1. **Introduction.** The Republic of Singapore Air Force (RSAF) undertakes AAR Operations using ATP 3.3.4.2 (ATP-56) as its AAR procedural manual.

**NOTE**

THE RSAF NORMALLY USE RVS ALPHA, DELTA, ECHO, FOXTROT AND GOLF. IF RV BRAVO OR RV CHARLIE IS SPECIFIED FOR A NATO EXERCISE/OPERATION, THE RSAF WOULD REQUIRE PRIOR KNOWLEDGE OF THIS, AND A DETAILED CO-ORDINATION BRIEF BETWEEN TANKER AND RECEIVER WOULD BE REQUIRED.

**CAUTION**

2. **Tanker Aircraft Types.** The Republic of Singapore Air Force (RSAF) operates two tanker types. The KC-135R and the KC-130B.

   a. **KC-135R.** The RSAF operates the KC-135R in the boom configuration as well as the Wingtip Mounted MPRS AAR Pods on each wingtip.

      (1) **AAR Equipment – Boom**

         (a) **Description.** The boom is approximately 8.5m (28 ft) long with an additional 5.6 m (18.5 ft) of inner fuel tube which can be extended or retracted by the boom operator. The boom is equipped with a Boom Interphone System which permits direct communication with suitably equipped receivers.

         (b) **Basic Operation**

            1. When ready to refuel, the boom is lowered from its stowed position and about 3m (10 ft) of the retractable portion is extended by the boom operator.

               i. When cleared, the receiver moves from a stabilised (zero rate of closure) astern position to a steady boom contact position.

               ii. Closure to contact will be slow and stable (approximately 1 foot per second) with the receiver stabilising in the contact position.

               iii. When this is achieved, the boom operator flies the boom to the receiver aircraft’s receptacle and extends the boom to make contact. Locking toggles in the receptacle operate to hold the boom nozzle in contact.
iv. The receiver then maintains its position within the boom operating envelope.

**WARNING**

THE RECEIVER WILL STABILISE IN THE ASTERN POSITION AND ATTAIN A ZERO RATE OF CLOSURE. IF THE RECEIVER FAILS TO ATTAIN A STABILISED POSITION, OR IT BECOMES APPARENT THAT A CLOSURE OVERRUN WILL OCCUR, BREAKAWAY PROCEDURES WILL BE INITIATED. FAILURE TO DO SO COULD RESULT IN A MID-AIR COLLISION.

EXCESSIVE CLOSURE RATE COULD CAUSE THE TANKER TO DESCEND INTO THE PATH OF THE RECEIVER. THE TANKER PILOT MUST BE PREPARED TO DISCONNECT THE AUTOPILOT TO PREVENT ALTITUDE DEVIATIONS. INITIATE A BREAKAWAY AT THE FIRST INDICATION OF A CLOSURE OVERRUN.

(c) Automatic Disconnect. Provided the receiver remains within the envelope, contact is maintained. However, if the receiver moves beyond the limits, a disconnect will automatically occur provided the tanker's system is operating normally.

**CAUTION**

APPROACHING BOOM LIMITS AT RELATIVELY HIGH VELOCITY CAN CAUSE STRUCTURAL DAMAGE AS A RESULT OF AN INABILITY TO DISCONNECT DUE TO BINDING ACTION OF THE BOOM NOZZLE.

**NOTE**

WHEN THE TANKER'S AIR REFUELLING SYSTEM IS IN OVERRIDE, BOOM LIMIT SWITCHES ARE INACTIVE, THE BOOM OPERATOR MUST INITIATE DISCONNECTS BEFORE THE RECEIVER EXCEEDS LIMITS.

(d) Boom Envelope. The envelope is defined by automatic limit switches connected to the boom; the envelope permits a limited amount of fore and aft movement and some freedom of manoeuvre in the pitching, rolling and yawing planes. The envelope limits are set well within the mechanical limitations of the boom. Therefore, provided the envelope limits are not exceeded too rapidly, disconnect will occur before the boom is damaged. The full boom envelope is illustrated in Appendix 1. However, the freedom of manoeuvre in boom elevation is reduced for some receiver aircraft because of their receptacle characteristics.
(e) **Normal Disconnect.** To make a normal disconnect, the receiver releases the receptacle toggles (this may also be effected remotely by the boom operator) and remains stabilized in the contact position until the boom operator confirms a disconnect has been achieved. The receiver then moves to the astern position.

(f) **Brute Force Disconnect.** There are two types of brute force disconnect, inadvertent, and controlled tension (coordinated).

i. **Inadvertent Brute Force Disconnect.** An inadvertent brute force disconnect is defined as any unplanned disconnect which is the result of one of the following:

   (i) The receiver aircraft moves rapidly to the aft limit, causing mechanical tanker/receiver separation.

