



Officer Commanding: Wg Cdr Joos Bral

2 I/Command: Flt Lt Ian Munro



Welcome to 101 Squadron

Home of the RAFvirtual

Air to Air Refuelling Training School

RAFvirtual AAR(T) – SINGLE & MULTIPLE AIRCRAFT

Standards, Organisation, Procedures, Positions, ..



Altimeter Settings

Unless otherwise directed, an altimeter setting of 1013.2 mb (29.92 inches) is to be used (= international pressure setting) for AAR operations at or above transition altitude. Tanker crews are to include the altimeter setting in the RV Initial Call.

When the tanker and receiver altimeters are set to 1013.2 (29.92 inches), vertical reference will be made using **the term FLIGHT LEVEL**.

When the tanker and receiver altimeters are set to QNH or a regional pressure setting, vertical reference will be made using **the term ALTITUDE**.

When the tanker and receiver altimeters are set to QFE or a regional pressure setting, vertical reference will be made using **the term HEIGHT**.

Height Separation

Receivers are normally to join from below and are to maintain a minimum of 1000 ft height separation, unless otherwise stated until visual contact and positive identification have been made. RV altitude separation will be maintained until 1NM from the tanker, then receivers are clear to initiate a progressive climb towards the tanker.

Speeds

The tanker speed during a RV procedure is usually the intended refuelling speed, this is normally optimised for best receiver AAR performance.

The receiver flies the tanker speed plus 20 kts once he is at 1 NM from tanker.

Turning Angles of Bank and Range

A planning assumption of 30° angle (Super VC10 K3) or 25° angle (VC10 C1K) of bank is used by tankers.

Racetracks and Orbits

All racetracks and orbits are to be to the left to give the tanker pilot the best lookout.

Fuel Flow Rates and Pressures

Fuel flow rates vary widely according to AAR installation. In general terms, the boom system offers the highest rate of fuel flow up to 3650 kg/min (8000 lb/min), podded hose systems offer **flow rates** between 870 kg/min to **1000 kg/min** (2800 lb/min to 3200 lb/min) and integral hose systems offer flow rates around 2300 kg/min (5000 lb/min). Fuel pressure is regulated in most systems not to exceed about 3.5 bars (50 psi) at the reception coupling. Fuel transfer rates will be affected by the SG of the fuel and the limitations of the receiver fuel system.

System Description

After making contact the receiver opens the fuel valve so he can receive fuel. When AAR is complete the receiver pilot drops back slowly to stabilize in the astern position and retract the probe.

If the tanker pilot commands a Breakaway, the receiver drops back quickly.

Hose Dimensions and Markings

The lengths of pod hoses vary between 15 m (50 ft) and 27 m (90 ft) depending on the system and use; 24 m (80 ft) is typical of an integral system hose

Rendez-vous Overrun procedure

When the receiver passes the tanker or the tanker detects that an overrun condition exists, following procedures will be employed :

Receiver(s) call – “Tanker Callsign) Execute Overrun”

The receiver(s) will ensure positive vertical separation such that they pass at least 1000 Ft below the tanker.

Terminate – “(Receiver Callsign) Terminate Overrun”

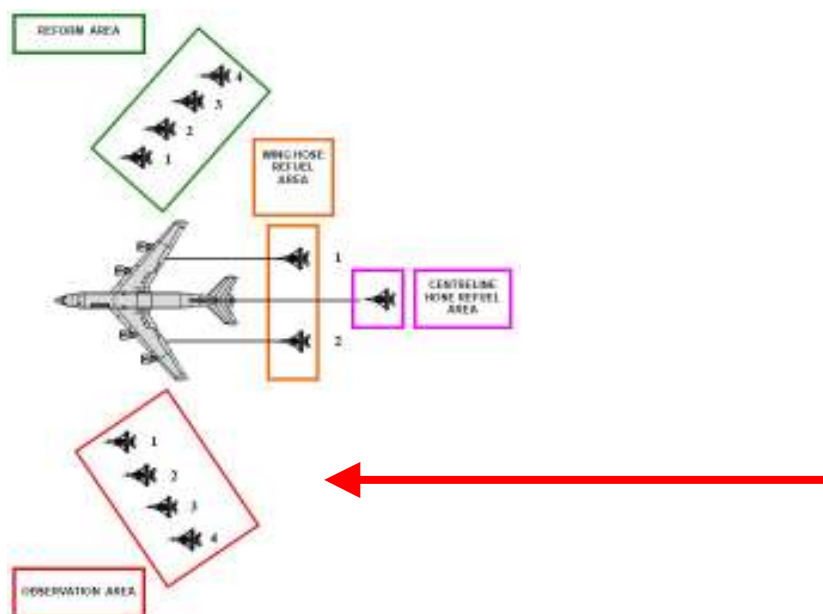
When either the tanker or receiver deems that the overrun condition is no longer a factor.

