<thead>
<tr>
<th>UK AAR Primary</th>
<th>264.350</th>
<th>AAR 1</th>
<th>335.525</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK AAR Secondary</td>
<td>265.125</td>
<td>AAR 2</td>
<td>292.000</td>
</tr>
<tr>
<td>UK AAR Tertiary</td>
<td>362.100</td>
<td>AAR 3</td>
<td>269.200</td>
</tr>
<tr>
<td>UK AAR Spare</td>
<td>355.800</td>
<td>AAR 4</td>
<td>328.450</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AAR 5</td>
<td>307.325</td>
</tr>
</tbody>
</table>
APPENDIX C2 - ANNEX C TO NATIONAL SRD – UNITED KINGDOM

CONTROL OF USAF TANKERS IN UK AIRSPACE

1. Rendezvous Procedures.

a. Pre-brief. After establishing initial contact with a USAF tanker, the Tanker Controller is to request the following information:

   (1) Types and callsigns of tankers and receivers.
   (2) ARCTs.
   (3) AARAs required.
   (4) AAR levels required.

b. RV Type. ATC or ASACS controller may be required to vector the tanker and receivers to achieve an RV. Alternatively, the tanker and receiver may use airborne internal aids to achieve a rendezvous (RV). During these procedures, pilots may ask for assistance in achieving the RV. However, unless such assistance is requested, controller responsibility during these RVs is limited to the provision of an ATS appropriate to the airspace status.

c. Communications. All receivers are to be controlled on the tanker control frequency until visual acquisition of the tanker has been achieved. When necessary, receivers may be controlled by another console, provided that a handover to the Tanker Controller is accomplished before closing to within 10 nm of the tanker. Controllers should be aware that certain internal-aids RV procedures require the tanker and receiver to be on the same frequency at extended range.

d. Rendezvous. When the radar unit is responsible for the RV, the receivers are to be vectored to a position 1 to 2 nm behind the tanker. The first receiver (or formation) that will join is to be instructed to fly at a level 1000 ft below the tanker. Subsequent receivers are to be vertically displaced 1000 ft below receiver formations that are closer to the tanker.

e. Join. There is no requirement for ATC/ASACS to ask the tanker captain for permission for a receiver to join. However, the Tanker Controller may only release the receiver to the tanker’s boom frequency if the receiver has visually acquired the tanker, and the receiver is at the correct joining level. The receiver is to maintain the joining level until further cleared by the tanker captain. The Tanker Controller must have been advised by the tanker captain that a previous receiver has vacated the joining level before subsequent receivers can be cleared to that level.
2. **Departure Procedures.** After AAR with a USAF tanker, receivers achieve a vertical separation within the AAR block, maintaining position near the tanker. It is standard procedure for fighter type receivers to climb to the top of the AAR block, whilst heavy aircraft receivers normally depart by descending to the bottom of the AAR block. The tanker captain is to co-ordinate the departure requirements of the receiver with the Tanker Controller before the receiver is permitted to leave the AAR level. This co-ordination may be waived with the permission of the Tanker Controller for multiple standard fighter type departures; however, it is mandatory for all other departures.

**Table C2-1 Phraseology for the Control of AAR**

<table>
<thead>
<tr>
<th>Circumstances</th>
<th>Phraseology</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CONTROLLER TO TANKER</strong></td>
<td></td>
</tr>
<tr>
<td>All Tankers</td>
<td></td>
</tr>
<tr>
<td>1 AAR with receivers on discrete frequency not monitored by Tanker Controller. Tanker captain has not advised that the joining level has been vacated and subsequent receivers are approaching the tanker.</td>
<td>Is FL…. clear?</td>
</tr>
<tr>
<td>2 Tanker pre-brief.</td>
<td>Receivers will be transferred to your control at FL …. Report when receivers vacate that level.</td>
</tr>
<tr>
<td>3 To determine departure requirements of receivers under control of tanker captain.</td>
<td>What are the departure requirements of (callsign)?</td>
</tr>
<tr>
<td><strong>CONTROLLER TO RECEIVERS</strong></td>
<td></td>
</tr>
<tr>
<td>4 Fighter receivers for AAR with <strong>USAF</strong> tankers.</td>
<td>After refuelling, climb 1000 ft above the tanker, maintain position near the tanker, contact (unit) on (freq).</td>
</tr>
<tr>
<td>Heavy receivers for AAR with <strong>USAF</strong> tankers.</td>
<td>What are your departure requirements after refuelling?</td>
</tr>
<tr>
<td>5 All receivers for AAR with <strong>USAF</strong> tankers.</td>
<td>The tanker frequency is …. Do not change until instructed.</td>
</tr>
<tr>
<td>6 All receivers for AAR with <strong>any</strong> tanker.</td>
<td>(Tanker callsign) is at FL …. in position (clock code and range from receiver may be used), heading ….</td>
</tr>
<tr>
<td>7 All receivers for AAR with <strong>any</strong> tanker.</td>
<td>Report visual with (tanker callsign).</td>
</tr>
<tr>
<td>8 Visual with <strong>USAF</strong> tanker.</td>
<td>Squawk standby, maintain FL …. contact (tanker callsign), frequency ….</td>
</tr>
</tbody>
</table>
## LIST OF EFFECTIVE PAGES TO ANNEX C - NATIONAL SRD – United Kingdom

<table>
<thead>
<tr>
<th>PAGE NUMBERS</th>
<th>EFFECTIVE PAGES</th>
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</thead>
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<td>Dec 17</td>
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<tr>
<td>C1-1 to C1-4</td>
<td>Dec 17</td>
</tr>
<tr>
<td>C2-1 to C2-2</td>
<td>Dec 17</td>
</tr>
<tr>
<td>LEP C-1</td>
<td>Dec 17</td>
</tr>
</tbody>
</table>
ANNEX D TO NATIONAL SRD-UNITED KINGDOM

AAR DEPLOYMENTS (FORCE EXTENSION)

1. **Introduction.** RAF crews are to conduct AAR deployments in accordance with HQ AIR Operation Order 029/11 Overseas Deployments Using AAR and ATP-3.3.4.2 (ATP 56). Terms of Reference for key deployment personnel and briefing requirements are in HQ AIR Operation Order 029/11. The procedures in this Annex are not exhaustive and the contents do not absolve crews from using their best judgment.

2. **Planning.**
   
a. **Principles.**
      
      (1) UK-managed deployments are planned on the basis of 2 fundamental principles:

      (a) The receiver is not to be beyond unrefuelled range of destination or a diversion airfield at any point during the deployment.

      (b) The receiver fuel state at destination or diversion airfields is not to be less than that specified by the receiver operating authority.

      (2) Deployments may be accompanied or unaccompanied:

      (a) Accompanied deployments are those where the receiver aircraft fly in formation with the tanker until released by the lead tanker captain.

      (b) Unaccompanied deployments are those where receiver aircraft are not accompanied by the tanker, except at pre-determined AAR rendezvous points along the deployment route.

b. **Method.** The AARC constructs the deployment plan (route brief) using performance data supplied by the receiver operating authority with due regard for constrained airspace and diplomatic limitations. Route and AAR planning is based on 85% statistical meteorological data from the HQ Meteorological Office Exeter, which ensures a high probability of deploying on the planned day and provides useful safety factors on most occasions. AAR transfers (brackets) are placed to keep the receiver fuel state above that required for unrefuelled transit to a diversion airfield. Each bracket has an associated abort point and each abort point has an associated diversion airfield. If an AAR transfer fails, the abort point designates the furthest position down route to which the receiver can fly and still remain within unrefuelled range of the associated diversion airfield.

c. **Structure.** When a large number of receivers deploy and/or large numbers of tankers are required, the deployment is usually divided into self-contained and successive waves. Relatively small formations are easier to manage and the station keeping task is eased, particularly in IMC. Furthermore, most countries impose limitations on the volume of controlled airspace which may be occupied by

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D-1

December 2017
formations. Deployments are usually planned so that the number of tankers in each wave does not exceed 2 and the number of receivers allocated to a tanker is normally limited to 4.