   (ii) Boom pull-out occurs at 38 degrees elevation or below.

   !

   **CAUTION**

   FOLLOWING AN INADVERTENT BRUTE FORCE DISCONNECT, AAR WILL BE TERMINATED EXCEPT DURING FUEL EMERGENCIES OR WHEN CONTINUATION OF AAR IS DICTATED BY OPERATIONAL NECESSITY.

   ii. **Controlled Tension Brute Force Disconnect.** A controlled tension brute force disconnect is defined as an intentional coordinated disconnect occurring above 38 degrees elevation, accomplished by gradual aft movement of the receiver aircraft (approx 1 ft per sec) until the boom is fully extended, and ending with a controlled tension boom pull-out. Coordination between the receiver pilot and boom operator is required to ensure as smooth a disconnect as possible. Following a controlled tension disconnect, AAR may be continued with other receivers, provided the results of the following checks are satisfactory:

   (i) Operational check of the boom for binding or uncontrollability.

   (ii) Test of the tanker signal coil.

   !

   **CAUTION**
A CONTROLLED TENSION BRUTE FORCE DISCONNECT WILL BE ACCOMPLISHED ONLY AS A LAST RESORT, AFTER ALL OTHER NORMAL AND EMERGENCY METHODS OF DISCONNECT HAVE FAILED.

(g) AAR Boom Lighting

i. Description. Pilot Director Lights (PDL) provide positioning information to receiver pilots during boom type refuelling. The PDLs are located on the bottom of the fuselage, aft of the nose landing gear; they consist of 2 panels of lights. The left panel gives boom elevation information and the right panel gives boom telescoping information. See Appendix 1.

ii. Basic Operation. The lights are controlled by movement of the boom in elevation and by the in and out movement of the telescoping portion. These lights indicate the position of the boom in relation to the boom operating envelope and command the direction of receiver movement required to bring the boom to the ideal refuelling position.

iii. Receiver Actions

(i) Elevation. At one end of the elevation panel is the illuminated letter U (for up); at the other end is the illuminated letter D (for down); see Appendix 2 to this Annex. Adjacent to the letters are red arrowheads. If a receiver is in contact with the boom near the upward elevation limit, the red arrowhead next to the D will be illuminated; this indicates a downward movement is required. As the receiver moves down, the red light extinguishes and a green arrowhead illuminates, indicating the boom is approaching the ideal elevation. When the ideal elevation is reached, the green light extinguishes and 2 parallel green bars illuminate.

(ii) Longitudinal Position. Longitudinal position is verified using similar indications to those described above for the vertical position. The right-hand telescoping panel is similar in function, although the display is slightly different. The ends of the panel have the illuminated letters F and A (forward and aft); see Appendix 2 to this Annex. The position information and movement commands are given by illuminated horizontal bars with red leading into green, with the ideal position shown by 2 parallel green bars illuminating. The command indications are separated by illuminated vertical white bars to give contrast. The telescoping part of the boom is in coloured segments, which duplicate PDL indications; at night these segments are illuminated by boom marker lights. Lights are not provided for azimuth positioning; however, a fluorescent yellow stripe on the under-surface of the tanker fuselage is provided for centreline reference. See Appendix 2.

(iii) Visual References - Heavy Receivers. Heavy receivers should refer to Appendix 2 for illustrations and descriptions of tanker visual references.
iv. **Radio Silent Procedures.** During radio silence, the PDLs can be used to give positioning commands to direct a receiver into the boom contact position. A steady red PDLs commands a large movement in the direction indicated, and a flashing red light commands a small correction. The PDLs can also be extinguished to signal a request for disconnect.

v. **Failure of PDLs to Illuminate**

(i) **PDLs Fail to Illuminate When Making Contact.** If the PDLs do not illuminate when a receiver makes contact, the receiver pilot will inform the boom operator if refuelling will continue. If refuelling is continued, verbal corrections from the boom operator may be requested.

(ii) **PDLs Fail During Contact.** If the PDLs go out during contact, the receiver is to initiate a disconnect and return to the astern position. Subsequently, if refuelling is continued, verbal corrections from the boom operator may be requested.

vi. **Flashing PDLs.** Flashing PDLs and the tanker lower strobe light ON command a breakaway.

vii. **Other Illumination.** During night AAR, the AAR floodlight, and boom nozzle light will also be used to illuminate the boom and receiver receptacle.

(2) **AAR Equipment - Wingtip Mounted MPRS AAR Pods**

(a) **Description.** The RSAF’s KC-135 aircraft can be fitted with two FRL Mk32B-753 wingtip mounted MPRS AAR pods. The pods trail a 22.5 m (74 ft) retractable hose with MA-4 coupling and collapsible para-drogue. The black hose is marked with a series of 0.3 m (1 ft) long white markings and two 0.6 m (2 ft) wide orange bands. The range between the orange bands corresponds with the green pod status lights indicating the fuel transfer position. Appendix 3 provides a visual description of the pod status lights and relates this to hose position.

