1. **Introduction.**
Colombia has two tanker types: the KC-137 “ZEUS” and the KC-767 MMTT “JUPITER” and two receivers: the C-10/12 “KFIR” and the A-37B “DRAGONFLY”. Each aircraft is identified by the Colombian Air Force (COLAF) by its Spanish initials. Due to the system characteristics, EMCON 2 modified procedures apply as reviewed in Annex 7.

2. **Tanker Aircraft Types.**

2.1. **KC-137 Tanker.** The Boeing KC-137 (B-707/300C) is equipped only with the probe and drogue Air-to-Air Refuelling system (no boom) and can perform both day and night refuelling missions.

   a. **AAR Equipment.** The KC-137 has the MK 32B-501 AAR pod, a self-contained store attached to the underside of each wing, which delivers fuel from a tanker-aircraft fuel system to a receiver aircraft. The twin pod system allows the KC-137 to air refuel two receivers simultaneously. Each refuelling station consists of a refuelling pod, and a 17 m (48.6 ft) hose. The diameter of drogue is 81.9 cm (32.25 Inches). Fuel flows when the receiver probe connects to the drogue and pushes the hose forward. Refuelling markings are provided in Appendix 3.

   **NOTE**

   WHEN PERFORMING DUAL RECEIVER OPERATIONS, RECEIVERS ARE LIMITED TO A MAXIMUM WINGSPAN OF 13.4 M (44 FT), AND ONLY ONE RECEIVER WILL BE CLEARED AT A TIME TO MOVE FROM ASTERN TO THE CONTACT POSITION.

   **WARNING**

   WHEN CLOSE TO THE DROGUE, THERE IS A TENDENCY FOR THE RECEIVER TO ROLL TOWARDS THE TANKER FUSELAGE. THIS TENDENCY IS CAUSED BECAUSE THE PRONOUNCED DIHEDRAL OF THE KC-137 CAN CREATE A VISUAL ILLUSION THAT THE HORIZON IS TILTED SLIGHTLY IN THE DIRECTION OF THE TANKER FUSELAGE IF THE RECEIVER PILOT Focuses HIS VISUAL SCAN ON THE WING INSTEAD OF THE TRUE HORIZON.

   b. **Refuelling Heights and Speeds.** The KC-137 can refuel aircraft from SL to 35,000 ft MSL, and at speeds between 200 to 325 KIAS. The tanker will hold in the refuelling area at speeds that will maximize available fuel and maximize endurance. Once the receiver establishes radio contact, the tanker will accelerate to and maintain the AAR speed coordinated with the receiver.
c. Maximum Transferable Fuel. Under optimal conditions, the maximum transfer fuel load is 159,000 lbs. Available offloads will depend on sortie duration and divert fuel required. For example, approximately 69,000 lbs total offload is available during a 4-hour sortie due to fuel burned and divert fuel.

NOTE

THE KC-137 IS CAPABLE OF PERFORMING COMBINED MULTIROLE OPERATIONS AND MAY FLY IN A PASSENGER, CARGO OR COMBINATION (ONLY WITH MILITARY PASSENGERS) CONFIGURATION WHILE AIR REFUELLING. MISSION DETAILS AND LOAD OUT WILL DictATE THE AVAILABLE TRANSFER FUEL LOAD.

d. Fuel Transfer Rate and Regulated Fuel Pressure. The AAR system is able to provide a fuel flow between 0 and 1.500 ltr/min (400 gal/min or 2736 lbs/min for Jet A1) at 50 psi, with minimum inlet pressure of 6 psig at each of the two couplings for simultaneous or individual operations. The rate of transfer also depends on the receivers capabilities.

e. Fuel Types Available for AAR. Primary fuel used is JET A-1. Jet fuels equivalent to JP-4, JP-5 and JP-8 are also usable.

f. Receiver Types Certified. The COLAF C-2/10/12 KFIR and A-37B DRAGONFLY are capable of conduct refuelling operations with the KC-137.