### d. Flight Plan.

1. Details of diplomatic clearances and flight plan annotations for each deployment are published in the route brief. When receivers accompany the tanker along the whole route, the tanker crew or AARC will normally be tasked with submitting a flight plan for the whole formation; in certain areas such as Oceanic airspace, separate flight plans may be required by the ATC authority. The route brief will specify responsibilities for flight plan submission.

2. Tankers tasked with non-AAR transits are to use Jetplan as the primary method of route optimization. The AAR Cell will arrange diplomatic clearances and advise on route selection if required.

### e. Changes.

A completed route brief is the product of harmonizing several AAR, airspace and diplomatic requirements. Seemingly minor changes to basic planning parameters can have a marked effect upon the itinerary and may cause a complete re-plan. Therefore, it is essential for receiver agencies to finalise the number and configuration of the aircraft required to deploy before detailed planning is started by the AAR Cell. Changes proposed later than 3 weeks before the deployment date are to be avoided.

### 3. Communications.

#### a. AAR Frequencies and A/A TACAN.

Six NATO UHF frequencies are allocated for use during AAR deployments and are listed in the RAF Radio Frequency List. The frequencies are used for the ground and air management of the AAR task. UHF frequencies and A/A TACAN channels are listed and allocated to each wave in the route brief.

#### b. Multiple Tanker Formations.

The lead tanker crew is to communicate with ATC on behalf of the formation; other communication tasks should normally be carried out by the crew of the second tanker. However, the lead tanker captain is responsible for the formation’s communications and may delegate tasks as circumstances require; this aspect is to be included in the tanker pre-flight briefing.

#### c. RV Confirmation.

When a tanker is positioned at an intermediate airfield for an RV en-route, it is important to confirm the RVCT. If suitable communications are available between deployment bases these should be used to confirm the RVCT. However, the RVCT is also to be confirmed by RT, using HF if available. HF frequencies are 9031 KHz (primary) or 6739 KHz (secondary), or as directed in the route brief. The following calls are to be made:

1. **HF Equipment Available.** The aircraft in transit is to call the tanker 2 hours before the RVCT, or as may be otherwise detailed at the face to face brief. The tanker HF is to be manned, ready to receive the call. If contact is not established, the aircraft in transit is to call the tanker 60, 45 and 30 minutes before the planned RVCT until contact is established.
HF Unavailable or HF Contact not Established. The tanker is to take-off to make good the RVCT. The aircraft in transit is to call the tanker on the appropriate wave UHF AAR frequency 20 minutes before the RVCT and thereafter until contact is established.

4. Reserve System.

a. General. It is important for waves to deploy punctually because diplomatic and airspace clearances are usually valid for limited periods only. Furthermore, operational considerations usually make delays undesirable or unacceptable. Therefore, tanker and receiver units will usually be required to implement a reserve system for all deployments. The selected reserve system will depend upon available resources and the priority placed by the AAR Cell upon punctual departure. A ground reserve dedicated to every deploying aircraft is rarely specified because this is expensive in resources. Similarly, airborne reserves are seldom required.

b. Single Waves. Deployments of one wave usually require at least one receiver ground reserve aircraft and, occasionally, a tanker ground reserve. If the AARC specifies ‘manned’ reserves then the reserve crews are to complete all preparations for flight (including cockpit and radio manning) simultaneously with the primary crews. The requirement for the reserve to start or taxi with the primary aircraft is usually left to the discretion of the AARC/DETCOM and will be dependent on local conditions. If unmanned reserve aircraft are specified, these are to be fully prepared for flight and ‘combat checked’ (if appropriate to aircraft type) to minimize delay in the event of a primary crew changing aircraft.

c. Multiple Waves. The Cascade Ground Reserve system is the most economical method for multiple wave deployments, with aircraft and crews of each wave reserving for their equivalent aircraft in the preceding wave. When the first wave is airborne, the second wave relinquishes its ground reserve duties and takes up the route brief tasks allocated to the second wave. The third wave then acts as reserve for the second wave. This sequence continues until the deployment launch is complete. Crews of second and subsequent waves are to complete all preparation for flight (including aircraft and radio manning) in order to meet the timing schedule of the preceding wave. Aircraft are to be loaded and prepared for flight in readiness to meet the flight schedule of the preceding wave. In certain circumstances dissimilar tanker types may not be able to reserve for each other; in these cases the AARC will brief the specific actions on the day.

d. Frequencies and Callsigns.

(1) Frequencies. On the ground, each wave and its reserves are to monitor the management frequency allocated. All waves, in a multiple wave deployment, are to check-in on the management frequency (using personal/squadron callsigns if required). Prior to takeoff, individual waves are to change to the allocated wave AAR frequency for departure. Details of the communications plan will be covered in the lead tanker captain’s brief.

(2) Operational/Task Callsigns. ASCOT (RRR) callsigns are allocated by the route brief to each deploying tanker and receiver; these callsigns identify a specific task in the AAR plan. Diplomatic and flight plan clearances associate
these callsigns with specific routes, flight levels and timings. Thus, these callsigns have both a management and an airspace clearance function. Crews performing a route brief task are to use the callsign allocated to that task, even if a reserve is substituted for a primary aircraft.

(3) **Personal/Squadron Callsigns.** In the event of unserviceability it is essential to avoid confusion when callsigns are transferred from primary to reserve aircraft. The lead tanker captain is to allocate personal/squadron callsigns to all participating crews and agree appropriate procedures for changing callsigns in the event that a reserve is substituted for a primary aircraft.

5. **Briefing.**

a. **Pre-deployment.** Co-located tanker and receiver crews are to conduct a face-to-face briefing before each stage of a deployment; ideally, all tanker and receiver crews should attend this briefing. The AARC is to arrange and manage the briefing and will distribute route briefs in time for all participants to consider the contents. If appropriate, the face to face briefing is also to include a brief on SAR capabilities and equipment available. When crews are not co-located and a face to face briefing is impractical, the lead tanker captain is to brief representative crew members (of the participating units) who are scheduled to participate in the deployment. However, notwithstanding the above, OC tanker/receiver squadrons are responsible for ensuring that their crews are properly briefed for all AAR-supported deployments and recoveries.

b. **Purpose.** The briefing format outlined below is optimized for a formal briefing when all participants are co-located. Irrespective of the format, the purpose of the briefing is to provide all participants with a comprehensive understanding of the deployment so that the most effective method of implementing the plan is adopted and the correct in-flight decisions are taken. The briefing is to encompass 3 general topics: the route and AAR plan, formation and communications procedures, and receiver malfunctions. It may be convenient for the AARC/DETCOM to include other administrative details such as MT timings etc.

c. **Format.**

(1) **Route and AAR Plan.** The AARC, or lead tanker captain if no AARC is available, is to outline the following factors and constraints which shape the deployment plan (The lead tanker captain may not be able to brief all the items, such as planning constraints):

(a) General outline of the deployment, planning constraints and amendments to the route brief.

(b) Forecast weather at departure airfields, RV, en-route, diversion and destination airfields.

(c) Movement table and reserve system.

(d) Local ATC requirements.
(e) RV procedure, including the practicability of substituting RV F if applicable, and radar assistance availability.

(f) Diplomatic clearances, airspace reservations, restrictions en-route, delay capability (AVANA, crew duty etc) and altitude reservation (ALTRV) bookings.

NOTE

TANKER CREWS ARE TO CHECK THE ROUTE IN THE ALTRV APPROVAL SIGNAL AS IT MAY DIFFER FROM THE ROUTE BRIEF. IN ADDITION, TANKER CREWS ARE TO CARRY A COPY OF THE ALTRV APPROVAL SIGNAL IN FLIGHT.

(g) AAR plan, brackets, single hose constraints, abort points and, if applicable, formation point of no return.

(h) Receiver requirements in the event of a malfunction and the diversion policy, including the requirement for the tanker, additional receiver(s) or route support aircraft to accompany a receiver to the diversion airfield.

(i) Flight plan requirements and annotations (if not already detailed in the route brief).