(b) **Basic Operation.** To start fuel flowing, the hose must be pushed in at least 1.5 m (5 ft), indicated by the first orange band, whereupon a green pod status lights coming on.

(c) **Receiver Actions.** Receiver pilots should remain within the ideal refuelling position; this is with the hose extended between the two orange bands. The inner limit is 16.4 m (54 ft) and the outer limit 21 m (69 ft). This provides a fore and aft range of movement of 4.6 m (15 ft). See Appendix 3, Figure 3-2 and Figure 3-3.

(d) **Receiver Too Close.** If the hose is pushed in too far, the amber pod status lights flash, fuel ceases after the hose is pushed in to less than 15.2 m (50 ft). Fuel flow will start again as the hose is pulled back out past 15.8 m (52 ft). Thus the receiver has a fore and aft range of movement of 5.8 m (19 ft) during which fuel will flow. See Appendix 3.
**WARNING**

THE SYSTEM CAN BE USED TO REFUEL TWO RECEIVERS SIMULTANEOUSLY IF THE RECEIVER WINGSPAN IS LESS THAN 68 FT. HOWEVER, THE BOOM OPERATOR WILL ONLY CLEAR ONE RECEIVER AT A TIME TO MOVE FROM ASTERN TO THE CONTACT POSITION.

(e) **Wingtip Mounted MPRS AAR Pods Lighting**

i. **Description.** Drogue lighting is provided by lights attached to four drogue ribs. Reflective tape is also affixed to both sides of each drogue rib and the outer ring. In addition to the drogue lighting, the following lights will be set by the boom operator; the receiver pilot can request intensity adjustments to lights as desired.

   (i) **Day AAR.** For day AAR, the pod status lights and pod floodlights should be turned on full bright.

   (ii) **Night AAR.** In addition to the day AAR lights, the underbody, underwing, nacelle illumination lights, pod illumination, horizontal stabilizer, and outboard nacelle illumination lights will be set to on/full bright for night AAR; they may be adjusted as requested by the receiver pilot. The AAR floodlight may also be used as desired.

ii. **Pod Status Lights.** Three pairs of the lights (red, amber, and green) are located on opposite sides of the rear fairing of each pod. These lights inform the receiver pilot of the current mode/status of the pod. The lighting sequence is listed in Appendix 3 Figure 3-3.

(3) **Refuelling Heights and Speeds**

(a) **AAR RV Speed.** The standard KC-135 tanker orbit speed is 275 KIAS or 0.78 Mach, whichever is lower.

   i. The tanker will normally adjust to AAR speed when rolled out towards the ARCP.

   ii. In the case of the A-10, fly orbit at 220 KIAS or the tanker’s charted holding speed, whichever is the higher, and plan to roll out ½ nm in front of the receiver.

(b) **Boom AAR.** Boom AAR height band is sea level to heights in excess of 30,000 ft; speed range is 200 to 320 KIAS.

(c) **MPRS AAR.** Wingtip mounted MPRS AAR pods height band for AAR is 5,000 to 35,000 ft; speed range is 220 to 300 KIAS.
(4) **Maximum Transferable Fuel.** The total fuel load is 92,060 kg (203,000 lb) for the KC-135R (CFM 56 engines). The maximum fuel available for offload on a four hour sortie is approximately 61,280 kg (135,000 lb) for a KC-135R.

(5) **Fuel Transfer Rate.** The tanker can transfer fuel at the following rates:

(a) **Boom.** Exceeding 2722 kg/min (6000 lb/min) through the boom.

(b) **MPRS.** Exceeding 1216 kg/min (2680 lb/min) through the wingtip mounted MPRS AAR pods.

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

(7) **Fuel Types Available for AAR.**

(a) **Primary Fuel.** The primary fuel is F34 (JP-8).

(b) **Alternate Fuels.** The alternative fuels are F35 (Jet A-1), F40 (JP-4) and F44 (JP-5).

(8) **Receiver Types Certified.** Refer to Appendix 4.

(9) **Lighting.** Aircraft under-surfaces are illuminated by a comprehensive array of lights, many of which are adjustable for brilliance upon request (see Appendix 5, Figure-5-1). The initial setting for under-body and under-wing lights will be on/full bright during all types of refuelling day or night. The nacelle lights will be on during all types of refuelling, but during night AAR, will be dimmed prior to receivers reaching the observation position.