NOTE

THE RECEIVER AIRCRAFT MUST BE EQUIPPED FOR PRESSURE FUELING AND BE FITTED WITH A NOZZLE COMPATIBLE WITH THE MA-3 TYPE COUPLING. FUEL WILL BE TRANSFERRED UP TO THE MAXIMUM PRESSURE OF 50 +/- 5 PSIG MEASURED AT THE INLET TO RECEIVER AIRCRAFT PROBE.

THE MK-32B-501 POD IS CAPABLE OF RESPONDING TO CONTACTS FROM THE RECEIVER AIRCRAFT FOR OVER SPEEDS UP TO 10 FPS OF CLOSURE RELATIVE TO THE TANKER AIRCRAFT.

THE RECEIVER AIRCRAFT MAY PULL BACK FROM THE TANKER AIRCRAFT AT SPEEDS UP TO 5 FPS, RELATIVE TO THE TANKER, WITHIN THE FUEL TRANSFER POSITION OF THE HOSE, WITHOUT DISCONNECTING.
g. Lights.

(1) **Advisory Lights.** Each pod includes an advisory lights assembly. There are three pairs of lights, each pair operates in parallel. The lights advise the receiver pilot of the condition and status of the affected refuelling point. The advisory lights are located on the lower side of the pod, just forward of the hose stowage tube.
(a) **Red Lights** ("Break away"): When the red lights illuminate prior to the probe connecting with the drogue, they indicate a "DO NOT CONNECT" condition. If the lights come on during engagement or refuelling, they indicate "EMERGENCY"/"BREAKAWAY".

(b) **Amber Lights**: When illuminated, indicate "READY" for refuelling.

(c) **Green Lights**: When the green lights illuminate, they indicate that the receiver has pushed forward into the refuelling range, the pod fuel valve is open for fuel transfer, and the fuel flow rate is above 189.3 ltr/min (50 gal/min or 342lbs/min for Jet A1).

(2) **Signal Lights.** The exterior lighting diagram for the aircraft is located in Appendix 2 and the relationships between lights and hose position are found on Appendix 3.

(a) **RED**: ON. When trail or rewind is selected. OFF. When hose reaches full trail extension. FLASHES. When Break Away is selected.

(b) **AMBER**: ON. When hose reaches full trail extension. OFF. When hose is pushed in into refuelling range. FLASHES. When hose is pushed in more than 25ft.

(c) **GREEN**: ON. When fuel flow is above 189.3 ltr/min (50 gal/min or 342lbs/min for Jet A1).

h. **Cleared for Contact.** Before a receiver is cleared for contact, the beacon is turned OFF to indicate that the tanker’s AAR checklist has been completed.

Drogue illumination for night refuelling operations is located inboard the air refuelling pod. In addition, there are twelve “Beta” light units that are spaced around the rim of the drogue, providing the illumination of the drogue.

For day operations, all lights will be set to full bright. For night operations in addition to the normal day lights, the underbody, under-wing, engine nacelle outboard illumination lights, pod illumination, horizontal stabilizer and flood lights will be set full bright. The receiver pilot can request intensity adjustment to lights as desired. All exterior lighting system is NVIS friendly.

i. **Breakaway.** The light signal commanding a breakaway is the FLASHING RED light located on both sides ON the trailing edges of the pod, and/or the lower rotating anti-collision beacon light switched to on.

j. **Refuelling Hose.** The hose is generally black and has white markings on it to provide the receiver with visual cues concerning his relative position to the hose refuelling range (23-25ft).

k. **Mark Facilities.** None.
I. **Dimensions.** See Appendices 1 and 4.

m. **RV Aids.** The aircraft has the following radio, navigation and RV aids:
   
   (1) VHF, UHF, HF radios.
   
   (2) VOR, DME, ADF, GPS and a weather RADAR.
   
   (3) TCAS II (standard Traffic Collision Avoidance System).