(2) **Formation and Communications Procedures.** The lead tanker captain is to brief the following:

(a) Callsign plan and crew out, RT check-in, engine start, taxi and take-off times.

(b) ATC clearance, start, taxi and departure frequencies and AAR frequencies.

(c) Heading reference; either magnetic or true throughout.

(d) Tanker snake/cell climb and/or tanker/receiver accompanied climb, as appropriate.

(e) Formation join-up.

(f) Formation for RV, en-route and AAR phases, to include procedures to be used if the formation encounters IMC.

(g) Weather reports and, if applicable, transfer failure messages.

(h) En-route formation leaving procedures.

(i) Formation dispersal at destination, including accompanied letdown, if appropriate.

(3) **Receiver Malfunction.** The lead tanker captain, following discussion with
the lead receiver captain should brief the initial formation position receivers are to adopt following a malfunction, including any use of transponder if appropriate.

6. **Formation.** RV and general formation procedures are in ATP-3.3.4.2 (ATP-56). However, en-route formation disposition will usually be governed by the route brief wave composition and the refuelling plan. The lead tanker captain is responsible for devising and briefing the formation plan best suited to the deployment. Careful consideration is to be given to the procedures to be used if the formation encounters IMC and the safety of the formation is an overriding consideration.

7. **General Refuelling Procedures.**

a. **Bracket Sequence.** The AAR plan assumes the receivers will be in contact with fuel flowing at the start of the bracket. The following pre-bracket sequence is advised:

   (1) At 8 minutes before the bracket, receivers are to be informed that the hose(s) will be trailed in 4 minutes, which is the receivers’ cue to close up from a loose transit formation and complete any pre-tanking checks. If the hose(s) are already trailed at the 8 minute point, the tanker captain is to order the receivers into close formation.

   (2) No later than 4 minutes before the bracket, the tanker is to trail its hoses.

   (3) At 2 minutes before the bracket the tanker is to obtain the receivers fuel state and clear the receivers astern.

   **NOTE**

   TANKER CAPTAINS ARE TO HAVE THE HEADING AND DISTANCE TO THE ASSOCIATED DIVERSION AND THE LATEST DIVERSION AIRFIELD WEATHER READILY AVAILABLE. TANKERS ARE TO PASS THE INFORMATION SHOULD A DIVERSION BE INITIATED, APPEAR LIKELY, OR ON REQUEST.

   **NOTE**

   AFTER THE BRACKET IS COMPLETE, THE TANKER IS TO CLEAR THE RECEIVER TO RESUME THE EN-ROUTE FORMATION, PASS THE FUEL TRANSFERRED AND ETA TO THE NEXT BRACKET.

b. **Abort Point (AP).** If fuel is not flowing into a receiver by the time the AP is reached, the tanker captain is to order the receiver to divert to the associated diversion airfield. The receiver operating authority specifies the required minimum receiver fuel state at the diversion airfield and the AP is positioned to achieve this based on receiver transit fuel consumption between the AP and the diversion airfield. Fuel consumption rises considerably during attempts at AAR. If an attempt is made to refuel after the AP en-route to the diversion airfield and this fails, the receiver will arrive at the diversion with less than the required minimum fuel state. Therefore, once the diversion decision is taken, further AAR is not permitted.

   **NOTE**
THE POSITION OF THE AP ASSUMES THAT THE RECEIVER IS ATTEMPTING AAR FROM 2 MINUTES PRIOR TO THE BRACKET UP TO THE AP.

NOTE

THE AARC MAY PROMULGATE ALTERNATIVE ABORT AIRFIELDS IN THE ROUTE BRIEF, AT THE FACE TO FACE BRIEFING OR IN THE AARWIN RESULTS; THESE DIVERSION AIRFIELDS MAY USED WHEN CALCULATING A VALID AP.

NOTE

IF AN AARC IS TRAVELLING ON THE TANKER, AT THE CAPTAIN'S REQUEST, THE AARC CAN REPLAN BRACKET AND AP POSITIONS USING THE AARWIN PROGRAM ON THE AARC COMPUTER.

c. Bracket Procedures.

(1) Receiver Full Early. Receivers may be full before the end of the bracket. However, the subsequent fuel plan is calculated on the assumption that the receivers reach the next bracket with the predicted fuel figure. When the en-route met conditions, particularly the wind component, are exactly equal to the 85% statistical figure (or the estimated value on a ‘live’ plan) and a receiver is disconnected before the end of the bracket, its fuel state at the next bracket will be below the predicted figure and the abort point will be invalid. Therefore, unless the receiver disconnects at or beyond the end of the bracket, the tanker crew is to validate the next abort point using the pre-bracket procedure. Accordingly, in order to attain the aim of a receiver being full at the end of the bracket, it may be necessary to adjust the timings of brackets by delaying the start. However, for the reasons given below, tanker captains are to order receivers to disconnect as soon as they are full.

(a) Tornado. A heavy Tornado burns fuel at a very high rate; any extra fuel burnt at this rate is lost to the formation. Moreover, AAR at high weight is fatiguing for the receiver pilot. Therefore, tanker captains may order Tornados to disconnect as soon as they are full.

(b) Typhoon. The Typhoon refuel valves will not open until 50 kg of fuel has been used. Therefore, when the tanks are full it can take approximately one minute at the refuel consumption rate before the refuel valves open; thus there is no value in keeping a Typhoon in contact to the end of a bracket if there is no fuel flow.

(2) Brackets Not to Full. The route brief may specify that some brackets (usually the final series) are not to full.

(a) Final Bracket. The requirement is for receivers to have at least the specified amount of fuel at (or beyond) the end of the bracket. Receivers may only disconnect before the end of the bracket if their fuel state, adjusted using anticipated groundspeed and receiver transit consumption rate, is such that they will have at least the specified fuel at the end of the
(b) **Other Than Final Bracket.** If the receiver disconnects before the end of the planned bracket and its fuel state is less than the route brief figure at the end of the planned bracket, the tanker crew is to validate the next AP using the pre-bracket procedure.

8. **Revised Abort Point (RAP) Procedures.**

   a. **General.** The receiver fuel plan and APs are calculated using the transit consumption rate (TCR) up to 2 minutes before the refuelling bracket, the refuel consumption rate (RCR) from 2 minutes before the bracket up to the AP and then the TCR from the AP to the diversion airfield. The receiver fuel plan and APs are published in the route brief. However, under the following circumstances, tanker crews are required to adjust APs in flight:

   (1) Shortfall before first bracket.

   (2) Partial transfer.

   (3) Wing hose unserviceability.

   (4) Fuel shortfall compared to the plan or for any other reason, eg disconnected early.

   RAP procedures ensure that the receiver will arrive at the nominated airfield with the required fuel, as specified in the route brief, in the above circumstances.

   b. When considering moving an AP, the only variable is the position of the AP airfield. Any AP to diversion airfield geometry can be approximated to one of 3 cases: abort airfield behind, abeam or ahead. By identifying which of the 3 cases is most applicable and then applying the appropriate factor (see definitions table), APs can be moved as appropriate. Fuel shortfalls move APs towards the formation; additional fuel above planned route brief fuel may be used to extend an AP away from the formation. The general formula for each case is:

   (1) Airfield behind: \[ \text{Time} = \frac{\text{Fuel}}{\text{RCR} + \text{TCR}}. \]

   (2) Airfield abeam: \[ \text{Time} = \frac{\text{Fuel}}{\text{RCR}}. \]

   (3) Airfield ahead: \[ \text{Time} = \frac{\text{Fuel}}{\text{RCR} - \text{TCR}}. \]

   c. **Application.**

   (1) If, after adjustment of the AP, the case has changed, recalculate using the new case. If this alters the case again apply the safer case. This double change can only occur when moving the abort point towards the formation. However, when moving the AP away from the formation, it is possible that the position of the RAP no longer satisfies the original case but on recalculation the RAP moves back towards the formation and the case reverts to the original case, for example: the AP moves too far down track to still satisfy the abeam case definition and becomes a behind case, but, on recalculation using the
behind case, the RAP position reverts to the abeam case; in these circumstances use the safer case (in this example behind).