(10) **Mark Facilities.** In response to a receiver request to “Mark” the tanker can dump fuel from the boom. “Mark” should only be used if a receiver low fuel state or other similar circumstance requires the rendezvous be expedited. If required, the tanker will dump fuel in 500 to 1000 lbs increments until positive visual contact can be maintained.

(11) **Dimensions.** The KC-135 is 39 m (128 ft) long with a wingspan of 40 m (130 ft).

(12) **RV Aids.** The KC-135 has the following radio, navigation and RV aids:

(a) UHF, VHF and HF radios.

(b) VOR, TACAN, INS, GPS, and search/weather radar.

(c) A/A TACAN (DME only), TCAS, IFF.

(13) **Limitations.** Refer to Appendix 1 (Boom) and Appendix 2 (MPRS).

3. **Receiver Qualification and Currency for Non RSAF Receivers**

a. Receiver aircraft must be certified for AAR operations and the aircraft must receive an assessment of technical and operational compatibility with the applicable tanker prior to scheduling AAR operations.
b. **AAR Clearances.** There are three types of AAR Clearances issued by RSAF for AAR pairings with Non RSAF aircraft. The details of the AAR clearances are as follows:

1. **Category 1** is issued when there is a requirement for an AAR clearance due to urgent operational need with little or no compatibility assessments carried out. This clearance will have a limited period of validity to support urgent operational needs.

2. **Category 2** is issued to support operational need with sufficient time for limited TCA to be conducted but would still result in certain restrictions in AAR clearance envelope or limitations imposed on systems/equipment during AAR.

3. **Category 3** is issued when the TCA is completed with sufficient information. This clearance will have an open-ended duration of validity but is subjected to five yearly review requirements by the RSAF Airworthiness Authorities. If the reviews are not completed by the required review date, the AAR pairings will be invalid. In addition to the five yearly reviews, prior to the start of operations or exercises, during the coordination phase, both parties will be required to highlight any modifications carried out on their aircraft that would impact key elements of the AAR clearance. The modifications highlighted would be surfaced to the respective airworthiness authorities to assess its impact on the AAR clearances.

c. The validity of the Category 3 AAR clearance is 5 years and during this period, any changes/modifications made to the aircraft that would impact key elements of the assessment of technical compatibility must be made known to the RSAF airworthiness authority.

d. **Hazards on Receiver Aircraft.** Due to possible unknown modifications on the receiver aircraft that may affect the assessed AAR technical compatibility, the following hazard was identified and assessed, with the residual mishap risk accepted by RSAF – Boom nozzle or drogue stuck to receiver aircraft leading to the loss of boom nozzle or drogue. The probability of occurrence was assessed to be "Improbable" for CAT 3 clearances and "Remote" for CAT 1 clearances. The associated possible mishaps to the receiver aircraft were identified for the respective receiver nation’s consideration if required – Failures and/ or damages on the receiver aircraft due to (1) the boom nozzle or drogue stuck to the receiver aircraft and/ or (2) collision with the separated boom nozzle or drogue.

e. All receiver aircraft pilots must be current and qualified for AAR operations (currency period is **180 days** from last AAR operations). Unit level documentation of aircrew currency will be made available upon request with the initial AAR request.

4. **Source Documents**

   a. For operations with KC-135R, refer to T.O.1C-135(K)-1, T.O1C-135(K)R(I)-1, T.O.1C-135(K)(I)-1 and T.O.1C-135(K)R(II)-1.

5. **POC for National Annex**

   Transport Operations Branch (TOB), AOD, HQ RSAF
   303 Gombak Drive, #03-23, Singapore 669645
6. **POC for Tanker/Receiver Clearances**

(As for National Annex).

7. **POC for STANEVAL**

(As for National Annex).

8. **National Annex Last Updated.** 31 Jul 17

9. **National Reservations**

   a. The RSAF normally use RV Alpha, RV Delta, RV Echo, RV Foxtrot and RV Golf.

   b. If RV Bravo or RV Charlie is specified for a NATO exercise/operation, the RSAF would require prior arrangements and detailed co-ordination briefings between tanker and receiver.

**List of Appendixes:**

1. **KC-135 - Boom**
2. **KC-135 – AAR Visual References.**
3. **KC-135 – MPRS Pod Status Lights.and Hose Markings.**
4. **RSAF Certified Receivers.**
5. **Common Warnings, Caution and Notes**
6. **KC-135 Stratotanker – Receiver-specific Information**
7. **KC-135 – Exterior Lighting**
APPENDIX 1 TO SRD-SINGAPORE

KC-135 – PILOT DIRECTOR LIGHTS ILLUMINATION PROFILE

Figure 1-1 - KC-135 Pilot Director Lights Illumination Profile and Boom Limits
Figure 1-2 - KC-135 Boom Limits
APPENDIX 2 TO SRD-SINGAPORE

KC-135 STRATOTANKER AAR – VISUAL REFERENCES

2.1 Refuelling Position - Visual References. When moving forward from the astern position to the contact position, the visual references used by heavy aircraft receiver pilots permit them to position their aircraft so that they remain within the tanker’s AAR envelop. The following paragraphs provide guidance to help pilots achieve the correct position.