**NOTE**

THE KC-137 HAS NEITHER A/A TACAN NOR DATA LINK TO AID RENDEZVOUS

n. **Defensive Systems.** None.

2.2. **KC-767 MMTT (Multi Mission Tanker and Transport).** The KC-767 MMTT is equipped only with the probe and drogue AAR system (no boom) and can perform both day and night refuelling missions.

![KC-767 MMTT refuelling a COLAF C-12 KFIR](image)

a. **AAR Equipment.** The refuelling system on the KC-767 MMTT is a two probe and drogue system. It provides the airplane with the capability to simultaneously refuel two receiver aircraft, via two wingtip pods. Each refuelling station consists on a refuelling pod, a 23.5 m (77 ft) hose, a 0.3 m (1 ft) collapsible drogue with MA-3 coupling. Fuel flows when the receiver probe connects to the drogue and pushes the hose forward. Refuelling markings are provided in Appendix 6.
NOTE

WHEN PERFORMING DUAL RECEIVER OPERATIONS, RECEIVERS ARE LIMITED TO A MAXIMUM WINGSPAN OF 13.4 M (44 FT), AND ONLY ONE RECEIVER WILL BE CLEARED AT A TIME TO MOVE FROM ASTERN TO CONTACT POSITION.

KC-767 Drogue View from a KFIR C-10 Cockpit

b. Refuelling Heights and Speeds. The KC-767 can refuel aircraft from SL and 30,000ft MSL, and at speeds between 200 to 325 KIAS. The tanker will hold in the refuelling area at speeds that will maximize available fuel and maximize endurance. Once the receiver establishes radio contact, the tanker will accelerate to and maintain the AAR speed coordinated with the receiver.

NOTE

THE KC-767 MMTT IS CAPABLE OF PERFORMING COMBINED, MULTIROLE OPERATIONS AND MAY FLY IN A PASSENGER, CARGO OR A COMBINATION (ONLY WITH MILITARY PASSENGERS) CONFIGURATION WHILE AIR REFUELLING. MISSION DETAILS AND LOAD OUT WILL DICTATE THE AVAILABLE TRANSFER FUEL LOAD.

c. Maximum Transferable Fuel. Due to its configuration to support multiple mission tasking, maximum fuel load for optimal conditions is 137,000 lbs. Available offloads will depend on sortie duration and divert fuel required. For example, approximately 77,000 lbs total offload is available during a 4-hour sortie due to fuel burned and divert fuel.

d. Fuel Transfer Rate and Regulated Fuel Pressure. The AAR system is able to provide a fuel flow between 0 and 1,500 ltr/min (400 gal/min or 2736 lbs/min for Jet A1) at 50 +/- 5 psig, with minimum inlet pressure of 17 psi; at each of the two couplings for simultaneous or individual operations. The rate of transfer also depends on receiver capabilities.
e. **Fuel Types Available for AAR.** Primary fuel used is JET A-1. Jet fuels equivalent to JP-4, JP-5 and JP-8 are also usable.

f. **Receiver Types Certified.** The Columbian Air Force C-2/10/12 KFIR and A-37B DRAGONFLY are capable of conducting AAR with the KC-767.

g. **Lighting.** Red, Amber and Green lights are located on both sides on the trailing edge of the pods. These AAR pod advisory/status lights indicate the following:

   - **Steady Amber (before contact):** Pod system is ready for contact
   - **Steady Amber (while in contact):** Hose pushed out beyond the limits of the refuelling range. No fuel flow.
   - **Flashing Amber:** Hose pushed in beyond the limit of the refuelling range. No fuel flow.
   - **Steady Green:** Hose is pushed in to refuelling range and fuel is flowing.
   - **Flashing Red (while in contact):** Breakaway

   The exterior lighting diagram for the aircraft is shown in Appendix 5 and the relationships between lights and hose position are shown in Appendix 6

h. **Cleared for Contact.** Before a receiver is cleared for contact, the beacon is turned OFF to indicate that the tanker’s AAR checklist has been completed.