(2) As each AP is treated as a separate case with its own AP airfield geometry, each AP should be moved by the anticipated groundspeed at that point. Anticipated groundspeed should be predicted using a combination of actual and Jetplan information over the relevant part of the route.

(3) Wind only has an effect on the airfield behind case; however, the effect is negligible and is not taken into account when calculating RAPs.

(4) For RAP calculation purposes, ToD for FJ receivers is assumed to be any position within 40 nm of the abort airfield.

### RAP Example

500 kg fuel shortfall, abort airfield behind, TCR = 35, RCR = 85.

Fuel consumption for an abort airfield behind is RCR + TCR (85 + 35) = 120 kg/min.

Therefore, the AP must move 500/120 = 4.2 min.

Anticipated groundspeed is 420 kts; distance is (420/60) x 4.2 min = 29.4 nm.

Thus, the AP must move 29.4 nm towards the formation.

d. **Pre-Bracket Procedure.** As soon as practicable after the formation has joined up and is at cruise altitude, the tanker captain is to obtain each receiver's fuel state. These figures are to be adjusted, using anticipated groundspeed and receiver TCR, and then compared with the receiver's planned route brief fuel at the start of the first bracket. Any shortfall will move the AP towards the formation.

   (1) If the RAP occurs after the start of the bracket, then no further action is required.

   (2) If the RAP occurs before the start of the associated bracket, then the receiver would become AAR dependent and a diversion would be the safest option.

e. **Partial Transfer.**

   (1) If a fuel transfer is interrupted, the AP may be repositioned along track using the RAP procedure and further AAR attempted.

   (2) Where the receiver is close to being full prior to the interruption, further attempts to reconnect at high weight may be undesirable. In this case, the tanker captain is to ascertain the receiver's fuel state and, using anticipated groundspeed and receiver TCR, compare the receiver's expected fuel state at the start of the next bracket with that shown in the route brief. Any shortfall will move that receiver's AP for the next bracket towards the formation. If the receiver's RAP occurs after the start of the bracket, then there is no requirement...
to bring the receiver back into contact. If the receiver's RAP occurs before the start of the bracket, the RAP becomes invalid. The bracket just completed must then be treated as a partial transfer, and another bracket completed to pass at least some of the shortfall. After the additional bracket, the tanker crew is to validate the receiver's fuel plan using the pre-bracket procedure.

f. Unserviceable Wing Hose.

(1) General. Brackets for FJ receivers being deployed by multiple-hose tankers are usually planned for the simultaneous refuelling of 2 receivers using the wing hoses. However, if a wing hose becomes unserviceable, the receivers will have to refuel sequentially; this will not be possible within the dimensions of the route brief bracket. (The AAR Cell can provide the tanker crew with a single hose plan if the hose is unserviceable preflight).

(2) Late Bracket Procedure. If the AP is some distance from the bracket, the first receiver should refuel within the route brief bracket and the second receiver should refuel after the route brief bracket.

(3) Early Bracket Procedure. If the AP is too close to make the above procedure practical, the first receiver is to refuel before the start of the route brief bracket. A valid bracket and AP can be created by moving both the start bracket position and AP towards the formation by the same distance. This early bracket should be planned so that sufficient fuel is passed to extend the AP to allow the second receiver to be refueled within the route brief bracket. As the first receiver is refuelled earlier than planned, it will be unable to accept all of the planned route brief fuel transfer. Therefore, the first receiver may need to be brought back into contact after the route brief bracket, to receive the remainder of the planned route brief transfer. This additional transfer must commence before the RAP is reached (treat as partial transfer). It may be desirable to carry out a measured partial transfer to the first receiver rather than filling to full so that the second contact is not made at a heavy weight. If one of the receivers is known to accept fuel faster than the other, it will be helpful to select that ac as the one to be refuelled early which will minimize AAR time outside the route brief bracket. However, due regard must be given to the importance of national refuelling areas and other ATC considerations.

g. Trapped Fuel.

(1) Receiver Fuel System. Route brief planning assumes a fully serviceable receiver fuel system (all tanks will accept and deliver fuel). In particular, AP positions and planned fuel states at destination fuel states are normally based on the assumption that the receiver has a full load of usable fuel at specific points on the route. However, if the integrity of a receiver's fuel system is impaired by an in-flight failure of a tank either to accept or to deliver fuel, then the deployment fuel plan (and its safety features) would be invalidated. The tanker captain is to decide whether the receiver must divert or continue with the deployment. To make this decision, using RAP procedures, it is possible to assess the effect of the failure on the receiver's capability to reach a diversion or the destination should a subsequent fuel bracket fail, ie whether the failure has rendered the receiver AAR dependent at any point on the remaining route.
(2) **Fuel Unavailable.** As soon as a receiver pilot is aware of a fuel system malfunction, he is to inform the tanker captain. The tanker captain is to obtain the following information:

(a) The quantity of fuel no longer available for use caused by fuel being trapped, or not received, in the malfunctioning tank.

(b) Any additional quantity of fuel required to be retained as unusable, or which must not be received in another tank, for trimming or C of G management purposes.

The quantity of fuel given by (a) + (b) is the receiver's constant unavailable fuel.

(3) **Positioning APs.** The tanker crew is to recalculate the subsequent abort points using the pre-bracket procedure.

(a) If all of the RAPs occur after the start point of their associated brackets, then the fuel system failure has not rendered the receiver AAR dependent. Continue as planned but consider destination fuel.

(b) If any RAP occurs before the start point of its associated bracket, the RAP becomes invalid. A diversion should be initiated unless a valid AP can be calculated.

(i) To calculate a valid AP, treat the bracket just completed as a partial transfer and extend its current AP using the fuel transferred less the total fuel unavailable. An extra bracket can now be planned to enable the receiver to regain the plan.

(ii) If more than one extra bracket is required to replace the total fuel unavailable, extend the additional bracket(s) AP(s) by the fuel transferred only, i.e. the total fuel unavailable has only to be accounted for once.

All fuel transferred after the problem has been accounted for (after the tanker crew has calculated a RAP) is usable.

**NOTE**

**IF A RECEIVER HAS A MALFUNCTION, WHICH REDUCES ITS CAPACITY BELOW THAT OF THE ROUTE BRIEF, THE TANKER CREW IS TO VALIDATE THE REMAINING AP(S) AFTER EVERY TRANSFER.**

h. **Destination Fuel.** If the deployment is continued, the tanker crew is to establish whether there is sufficient fuel available within the formation to ensure that all aircraft arrive at destination with at least the minimum fuel specified in the route brief or at the pre flight briefing. They are to compare the receiver route brief planned overhead fuel state with the route brief minimum overhead fuel state. Often there will be sufficient surplus in the plan to cover the fuel deficiency caused by the receiver fuel malfunction, in which case fuel transfers should take place as planned and additional AAR is not required. However, if deducting the receiver's constant unavailable fuel from the planned overhead fuel brings the receiver's fuel
If the receiver malfunction is a failure to accept fuel and trimming fuel does not have to be retained in another tank, the tanker will have fuel available and the deployment can continue using the procedures below.

(2) If the malfunction is trapped fuel, and/or fuel retained as trimming ballast, the tanker will need to transfer more fuel than planned. If there is insufficient fuel for this, either the receiver is to divert before the final bracket or the tanker is to divert after the final bracket, providing the receiver is able to continue to destination unaccompanied. If the tanker has sufficient fuel, then the deployment may continue and the in-use AP for the final bracket may be extended down track using the partial transfer method. An additional AAR to replace the destination fuel shortfall must be commenced (i.e. in contact with fuel flowing) by this RAP.

NOTE

IF THE FINAL PLANNED ROUTE BRIEF BRACKET IS NOT TO FULL, IT MAY BE POSSIBLE TO TRANSFER THE PLANNED ROUTE BRIEF FUEL PLUS THE SHORTFALL IN ONE GO WITHOUT THE NEED FOR FURTHER AAR. IT MAY ALSO BE POSSIBLE TO DELAY THE BRACKET TO ACHIEVE THE SAME RESULT.

i. Malfunction Occurring During or After Last Bracket.