2.2 Position – Elevation. Determination of correct elevation is best achieved by comparing the alignment of the lower UHF antenna with the white line painted on the lower fuselage of the tanker. This antenna is easily seen on Block 30 KC-135 aircraft, but may be hidden by the significantly larger Block 40 VHF Data Link (VDL) antenna installed between the UHF antenna and the white line.

a. Vertical Visual References – Heavy Aircraft Receivers

(1) Upper Limit. The upper limit is reached when the UHF antenna moves through the white line changing the inverted “T” to a “t”. In addition, there will be more sky visible above the tanker’s wing to the top of the receiver pilot’s window.

(2) Lower Limit. When the lower limit is reached, there will be gap between the white line and the tip of the UHF antenna. This gap will be approximate one third of the length of the antenna.

Figure 2-1. Lower UHF Vertical Visual Reference
b. **Vertical Visual Reference (Block 40) – Heavy Aircraft Receivers**

1. **Lower UHF Antenna.** When receiving fuel from Block 40 aircraft, receiver pilots must exercise caution to ensure that they do not mistakenly attempt to create an inverted “T” using the VDL antenna instead of the UHF antenna. Moving two degrees left or right will allow the receiver pilot to distinguish the lower UHF antenna, and use normal references.

2. **Alternative Reference – VDL Antenna.** When AAR position is determined by reference to the VDL antenna, the correct vertical position is achieved when the receiver pilot aligns the tip of the VDL antenna with an imaginary line drawn between the top of “D” and the top of the “F” of the Pilot Director Lights.

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Figure 2-2. Upper and Lower Limits - Lower UHF Reference

Figure 2-3. Block 40 Vertical Visual Reference

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Block 40 - Contact
APPENDIX 3 TO SRD-SINGAPORE

KC-135 MPRS POD STATUS LIGHTS

Figure 3-1 – KC-135 MPRS Pod Status Light

<table>
<thead>
<tr>
<th>LIGHTS</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>RED (2)</td>
<td>Light is on steady when power is on and hose is stowed and when the hose is deploying or being rewound using the REWIND/TRAII switch on the pod control panel. Steady red light indicates to receiver the pod system is not ready to transfer fuel. Flashing indicates the need to immediate disconnect and separation. Comes on flashing when emergency breakaway switch on boom telescope lever is pressed; goes off after approximately 10 seconds or if emergency breakaway switch is pressed while lights are flashing.</td>
</tr>
<tr>
<td>AMBER (2)</td>
<td>When light is on steady, indicates to receiver that hose is fully extended and refueling system is ready for contact. Light flashes when hose is pushed in so deployed hose length is less than 51 feet and goes off when deployed hose length is more than 54 feet, when hose is pulled-out. Light is also on flashing when supplemental hose response is active.</td>
</tr>
<tr>
<td>GREEN (2)</td>
<td>Indicates to receiver that fuel transfer (greater than 50 gpm) is occurring. Lights are on when hose is deployed greater than 52 ft (but less than 69 ft), when the hose is pulled out. Lights are off when hose is pushed-in and less than 50 ft of hose is deployed or while supplemental hose response is active.</td>
</tr>
</tbody>
</table>
Figure 3-2 - KC-135 MPRS Hose Markings/Pod Status Lights
<table>
<thead>
<tr>
<th>Receiver Position</th>
<th>Lights</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before Contact</td>
<td>Steady Red</td>
<td>Pod not ready, do not make contact</td>
</tr>
<tr>
<td></td>
<td>Steady Amber</td>
<td>Ready for contact</td>
</tr>
<tr>
<td>In contact</td>
<td>Steady Green</td>
<td>Fuel flows</td>
</tr>
<tr>
<td></td>
<td>All lights out (receiver in fuel transfer position)</td>
<td>Offload complete/dry contact</td>
</tr>
<tr>
<td></td>
<td>Flashing Amber</td>
<td>Forward limit, drawback</td>
</tr>
<tr>
<td></td>
<td>Steady Amber</td>
<td>Aft limit</td>
</tr>
<tr>
<td>Anytime</td>
<td>All 3 lights out</td>
<td>Disconnect</td>
</tr>
<tr>
<td></td>
<td>Flashing Red</td>
<td>Breakaway</td>
</tr>
</tbody>
</table>
Figure 3-4 – KC-135 Hose and Drogue – In-Flight Positioning

WARNING
Flight outside designated envelope areas could result in receiver control difficulties and impingement on the refueling envelope of the other wing-tip pod or of the tanker envelope.