Drogue illumination for night refuelling operations is located outboard of the engine pylon nacelle strut. In addition, there are 6 equally space lights installed on the drogue trailing edges.

For day operations, all lights will be set to full bright. For night operations, in addition to the normal day lights, the underbody, under-wing, engine nacelle outboard illumination lights, pod illumination, horizontal stabilizer and flood lights will be set full bright. The receiver pilot can request intensity adjustment to lights as desired. All exterior lighting system is NVIS friendly.

i. **Breakaway.** The light signal commanding a breakaway is the FLASHING RED light located on both sides on the trailing edges of the pod, and/or the lower rotating anti-collision beacon light switched to ON.

j. **Mark Facilities.** None.

l. **Dimensions.** See Appendix 4.

m. **RV Aids.** The aircraft has the following radio, navigation and RV aids:

   1. VHF, UHF, SATCOM and HF radios.
   2. VOR, DME, ADF, INS/GPS and a weather RADAR.
   3. TCAS II (standard Traffic Collision Avoidance System).

   **NOTE**

   THE KC-767 HAS NEITHER A/A TACAN NOR DATA LINK TO AID RENDEZVOUS
n.  **Defensive Systems.** None.

3.  **Receiver Aircraft Types.**

3.1.  **C-10/12 KFIR.** COLAF KFIR are day/night AAR capable.

![COLAF KFIR C-10/12 refuelling from COLAF KC-767](image)

### a. AAR Equipment.

Air-to-Air Refuelling of the KFIR is done via the structural tube (probe) designed to withstand aerial refuelling loads (contacts and disconnects) and refuelling pressures. The aerial refuelling probe protrudes from the RH side of the fuselage behind the cockpit. The system allows the plane to be completely refuelled (including the external tanks).

**b. Fuel Capacity (lbs based on Jet-A1 weight).** The KFIR has an internal fuel capacity of 830 gallons (5670 lbs). As with most fighters, the KFIR can carry various external fuel tanks to increase fuel capacity. The 1702 tank is designed for use on the wings and can hold 450 gallons (3078 lbs). The 1301 centreline tank and 1302 wing tank can each carry 343 gallons (2345 lbs). The 825 is a centreline tank designed for air-to-air missions and can hold 210 gallons (1368 lbs).

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Fuel Capacity (gallons)</th>
<th>Fuel Capacity (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 x 1702 tanks &amp; 1 x 1301 tank</td>
<td>2073</td>
<td>14,179 lbs</td>
</tr>
<tr>
<td>2 x 1302 wing tanks &amp; 1 x 1301 tank</td>
<td>1850</td>
<td>12,716 lbs</td>
</tr>
<tr>
<td>2 x 1702 tanks</td>
<td>1730</td>
<td>11,833 lbs</td>
</tr>
<tr>
<td>2 x 1302 tanks &amp; 1 x 825</td>
<td>1726</td>
<td>11,805 lbs</td>
</tr>
<tr>
<td>1 x 1301 tank</td>
<td>1170</td>
<td>8,003 lbs</td>
</tr>
<tr>
<td>1 x 825 tank</td>
<td>1040</td>
<td>7,113 lbs</td>
</tr>
<tr>
<td>No external tanks</td>
<td>830</td>
<td>5,677 lbs</td>
</tr>
</tbody>
</table>

**Note**

IN ALL CASES SUBTRACT 120 GAL (821 LBS) FOR THE TWO SEAT KFIR.
c. **Refuelling Altitudes and Speeds.** The KFIR refuelling altitude envelope is from 5,000ft to 25,000ft. The maximum altitude for air refuelling depends on receiver weight and drag. Recommended air refuelling speed is 275 KIAS to 325 KIAS, or 0.80M. The KFIR is capable of altitudes exceeding the tanker’s normal ceiling in most cases; however, in the case of a lightweight tanker and a heavyweight receiver with high drag, AAR altitude may be limited by receiver capability.