(1) If a fuel malfunction occurs during or after the last planned route brief bracket, check destination fuel.

(2) If a fuel malfunction occurs after the final bracket AP/RAP has been passed, the tanker crew has the following options:

(a) Divert the receiver to the nearest suitable airfield.

(b) The receiver accepts the predicted destination fuel state.

(3) Consider emergency AAR.

Crews must use their best judgment as failed attempts to refuel will make the situation worse; receiver safety is overriding.

j. Diversion Action. If it is established that the remainder of the route cannot be completed without the receiver becoming AAR dependent, and/or insufficient fuel is available to achieve the minimum destination fuel states, then diversion action will be necessary. On occasion, an immediate diversion to the nearest (in time) nominated route brief diversion may be the only course of action. However, if diversion is not required immediately, then it may be more appropriate for the formation to continue further down route, either to position for more suitable ground support or to place the receiver within staging distance of the destination. This may be done providing none of the route to be flown is AAR dependent.

k. The procedures described above can also be used at any other time, if the
captain concludes that the use of this procedure will achieve a successful trail SAFELY. However, if in doubt, DIVERT.

9. **Diversion.** Following a receiver failure or malfunction (including, but not limited to, fuel system failures), the tanker captain is to seek the receiver leader’s advice and decide the best course of action. If the decision is to divert, and the receiver leader considers it desirable, the tanker is to accompany the receiver(s) to the diversion airfield. Specific advice on diversion policy is to be provided in the route brief or at the face to face briefing prior to the deployment. If the receiver(s) is accompanied by a tanker, the tanker captain retains control of, and the responsibilities of leading, the diverting formation.

10. **Airfield Terminal Procedures.**

   a. **Airfield Recovery.**

      (1) After the final bracket receivers may wish to leave the tanker and continue independently to destination, in which case the tanker captain is to negotiate appropriate clearances with the ATC authority. Once ATC give approval, the tanker captain is to call the receivers to the in-use ATC frequency. When the receivers have established 2-way contact with ATC, the tanker captain may then release the receivers to continue independently.

      (2) Receivers may request an accompanied let down with the tanker. The considerations for this, and the standard NATO Accompanied Let Down profile, are detailed in ATP 3.3.4.2 (ATP-56).

   b. **Terminal Airborne Tanker.** A terminal airborne tanker (TAT) may be provided when terminal weather conditions are expected to be poor, or where the terminal airfield is isolated. The TAT will RV with the incoming formation to provide additional transfers to receivers or tankers as required, or accompanied transit and further fuel en-route to a diversion airfield. The TAT may also provide additional fuel to enable aircraft to loiter at height awaiting an expected clearance to land at a terminal airfield which is temporarily unfit for recovery.
Action Before the Final Bracket

Using the pre-bracket procedure recalculate the AP for the next bracket

Is the RAP in front of the bracket (limiting)?

Yes

Consider the previous brackets as partial transfers and revise the AP. Can an extra bracket(s) occur before the RAP?

Yes

Pass fuel and revalidate the previously limiting AP. Is it still limiting?

Yes

Complete the planned

No

Consider the final bracket as a partial transfer and reposition the AP. Can an extra bracket occur before the RAP?

Yes

No

DIVERT

Notes:

1. Use receiver actual useable fuel and compare to route brief bracket start fuel.
2. If bracket is not to full it may be possible to transfer the planned route brief fuel plus the shortfall without further AAR. It may also be possible to delay the bracket to achieve the same result.
3. The tanker crew need only account for unusable fuel once.
Action During or After the Final Bracket

Check Destination Fuel

Is the revised O/H fuel at or above the minimum reqd or can the tanker crew adjust the final refuelling to achieve it?¹

Yes → No further action after the final bracket is complete.

No → Consider the final bracket as a partial transfer and reposition the AP. Has the formation already passed the RAP?²

Yes → a. DIVERT or, b. Receiver accepts the predicted fuel state or, c. Consider emergency AAR.³

No → Can an extra bracket occur before the

Yes → Pass sufficient fuel and continue.

No → DIVERT

Notes:

1. If the bracket is not to full, it may be possible to transfer the planned route brief fuel plus the shortfall without further AAR. It may also be possible to delay the bracket to achieve the same result.
2. Use the fuel transferred at final bracket minus total unavailable.
3. The exact course of action will depend on the circumstances. Receiver safety is paramount.
## Definitions for RAP Calculations

<table>
<thead>
<tr>
<th>Moving Abort Point</th>
<th>Position of Diversion</th>
<th>Moving Abort Point</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TOWARDS</strong> Formation</td>
<td><strong>Airfield Relative to the Anticipated Position of the RAP</strong></td>
<td><strong>AWAY</strong> from Formation</td>
</tr>
</tbody>
</table>

### [Most advantageous case]

The time that the AP is moved back must be considered to be the same as the reduction in time to the diversion airfield

<table>
<thead>
<tr>
<th><strong>Airfield Behind:</strong></th>
<th><strong>Time = Fuel</strong>&lt;br&gt;<strong>(RCR + TCR)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[Least advantageous, but <strong>SAFEST</strong> case]</td>
</tr>
<tr>
<td></td>
<td>The anticipated position of the RAP is likely to increase the time to the diversion airfield</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th></th>
<th><strong>Airfield Abeam:</strong></th>
<th><strong>Time = Fuel</strong>&lt;br&gt;<strong>RCR</strong></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>The anticipated position of the RAP does not increase the time to the diversion airfield</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th></th>
<th><strong>Airfield Ahead:</strong></th>
<th><strong>Time = Fuel</strong>&lt;br&gt;<strong>(RCR − TCR)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[Most advantageous case]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The time that the AP is moved forward must be considered to be the same as the reduction in time to the diversion airfield</td>
<td></td>
</tr>
</tbody>
</table>

### [Least advantageous, but **SAFEST** case]

The anticipated position of the RAP is likely to increase the time to the diversion airfield

### [Most advantageous case]

The time that the AP is moved forward must be considered to be the same as the reduction in time to the diversion airfield

### IF THERE IS ANY DOUBT - USE THE SAFER CASE
<table>
<thead>
<tr>
<th>PAGE NUMBERS</th>
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<td>D-1 to D-16</td>
<td>Dec 17</td>
</tr>
<tr>
<td>LEP D-1</td>
<td>Dec 17</td>
</tr>
</tbody>
</table>
1. **Tanker Snake/Formation Climb and Accompanied Let Down.**

   a. **Tanker Snake/Formation Climb.** Tanker snake/formation climb procedures are designed to permit 2 or more tankers operating from the same airfield to start and taxi as a formation, take-off at specified intervals, climb in a stream and achieve a VMC formation join. The Tanker Snake/Formation Climb Guide is at ATP 3.3.4.2 (ATP-56).

   b. **Accompanied Let Down.** Accompanied let down procedures allow a tanker to lead receivers from cruising level, through a joint descent, to a height of 500 ft AGL on the approach to a runway. Considerations and the NATO Standard Accompanied Let Down are at ATP 3.3.4.2 (ATP-56). Specific profiles optimized for the Tornado, Typhoon and for Tanker/Tanker are detailed in this Annex.