NOTE
Depicted hose extensions are based on nominal values and do not account for hysteresis in the fuel-draulics or the effects of receiver closure rate and activation of supplemental hose response mode.
## APPENDIX 4 TO SRD-SINGAPORE

### AAR RECEIVER CLEARANCES

4.1 Unless otherwise stated, the United States SRD for the KC-135R’s operating envelope applies.

<table>
<thead>
<tr>
<th>Country</th>
<th>Receiver Aircraft</th>
<th>AAR Clearance</th>
<th>Category 1</th>
<th>Category 2</th>
<th>Category 3</th>
<th>Period of Validity (Cat 1) / Review Date (Cat 3)</th>
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* Category 1 AAR Clearance have limited period of validity.
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<th>BUDDY CRUISE IAS/MACH</th>
<th>OPTIMUM AAR ALT/IAS/MACH</th>
<th>RCVR RV SPEED IAS</th>
<th>OVERRUN IAS/MACH</th>
<th>PPM/ # PUMPS</th>
<th>BOOM INTERPHONE</th>
<th>LIMITS</th>
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<td>A-10</td>
<td>245</td>
<td>150 / 220 / 0.48 (0.6 AOA MAX)</td>
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<td>355 / 0.90</td>
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<td>- / 0.76</td>
<td>250 / The lower of 260 / 0.75</td>
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<td>300 KCAS</td>
<td>5200 / 4</td>
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<td>310</td>
<td>6800 / 4</td>
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<td>C-17A</td>
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<tr>
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<td>6600 / 4</td>
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## KC-135 AAR MISSION PLANNING AND INFILIGHT DATA (BOOM)

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<th>TYPE RCVR</th>
<th>BUDDY CRUISE IAS/MACH</th>
<th>OPTIMUM AAR ALT/IAS/MACH</th>
<th>RCVR RV SPEED IAS</th>
<th>OVERRUN IAS/MACH</th>
<th>PPM/ # PUMPS</th>
<th>BOOM INTERPHONE</th>
<th>LIMITS L R U D</th>
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<tbody>
<tr>
<td>F-15 A-E / SA</td>
<td>315</td>
<td>300 / 315 / 0.82</td>
<td>335</td>
<td>335 / 0.90</td>
<td>3400 / 2</td>
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<td>250 / 310 / -</td>
<td>335</td>
<td>335</td>
<td>3000 / 2</td>
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<td>10 10 20 35</td>
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<tr>
<td>WEDGETAIL (717 AEW&amp;C)</td>
<td>270 / 0.74</td>
<td>200-250 / 270 /</td>
<td>310</td>
<td>310</td>
<td>3000 / 2</td>
<td></td>
<td>10 10 20 40</td>
</tr>
</tbody>
</table>

**NOTES:**

1. B-2 FWD limit is 10, AFT limit is 18. Extend boom to 12 feet for astern
2. < 5 units of trim the elevation limits are 20 UP and 35 LOWER
3. < 5 units of trim the elevation limits are 25 UP and 35 LOWER
4. E-8C and USAF E-3 receivers are equipped with boom interphone system
5. E-3D / F – Use a maximum of two A/R pumps.
6. Use one A/R pump with receivers configured with external tanks.
7. The receiver may request to decrease to one A/R pump during fuel transfer or after a pressure disconnect
8. To minimize pressure disconnects, reduce the number of A/R pumps to two at the first indication of reduced fuel transfer rate.
<table>
<thead>
<tr>
<th>TYPE RCVR</th>
<th>BUDDY CRUISE IAS/MACH</th>
<th>OPTIMUM AAR ALT/IAS/MACH</th>
<th>RCVR RV SPEED IAS</th>
<th>OVERRUN IAS/MACH</th>
<th>PPM/ # PUMPS</th>
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F-15SA 200/300/-. See Notes in F-15 Receiver-Specific AAR Information stated in the US SRD.
<table>
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<th>TYPE RCVR</th>
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<th>OPTIMUM AAR ALT/IAS/MACH</th>
<th>OVERRUN IAS</th>
<th>CLOSURE RATE</th>
<th>PROBE LIMIT MACH</th>
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<td>150 / 250 / -</td>
<td>2 – 4 FPS</td>
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<tr>
<td>AV-8B</td>
<td>300 / 0.80</td>
<td>150-200 / 275 / 0.66</td>
<td>310</td>
<td>0.80</td>
<td></td>
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<tr>
<td>EA-6B</td>
<td>250 / 0.68</td>
<td>250 / 275 / 0.66</td>
<td>335</td>
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<td>EA-18G F/A-18A-G</td>
<td>300 / 0.78</td>
<td>250 / 275-285 /</td>
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<td>1-2 FPS</td>
<td>0.86</td>
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<td>EF-2000 SS/ST</td>
<td>/0.76</td>
<td>200/255/0.85</td>
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<td>GRIPEN</td>
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<td>RAFALE</td>
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<td>1-4 FPS</td>
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<td>150 / 270 / 0.64</td>
<td>310</td>
<td>3-4 FPS</td>
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**NOTES:**