d. **System Limitations.** The KFIR is capable of refuelling with degraded flight controls, due to hydraulic system and servo commands failures (Hyd-1, Hyd-2, Stab aug), but only in case of emergency and greater pilot ability would be required. AAR is allowed with any other minor problem. The KFIR has a warning light which indicates an internal refuelling failure, in which case disconnection is mandatory. Due to oil consumption, the KFIR can fly for approximately 10 hours before landing for required servicing. The KFIR has no light onboard to illuminate the drogue during night air to air refuelling.


f. **AAR certifications and restrictions.** The KFIR is certified by the COLAF to conduct refuelling operations with the KC-137 (B-707 COL), KC-767 (COL).

3.2. **A-37B DRAGONFLY.** Omitted from this version of the Colombian National SRD.

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List of Appendices:

1. KC-137 Aircraft General Dimensions
2. KC-137 Aircraft Exterior Lightning System
3. KC-137 Hose and Drogue In-Flight Positioning
4. KC-137 Hose and Pod Markings and Lights.
5. KC 767 – Aircraft General Dimensions.
7. KC-767 Hose Markings and Advisory Lights.
APPENDIX 1 TO NATIONAL SRD-COLOMBIA

KC-137 Aircraft General Dimensions

KC-137 General Overall Dimension
APPENDIX 2 TO NATIONAL SRD-COLOMBIA

KC-137 Aircraft Exterior Lightning System

KC-137 Lighting Diagram
APPENDIX 3 TO NATIONAL SRD-COLOMBIA

KC-137 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 THE TANKER ENVELOPE TO INCLUDE HEAVY LOADS ON THE RECEIVER PROBE. DO NOT GO PAST THE 20° BALL JOINT OF THE MA3 COUPLING.
KC-137 Hose and Pod Markings and Lights

KC-137 Hose Markings and relationship with pod lights

KC-137 Pod Light Location
Appendix 4 to National SRD-COLOMBIA

KC-137 Pod Light Location

<table>
<thead>
<tr>
<th>LIGHTS</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>RED (2)</td>
<td>When the red lights illuminate prior to hose engagement they indicate a “DO NOT CONNECT” condition.</td>
</tr>
<tr>
<td>AMBER (2)</td>
<td>When illuminated, indicate “READY” for engagement.</td>
</tr>
<tr>
<td>GREEN (2)</td>
<td>When the green lights illuminate, they indicate that the receiver has pushed forward into the refuelling range, the pod fuel valve is open for fuel transfer, and the fuel flow rate is above 50 G.P.M.</td>
</tr>
</tbody>
</table>

KC-137 Pod Light Explanation
### KC-137 Pod Status Lights

#### BEFORE CONTACT

<table>
<thead>
<tr>
<th>STEADY RED</th>
<th>STEADY AMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pod NOT ready</td>
<td>Ready for contact</td>
</tr>
<tr>
<td>Do NOT make contact</td>
<td></td>
</tr>
</tbody>
</table>

#### IN CONTACT

<table>
<thead>
<tr>
<th>STEADY GREEN</th>
<th>FLASHING AMBER</th>
<th>STEADY AMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>When fuel flow is above 50 GPM.</td>
<td>When hose is pushed in more than 25 ft.</td>
<td>When hose reaches full trail.</td>
</tr>
</tbody>
</table>

![Pod Status Lights](image)
### ANY TIME

<table>
<thead>
<tr>
<th>FLASHING RED</th>
<th>BREAKAWAY</th>
</tr>
</thead>
</table>

![Image of airplane][1]

[1]: #/image.png
KC 767 – Aircraft General Dimensions
APPENDIX 6 TO NATIONAL SRD-COLOMBIA

KC 767 – Aircraft Exterior Lightning System

KC 767 Lighting Diagram
APPENDIX 7 TO NATIONAL SRD-COLOMBIA

KC-767 Hose Markings and Advisory Lights

KC-767 Hose Markings and relationship with pod lights