2. **General Receiving Techniques.** This section provides generalized flying and management techniques for aircraft engaged in AAR. Specific techniques for different aircraft types are contained in aircraft manuals.

   a. **Joining.** Receivers are to join to the Echelon Left position in accordance with ATP 3.3.4.2 (ATP-56) procedures. During the last 2 nm of the join, the receiver's speed should not exceed the tanker's speed by more than 30 KIAS. At night, at approximately 2 nm range, the tanker underwing lighting becomes distinct and separates into the individual light sources. At approximately 1 nm, a gentle climb should be started towards the tanker's level. At night, it is vital not to go high during the join otherwise the horizontal references provided by the tanker's floodlit undersurfaces will be lost. Floodlighting is dimmable in selected groups or as a whole; this may be requested by the receiver pilot at any stage. When the receiver is steady in the Echelon Left position, any pre-AAR checks should be completed. For most receivers, this is the optimum position to extend the probe and retrim the aircraft.

   b. **Moving Astern.** When cleared, the receiver is to move from the Echelon Left position to astern the appropriate hose to achieve the pre-contact position. Whilst moving astern, the receiver pilot should check that the hose is flying normally and is fully trailed. It is important for the receiver to descend below the level of the drogue before moving astern in order to keep the aircraft clear of the tanker's powerful wing vortices. At night, this will also ensure that the floodlit surfaces remain in view. Pilots of receiver aircraft with limited power should avoid dropping too far astern of the hose. The move astern is potentially disorientating at night or in poor visibility. Crew members in multi-crew receivers should be prepared to assist the pilot by monitoring the flight instruments, calling angles of bank and being ready to take control if this is appropriate to aircraft type. This advice is equally pertinent to all other phases of AAR when formation changes are required.
c. **Pre-contact.** The pre-contact position is the stable position astern the hose from where a steady and continuous approach to contact is made. This position varies from 5-25 ft astern the drogue, according to receiver type. The majority of trim changes caused by the tanker’s wake usually occur as the receiver is advanced to the pre-contact position. In the pre-contact position, the receiver should be trimmed in steady formation without any relative movement in all planes. Power should be adjusted and refined so that little throttle movement is required to hold a steady fore and aft position. Line-up markings are provided for all AAR stations on RAF tankers. However, the centerline markings provide only a generalized guide to most receivers and some interpretation will be necessary to suit the viewing position of each receiver type. It is important to avoid over-concentration on one selected formation reference point; in particular, the drogue should be ignored. The secret of achieving a steady pre-contact position, and a subsequent orderly approach, is to relax and take a general view of the tanker as the guide for positioning.

d. **Approach.** A stable pre-contact position is an essential prerequisite for a controlled and successful approach to contact. The correct approach path is then achieved by flying up an imaginary extended line of the hose, using the whole picture of references which established the pre-contact position. It is most important to avoid concentrating on the drogue; this will inevitably lead to drogue chasing and exacerbate any tendency towards over-controlling. It is vital that the receiver does not go high at any stage of the approach as the turbulent wake from the tanker’s wing and/or engines will be encountered, which could cause loss of control. From the pre-contact position, a small power increase is sufficient to make an approach; large receivers have considerable inertia and time is required to allow the power increase to take effect. The recommended closing speed is around 3 KIAS. However, airspeed indicators are an unreliable guide for this phase of AAR and the correct overtake rate should be demonstrated during initial CONVEX. Fast approaches must be avoided because they may cause the hose to whip which may damage the probe and/or the tanker’s AAR equipment. However, the approach should be continuous from the pre-contact position through to making contact and not stopped just short of the drogue. Short approaches are usually caused by the approach being too slow because the initial power application was too small. If the receiver does stop short, the drogue is likely to oscillate under the influence of the receiver’s bow wave. The temptation to apply more power and make a last-minute lunge at the drogue must be resisted; the moving drogue becomes a powerful visual cue and may lead to drogue chasing and over-controlling. The most likely consequences of this are a spokes or a dangerously unstable in-contact position. The only correct action following a short approach is to drop back, re-stabilize in the pre-contact position and make a fresh approach with a slightly increased power application. Strong turbulence may also cause the drogue to oscillate, the amount of movement depending on the severity of the turbulence. If possible, the approach should be delayed until the drogue has settled. However, if contact must be made without delay, a normal approach should be flown aiming to arrive at the mid-point of the oscillation. Contact in these circumstances is largely a matter of luck; it remains essential to avoid concentrating solely on, and chasing, the drogue.

e. **Making Contact or Missing**

(1) **Contact.** If the correct approach path and closing speed have been maintained then a good contact should be achieved. For some receiver aircraft,
increases in noise level and some trim changes may be experienced just prior to contact. If a fast approach results in a hose whip, it is vital for the receiver pilot to remain smoothly in formation using the tanker references. Any attempt to smooth out hose oscillations by maneuvering the aircraft will make matters worse. If the whip does not damp out, the receiver pilot must carry out a breakaway. A slow approach may result in a soft contact which occurs when the contact speed is too low to achieve a firm connection between probe and drogue. Often the probe may appear to be properly connected and the first indication of a soft contact will be an apparent failure for fuel to pass to the receiver. On some occasions the probe may just nudge the drogue reception coupling resulting in a fuel spray, in which case the hose will probably start to wind in away from the probe. Once a soft contact is confirmed, the receiver pilot should carry out a breakaway. A slow approach may result in a soft contact which occurs when the contact speed is too low to achieve a firm connection between probe and drogue. Often the probe may appear to be properly connected and the first indication of a soft contact will be an apparent failure for fuel to pass to the receiver. On some occasions the probe may just nudge the drogue reception coupling resulting in a fuel spray, in which case the hose will probably start to wind in away from the probe. Once a soft contact is confirmed, the receiver pilot must carry out a breakaway. A slow approach may result in a soft contact which occurs when the contact speed is too low to achieve a firm connection between probe and drogue. Often the probe may appear to be properly connected and the first indication of a soft contact will be an apparent failure for fuel to pass to the receiver. On some occasions the probe may just nudge the drogue reception coupling resulting in a fuel spray, in which case the hose will probably start to wind in away from the probe. Once a soft contact is confirmed, the receiver pilot must carry out a breakaway. A slow approach may result in a soft contact which occurs when the contact speed is too low to achieve a firm connection between probe and drogue. Often the probe may appear to be properly connected and the first indication of a soft contact will be an apparent failure for fuel to pass to the receiver. On some occasions the probe may just nudge the drogue reception coupling resulting in a fuel spray, in which case the hose will probably start to wind in away from the probe. Once a soft contact is confirmed, the receiver pilot must carry out a breakaway.

(2) **Spokes.** If the receiver damages the drogue, this is defined as a spokes. The most common occurrence is the receiver probe striking the drogue a glancing blow and tearing the drogue canopy. The receiver pilot should call “spokes” on the RT and give the tanker crew a damage assessment. The hose may partially wind in under the influence of the impact and damage to the drogue may cause it to oscillate. The receiver pilot should drop back and move to echelon to clear the oscillating drogue and to allow the hose to be retrailed or wound in. However, on rare occasions, the receiver probe may penetrate the drogue structure or canopy and become lodged in the drogue. This type of damage is usually the consequence of a fast approach and/or a last-minute lunge at the drogue from an unstable or short approach. If the probe penetrates the drogue structure, the receiver pilot is to call “spokes” and report that the probe is lodged in the drogue. The receiver pilot is not to attempt an immediate withdrawal but is to maintain a steady in-contact position, ignoring the hose, and await the tanker command to disconnect. When cleared, the receiver pilot should start a slow withdrawal down the natural line of the hose, attempting to fly a normal disconnect. Pilots should use the normal formation references, resisting the natural tendency to transfer all their attention to the drogue. If a normal controlled disconnect is flown, the probe should separate from the drogue without creating a mechanical lock and cause no further damage to the probe or drogue. Some resistance may be felt as the probe frees and a further small power reduction may be required at this point; it should not be necessary to use airbrake. After separation, the damaged drogue will probably be very unstable and it may continue to shed debris. Therefore, after disconnecting, the receiver pilot should promptly move to the echelon position without awaiting further instructions from the tanker. Receiver pilots should then proceed in accordance with the instructions for a spokes in ATP 3.3.4.2 (ATP-56). In all cases of damage to the drogue, the receiver pilot should, when in echelon, check the receiver aircraft engine parameters.