1. Due to probe weakness, attempt contact at lower airspeeds/closure rate; if required, increase airspeed in 5 knots increments, closure rate as necessary, up to indicated limits
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>1</td>
<td>Use only one pod and one AR pump. Simultaneous AAR is prohibited. Inform the receiver of any observed fuel venting; continuation of AAR will be at the discretion of the receiver pilot.</td>
</tr>
<tr>
<td>2</td>
<td>Fuel transfers shall be conducted with no more than two aerial refuelling pumps.</td>
</tr>
<tr>
<td>3</td>
<td>Fuel transfers shall be limited to one AR pump per receiver during AR with the KC-135R.</td>
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</table>
APPENDIX 5 TO SRD-SINGAPORE

COMMON WARNINGS, CAUTION AND NOTES

Applicable Common WARNINGS, CAUTION and NOTES

1. The following WARNINGS, CAUTIONS and NOTES are common to all receiver aircraft and must be read in conjunction with the receiver-specific information.

![WARNING]

2. Do not transmit on the HF radio when the receiver is within ½ nm; this includes datalink.

3. For all boom receiver AARs, do not transmit on HF radio when receiver is in close proximity or in contact with the AAR boom, unless otherwise specified.

4. Tanker airspeed and altitude changes must be made smoothly and cautiously while the receiver is in or near the contact position, any airspeed or altitude adjustments required by the tanker due to aerodynamic effect of receiver closure should be accomplished after the receiver is stabilised in the contact position.

5. The boom operator must be constantly aware of the receiver’s rate of movement. The receiver’s rate of movement toward an envelope limit will dictate the need to initiate a disconnect. If the movement is toward the inner limit, boom operators will exercise sound judgment in initiating a disconnect or breakaway prior to the receiver exceeding the limit or overrunning the tanker.

![CAUTION]

6. For all fighter aircraft, the telescope-at-disconnect switch will be in manual during AAR operations.

7. For all fighter aircraft, avoid excessive retraction rates to prevent pulling the receiver forward if a boom release is not obtained.

8. Contact will not be attempted until the fighter type receiver has stabilised 2 to 3 feet from the contact position.

9. For UARSSI and all fighter receptacles, to minimize nozzle cocking when making contact with the receiver, the boom nozzle should be inserted straight into the receptacle without aid of the slipway; using the slipway may cause the nozzle to cock, preventing contact.
10. During AAR operations, exercise caution to avoid striking any antenna in the vicinity of the AAR receptacle.

11. Attempts to affect a contact during loss of any AAR lighting that results in less than desired illumination will be at the discretion of the boom operators.

NOTE

12. The boom flight controls may block the view of the receptacle as the receiver moves in from approximately 30 feet, especially if the receiver is high in the envelope (receivers equipped with a nose mounted UARSSI, eg. A-10, B-1)

13. Except when security would be compromised, a verbal hot armament check will be accomplished between the tanker and receivers carrying forward firing ordnance during the 15 minutes prior to ARCT call. The verbal hot armament check accomplished between the tactical air controller and the receiver during anchor rendezvous will satisfy this requirement.

14. Night is defined as the period of time when the boom nozzle is not clearly visible without the aid of the nozzle light(s) or tail mounted flood light(s).

15. When conducting AAR with receivers, the term “pre-contact” may be used in lieu of “astern”. Pre-contact is defined as a position approximately 50 feet. Behind and slightly below the tanker boom nozzle where the receiver stabilizes with zero rate of closure before being cleared to the contact position.

16. RSAF KC-135 is unable to carry out AAR operations using the boom drogue adapter (BDA). Hence, there will be no AAR operations with RSAF KC-135 using the BDA.
**APPENDIX 6 TO SRD-SINGAPORE**

**KC-135 STRATOTANKER – RECEIVER-SPECIFIC INFORMATION**

**Receiver-Specific Information**

1. For the following receiver aircraft types, refer to the latest ATP-3.3.4.2.US Standards Related Document (SRD). Information applicable to AAR with the US KC-135 will be applicable to the RSAF KC-135.