(3) **Missed Approach.** If the probe misses the drogue, the receiver pilot should arrest the approach by making a small power reduction. The receiver should avoid going high during a miss as the tanker wing/engine vortices are very powerful at this distance from the tanker. The receiver pilot should then drop back down the line of the hose to return to the astern position. After a
miss, the hose may oscillate with the drogue swinging across the pilot’s field of view and it may touch parts of the receiver aircraft. This should be ignored and attention devoted to achieving a normal downwards path using the normal formation references. Assuming that a steady and controlled approach was flown, a miss is usually caused by starting the approach from an inaccurate astern position. Before commencing the next approach, the receiver pilot should re-stabilise in a slightly adjusted astern position which takes account of where the probe missed the drogue.

f. Holding in Contact.

(1) **General.** After making contact, the receiver should move gradually forwards up the line of the hose until the optimum AAR position is reached. The vertical position is correct when the hose is trailing from the AAR equipment at its natural free-flying trail angle. Refer to Appendix A1 to Annex A for hose reference markings.

(2) **Safety Zone.** Whilst in contact, there is reasonably generous latitude for movement by the receiver in all planes. However, there are limits to this safety zone. If the receiver drifts towards these limits, the pilot should promptly manoeuvre the aircraft back to the optimum AAR position. Attempts to disconnect outside the safety zone could be hazardous as damage to AAR equipment (tanker and/or receiver) or control difficulties could ensue. The safety zone is defined as follows:

(a) **Upper Limit.** Behind the wing hoses, the upper limit is reached when the receiver approaches the level of the tanker’s wing trailing edge. Any higher and the tanker vortex will tend to roll the receiver towards the tanker; this is an extremely dangerous position. A cue common to all AAR stations is the trail angle of the hose. When the receiver rises above the optimum position, the hose takes up a very pronounced loop.

(b) **Lower Limit.** As the receiver moves downwards, the hose gradually straightens away from the ideal gentle curve. When the hose becomes straight, the upward force exerted on the probe will cause a geometric lock with the drogue coupling preventing a normal disconnect. This is the lower limit for receiver movement.

**NOTE**

RECEIVERS WITH CENTRELINE PROBES MAY HAVE TO SIT LOW IN CONTACT TO ALLOW THE RECEIVER PILOT TO SEE THE AAR SIGNAL LIGHTS.

(c) **Lateral Limits.** As the receiver moves towards the left/right limits, the hose will bow towards the tanker. At the limit, the sideways force exerted on the probe will cause a geometric lock with the drogue coupling preventing a normal disconnect. Behind the wing hoses, pilots should not stray beyond the chord-wise wing markings.

(d) **Forward Limit.** The forward limit is governed by the need to maintain a safe distance from the tanker rather than by potential control
problems. At the forward limit fuel transfer will cease and the Amber light flashes. If the receiver does not drop back into the normal refuelling range, within approximately 10 secs, the Red light will illuminate steady requiring an immediate disconnect.

(e) **Aft Limit.** To achieve fuel flow, all hoses must be pushed in 5 to 7 ft so that the tanker’s AAR equipment fuel valve opens. If the receiver drops aft of this position, the Amber light will illuminate steady for approximately 10 secs. If the correct refuel position is not regained within this time period, the Red light will illuminate steady requiring an immediate disconnect.

3. **Disconnect.**

a. **Normal Disconnect.** To disconnect, the normal formation references used for the approach should be used to drop back to the astern position and the hose should be kept at its natural trail angle. This will avoid the hose flailing as the receiver disconnects and will minimise pull-off and side forces on the probe. Only a small power reduction is required to start the aircraft moving back; for most receiver types the throttle movement will be roughly equivalent to that used to start the approach. During the move back, small power adjustments may be required to control the rate of movement, which should be slightly slower than that used for the approach. Fast withdrawal rates will cause the tanker’s hose drum to overspeed and its automatic drum brake to apply. In this event, the hose will stop trailing, the Red light will illuminate and the receiver will disconnect prematurely. This will necessitate the receiver being ordered to the echelon position while the hose is retrailed. After disconnecting, power should be restored so that the receiver stabilizes in the astern position. If the receiver is heavy and/or minimal power reserves are available, early anticipation with the power may be required to prevent the receiver from dropping too far behind the hose.

b. **Breakaway.** If the tanker orders a breakaway, or the receiver pilot finds himself in a dangerous/uncontrolled in-contact position, the receiver is to disconnect as promptly as possible. The urgency for prompt action should not lead the receiver pilot into misplaced zeal which might prejudice the safety of either aircraft. The receiver pilot’s aim should be to fly the normal withdrawal path but at a brisker rate than normal. He must not allow his aircraft to go high or stray towards the tanker at any stage of the manoeuvre. The receiver’s brisk deceleration will automatically apply the hose drum brake, which will ensure an early disconnect. The receiver pilot is then to take up the echelon position on the tanker. This should be done promptly and without awaiting further instructions from the tanker.

4. **Boom Drogue Adapter.** FJ aircraft may be cleared in their Military Aircraft Release to refuel from the Boom Drogue Adapter (BDA). A full description of the BDA and the recommended refuelling techniques are in ATP 3.3.4.2 (ATP-56).
5. Accompanied Let Down Procedures.

**Tanker/Tornado Profile**

<table>
<thead>
<tr>
<th>Stage of Profile</th>
<th>Tanker</th>
<th>Tornado</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Homing to descent point</td>
<td>Cruise IAS reducing to 300 kts</td>
<td>Vic formation, leader on tanker’s right side</td>
</tr>
<tr>
<td>2 Descent point</td>
<td>300 kts reducing to 250 kts by initial approach height</td>
<td>300 kts. Airbrake out 25° sweep</td>
</tr>
<tr>
<td>3 Initial approach height</td>
<td>Flap 1/2. Landing gear as required Power to hold 180 kts minimum</td>
<td>Downwind configuration. Mid flap. U/C down. 25° sweep. Call approach IAS required</td>
</tr>
<tr>
<td>4 Glidepath</td>
<td>Reducing to 165 kts Flaps as required but do not use flap full</td>
<td>Full flap</td>
</tr>
<tr>
<td>5 Break off (500 ft AGL)</td>
<td>Go-around at 500 ft AGL</td>
<td>Continue to land</td>
</tr>
</tbody>
</table>

**Considerations:**

1. **Descent** The descent speed is 300 kts.

2. **Initial Approach Height.** At initial approach height, speed should be smoothly reduced to 200 kts for tanker and receiver service selection. Tornado mid-flap limiting speed is 280 kts; undercarriage lowering limit is 235 kts. Hold 200 kts until glidepath is approached.

3. **Glidepath.** Steady reduction of speed to Tornado approach speed (155 to 165 kts depending on weight). The Tornado leader will state the approach speed required.

4. **Break Off.** At 500 ft AGL tanker should go-around straight ahead using a gentle rate of climb.

5. **Formation.** Primary considerations for the tanker pilot are smooth flying, accurate speeds and the avoidance of rapid applications of bank. Call when selecting services, changing speeds and on commencing descents and the overshoot.
Tanker/Typhoon Profile

<table>
<thead>
<tr>
<th>Stage of Profile</th>
<th>Tanker</th>
<th>Typhoon</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Homing to descent point</td>
<td>Cruise IAS reducing to 300 kts</td>
<td>Vic formation, leader on tanker’s right side</td>
</tr>
<tr>
<td>2 Descent point</td>
<td>300 kts reducing to 250 kts by initial approach height</td>
<td>300 kts. Airbrake as required.</td>
</tr>
<tr>
<td>3 Initial approach height</td>
<td>Flap 1/2. Landing gear as required</td>
<td>250 kts reducing towards 180 kts U/C as required</td>
</tr>
<tr>
<td>4 Glidepath</td>
<td>Reducing to 165 kts Flaps as required but do not use flap full</td>
<td>Slow reduction to 165 kts</td>
</tr>
<tr>
<td>5 Break off (500 ft AGL)</td>
<td>Go-around at 500 ft AGL</td>
<td>Continue to land</td>
</tr>
</tbody>
</table>

Considerations:

1. **Initial Approach Height.** At initial approach height, speed should be smoothly reduced towards 180 kts for tanker and receiver service selection. The Typhoon undercarriage lowering limit is 290 kts.