   a. A-10A/C
   b. B-1B
   c. B-2A
   d. B-52H
   e. C-5A-C/M
   f. C-17A
   g. KC-135
   h. EA-6B
   i. E-3A-D/F / E-8C
   j. F-15A-E/S/SA
   k. F-16A-F/I
   l. F-22A
   m. KC-10A
   n. Wedgetail (737 AEW&C)
   o. AM-X
   p. AV-8B
   q. EF-2000SS/TS (Typhoon)
   r. F/A-18A/B/C/D, F/A-18E/F and EA-18G
   s. GRIPEN (JAS 39 C/D)
   t. Tornado (F-3 ADV, GR-4/-4A, IDS/ECR/PA-200)
   u. RAFALE

2. There are additional information applicable to certain receiver aircraft but are not stated in the US SRD. As such, they are presented as follows:

   a. **Wedgetail (737 AEW&C)**

   **NOTE**

   - AAR operations shall not be conducted when the yaw damper on the Wedgetail is disabled.
b. **EF-2000SS/TS (Typhoon)**
   (1) AAR Operations
   (a) Receiver closure rates for contact shall be limited to 4 feet/second.
   (b) Fuel transfers shall be conducted with no more than two aerial refueling pumps.
   (c) Due to the lack of a probe light on the Typhoon, all KC-135R lighting normally utilized for night AR shall be fully functional.
   (d) NATO EF2000 TS variant rear cockpit pilot shall conduct AR during daylight conditions only.
   (e) KC-135 crews shall ensure that for dry contacts (training) the respective AR valve is DISARMED.

   ![](image)

   **CAUTION**
   - Receiver to disconnect immediately when Multi-function Heads Down Display (MHDD) indicates “Refuel Complete” or tanker pod/HDU lights extinguish to prevent possible overpressure to the Typhoon fuel system
   - Except in an emergency, bracket/towlining (main group fuel tank top-ups) refueling is prohibited.

c. **GRIPEN (JAS C/D)**
   (1) AAR Operations
   (a) (RTAF Gripen 39 C/D). AR Envelope airspeed for RSAF KC-135 and RTAF Gripen 39 C/D is between 220 – 300 KIAS. The AR altitude is between 5,000 – 33,000 feet.

d. **RAFALE**
   (1) AAR Operations
   (a) Night AR shall be permitted. All of the KC-135 lighting typically utilized during AR shall be functional.
   (b) The tanker pressure regulation system and the pressure regulator(s) in the MA-3/MA-4 coupling shall be fully functional.
   (c) Receiver closure rates for contacts shall be limited to 4 feet/second.
   (d) Due to French Rafale utilizing a weak-link probe system design, tanker crews shall remind the receiver pilots to exercise caution when closing to contact to avoid closure rates greater than 4 ft/sec. Shearing of the weak-link may result in the probe
remaining in the tanker’s coupling, thus making the impacted AR system inoperable for the remainder of the mission.
(e) The probe used on the French Rafale does not have a flexible tip designed to reduce binding during off-centre disconnects. As such, Rafale pilots shall avoid off-centre disconnects.
(f) Simultaneous AR is permitted with KC-135 MPRS.
(g) Fuel transfers shall be limited to one AR pump per receiver during AR with the KC-135.
(h) All Rafale electronic stores, radar and electronic counter measures must be turned off prior to reaching the AR astern position.
(i) No tanker or receiver aircraft high frequency radio transmissions shall be permitted while the French Rafale is in the astern, contact or formation position.
(j) Unless there is an emergency fuel condition within the receiver, no AR operations shall be conducted with the Rafale having a degraded Electronic Flight Control System.
Figure 5-1 – KC-135 Exterior Lighting

1 NOSE LANDING AND TAXI LIGHT (WHITE)
*2 NACELLE ILLUMINATION LIGHT (TYPICAL) (WHITE)
3 TAXI LIGHT (WHITE)
4 LANDING LIGHT (FIXED) (WHITE)
5 [MPRS] POD ILLUMINATION LIGHTS (2) (WHITE)
6 NAVIGATION LIGHT (LEFT-RED, RIGHT-GREEN, REAR - RED AND WHITE)
7 [MPRS] OUTBOARD NACELLE ILLUMINATION LIGHTS (2) (WHITE)
8 FIN TIP AERIAL REFUELING FLOODLIGHT (WHITE)
*9 [MPRS] HORIZONTAL STABILIZER ILLUMINATION LIGHTS (2) (WHITE)
10 UNDERWING ILLUMINATION LIGHT (TYPICAL) (WHITE)
11 STROBE LIGHTS (2) (RED OR WHITE)
12 UNDERBODY ILLUMINATION LIGHT (TYPICAL) (WHITE)
13 TERRAIN LIGHT (RETRACTABLE) (WHITE)
14 RECEIVER PILOT DIRECTOR LIGHTS (WHITE, RED, GREEN)
15 BOOM MARKER LIGHTS (FLUORESCENT)
*16 BOOM NOZZLE LIGHT(S) (WHITE)

* Designates Adjustable Lighting