2. **Glidepath.** Steady reduction of speed to Typhoon approach speed (165 to 185 kts depending on weight) as glidepath is approached. The Typhoon leader will state the approach speed required.

3. **Break Off.** At 500 ft AGL tanker should go-around straight ahead using a gentle rate of climb.

4. **Formation.** Primary considerations for the tanker pilot are smooth flying, accurate speeds and the avoidance of rapid applications of bank. Call when selecting services, changing speeds and on commencing descents and the overshoot.
Tanker/Tanker Profile

<table>
<thead>
<tr>
<th>Stage Of Profile</th>
<th>Lead Tanker</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Homing to descent point</td>
<td>300 kts</td>
</tr>
<tr>
<td>2 Descent point</td>
<td>290 kts above 10,000 ft reducing to 250 kts below 10,000 ft Spoilers as required</td>
</tr>
<tr>
<td>3 Initial approach height</td>
<td>200 kts minimum Flap 1 / 2 Landing gear down Reduce to 170 kts minimum</td>
</tr>
<tr>
<td>4 Glidepath</td>
<td>165 kts minimum. Approaching glidepath, select Flap 3 Do not use flaps full</td>
</tr>
<tr>
<td>5 Break off (500 ft AGL)</td>
<td>Go-around at 500 ft AGL minimum</td>
</tr>
</tbody>
</table>

Considerations:

1. **Formation.** All normal formation considerations apply. The primary considerations of the lead tanker are smooth flying, accurate speeds and avoidance of rapid applications of bank. The lead tanker should avoid turning and leveling at the same time and should make all speed changes slowly. Call all height, speed and configuration changes.
APPENDIX E1 - ANNEX E TO NATIONAL SRD – UNITED KINGDOM

RECEIVER QUALIFICATION AND CURRENCY

1. **Introduction.** Crews of nations other than the UK who request AAR from UK assets are to be qualified to refuel from the RAF tanker before commencement of any exercise or operation. The amount of AAR training required will depend on the crews’ previous AAR experience. Training is to include a brief on ATP-3.3.4.2 (ATP-56) procedures, AAR techniques and equipment pertinent to the RAF tankers being employed during the exercise/operation. This brief is to be followed by AAR flight training by day and, if appropriate, by night. Specific training requirements are summarised at paragraph 5. For exercises that include AAR of other nation’s receivers, Exercise Planners are to include sufficient pre-exercise time to fulfill these requirements. AAR training for FJ pilots not current in AAR is not to be carried out during exercise or operational sorties without prior approval from the Senior Operator (SO), HQ 2 Gp. If foreign crews are non English-speaking or do not understand the AAR procedures brief, they are not to proceed with any AAR training from an RAF tanker.

2. **Levels of Receiver Training.** There are 4 levels of receiver training:
   
   a. **Ab-initio Training.** Ab-initio training is for those who are not qualified on a probe-and-drogue system.
   
   b. **Tanker Type Training.** Tanker type training is for those not qualified on RAF tankers but who are qualified and current (defined as AAR within previous 90 days) on another tanker probe-and-drogue system, which may be a buddy-buddy system.
   
   c. **Refresher Training.** Refresher training is for those who are qualified on RAF tankers but who are out of AAR currency.
   
   d. **Routine Training.** Routine training is for those who are qualified on RAF tankers and are current in AAR.

3. **Ground Training.** There are 2 levels of ground training:
   
   a. **Full Brief.** The full brief is to include all aspects of RAF tanker aircraft, ATP-3.3.4.2 procedures, AAR techniques and equipment. The brief is to be given by an approved THALES instructor from the Voyager Academy, a Voyager AAR instructor, the tanker captain, a receiver AAR instructor qualified on the RAF tanker or a deputy authorised by OC 2 Gp STANEVAL.
   
   b. **Short Brief.** The short brief is to include differences in procedures and techniques pertinent to the FJ crews. The brief is to be given by an approved THALES Instructor from the Voyager Academy, a Voyager AAR Instructor, the tanker captain, a receiver AAR Instructor qualified on the RAF tanker or a deputy authorised by OC 2 Gp STANEVAL

4. **Flight Training.** There are 3 levels of airborne training:
a. **Initial AAR Conversion Training.** Unless otherwise authorised by the SO, HQ 2 Gp, initial AAR conversion training of ab-initio receiver crews is to be supervised by a FJ AAR instructor. Ideally, training is to be given in a 2-seat aircraft; however, if the 2-seat option is not available, the AAR instructor is to be either in another aircraft alongside or in the tanker. Following training, the AAR instructor is to certify that the student pilot has reached an adequate standard before the student commences solo AAR conversion training.

b. **Supervised Solo AAR Conversion Training.** Normally, supervised solo AAR conversion training is to be supervised by a FJ AAR instructor, either in another aircraft alongside or in the tanker. However, with the prior agreement of the SO, HQ 2 Gp, a tanker instructor may supervise such training.

c. **Unsupervised Solo AAR Conversion Training.** Unsupervised solo AAR conversion training is any training not supervised by an AAR instructor.

5. **Summary of Training Required.** The following table summarises the minimum training required to achieve an AAR qualification (day only) from an RAF tanker. Any reduction in training is to be approved by the SO, HQ 2 Gp:

### Table E1-1 – Receiver AAR Qualification Minimum Training Requirements

<table>
<thead>
<tr>
<th>Receiver Training</th>
<th>Ground Brief</th>
<th>Initial AAR Conversion</th>
<th>Supervised Solo</th>
<th>Unsupervised Solo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ab-initio</td>
<td>Full</td>
<td>1 sortie</td>
<td>3 sorties</td>
<td>A/R</td>
</tr>
<tr>
<td>Tanker Type</td>
<td>Full, if current buddy-buddy or prop tanker</td>
<td>-</td>
<td>2 sorties</td>
<td>A/R</td>
</tr>
<tr>
<td></td>
<td>Short, if current on non-RAF large jet tanker</td>
<td>-</td>
<td>1 sortie</td>
<td></td>
</tr>
<tr>
<td>Refresher</td>
<td>Short</td>
<td>-</td>
<td>1 sortie</td>
<td>A/R</td>
</tr>
<tr>
<td>Routine</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>A/R</td>
</tr>
</tbody>
</table>

6. **AAR Currency.** AAR currency for RAF tankers is 6 months. Once an initial AAR qualification has been obtained, AAR currency may be maintained on any jet tanker wing hose. If currency is lost, an AAR training sortie must be flown under the supervision of a type AAR instructor, who may be in another aircraft.

7. **Billing for Transferred Fuel.** For all AAR sorties it is essential that tanker crews complete and submit accurate and complete Details of Tasking (DOT) sheets. The completed DOT sheet is to include the receivers’ squadron number, aircraft type, call sign, tail number (for other nations and civil/trials aircraft, e.g. BAE Systems) and the quantity of fuel transferred. The details of planned receivers, except tail numbers, should be established before the sortie begins. All completed DOT sheets are to be submitted to HQ AIR, Aviation Fuels and Stocks Finance Manager. The DOT sheet is a vital part of the billing mechanism when HQ AIR allocates or seeks to recover fuel costs. Failure of tanker crews to record these details correctly will result in 2 Gp incurring the financial cost of transferred fuel as it will not be possible to correctly allocate or recover transferred fuel costs.
8. **Planning of Conversion Training.** Tanker tasking and operating authorities require at least 24 hours notice of a receiver unit’s intention to use allocated tasking for conversion training (CONVEX). Receiver units should not underestimate the tanker time required for a CONVEX; experience indicates that at least 45 minutes ‘on tanker’ time is required, particularly for early CONVEX sorties with multi-point tankers.
<table>
<thead>
<tr>
<th>PAGE NUMBERS</th>
<th>EFFECTIVE PAGES</th>
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<tbody>
<tr>
<td>E-1 to E-8</td>
<td>Dec 17</td>
</tr>
<tr>
<td>E1-1 to E1-3</td>
<td>Dec 17</td>
</tr>
<tr>
<td>LEP E-1</td>
<td>Dec 17</td>
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