Rejoin

Once the overrun condition has been corrected and the receiver is below and behind the tanker. Receivers will not begin a climb from the RV altitude until it is evident that the tanker will remain in front of the receiver for the entire closure.

Join

Receivers arrive from tanker's left side and form up in the observation position.



Observation Position

The left-hand side of the tanker is allocated for joining aircraft, unless the lead tanker directs otherwise. The exact location of the observation position is dependent upon the availability of rearward facing observers or boom operators that can monitor the receivers. **Here in RAFv there is no boom operator (VC10 C1K).**

Where the tanker has no rearward facing observers, **the receivers must move forward ahead of the wingline to the observation position in order to be seen and identified by the tanker pilots.**

Pre-Contact Position

When directed by the tanker, the first receiver or pair of receivers moves from the Observation Position to the pre-contact position. The receiver closest to the tanker moves behind the right hose and the other receiver moves astern the left hose.

Once stable in the pre-contact position, the receiver(s) await further instruction from the tanker.

One receiver on tanker

When the tanker has 2 (wing hoses) refuelling stations and both are available, the receiver moves to the right hand refuelling position.

Two receivers on tanker

If there is more than one receiver and both refuelling stations (wing hoses) are vacant, the first receiver moves to the right hand refuelling position and the second receiver moves in turn to the left hand position.

To ensure safe operations, the tanker will direct receivers to the formation position that they are to adopt. Furthermore, the tanker will direct when receiver aircraft are to reposition

Clear for Contact

Individual Clearance to Contact.

Normally, the tanker is only able to safely monitor one receiver at a time. Consequently, receivers will be cleared to make contact one at a time. Where the tanker is able to monitor both receivers, simultaneous contact may be approved.

Remaining in Contact.

Because of the potential to cause the tanker to yaw slightly if one receiver disconnects, receivers should remain in contact until cleared to disconnect by the tanker.

Disconnect.

Normally, the tanker will instruct receivers to disconnect simultaneously. However, the tanker may order individual disconnects either to maximise hose efficiency or due to disparate receiver fuel states. **Once stable astern the hose, the tanker will direct the receiver(s) to move to the reform area.**

Reforming

Once cleared from astern the hose, receivers will reform in echelon on the right wing. If there are two or more receivers, they should reform using echelon right formation, moving sequentially outboard of the tanker with the first receiver remaining closest to the tanker's wing.

Leaving

Receiver(s) leave the tanker either level with the tanker or climbing. Normally, receivers must NOT descend from a tanker unless co-ordinated with an ATC or other controlling unit as other receivers are likely to be joining the tanker from below.

TYPES OF RENDEZ-VOUS PROCEDURES IN RAFv

RV Alpha

This is a procedure directed by a radar control station, whether ground based, seaborne, or airborne (AEW) – **RACE TRACK OPERATIONS**.

RV Bravo

This is a heading based procedure which utilises air to air equipment of both tanker and receiver. The tanker controls the procedure – **RV BRAVO PROCEDURE**.

RV Charlie

This is a heading based procedure similar to the RV Bravo which allows receivers with an Airborne Intercept (AI) radar to control the procedure once positive AI radar contact is established – **RV CHARLIE PROCEDURE** (*under construction*).

RV Golf (Enroute)

This procedure facilitates join up on a common track to make good a scheduled time. The receivers may have departed either from the same or different bases. There are a number of enroute RVs

During call outs: Requesting refuel – Judy – Visual – Clear Join, Clear Astern, Astern:
Single a/c; communications between Tanker and receiver.
Multiple a/c: communications only between Tanker and flight leader.

Note: if AWACS is airborne, receiver will first contact WAD01 or WAD02

Its the responsibility of the flight leader to keep his formation together.

If a flight is approaching, unorganized, the refuel will be called off by the Tanker, giving the leader the possibility to reform his formation.

The flight leader informs the Tanker :
who is coming first for refuel followed by callsign XXX etc.
dry or wet hook up/refuelling.
Each pilot will give his fuel demand to the Tanker.

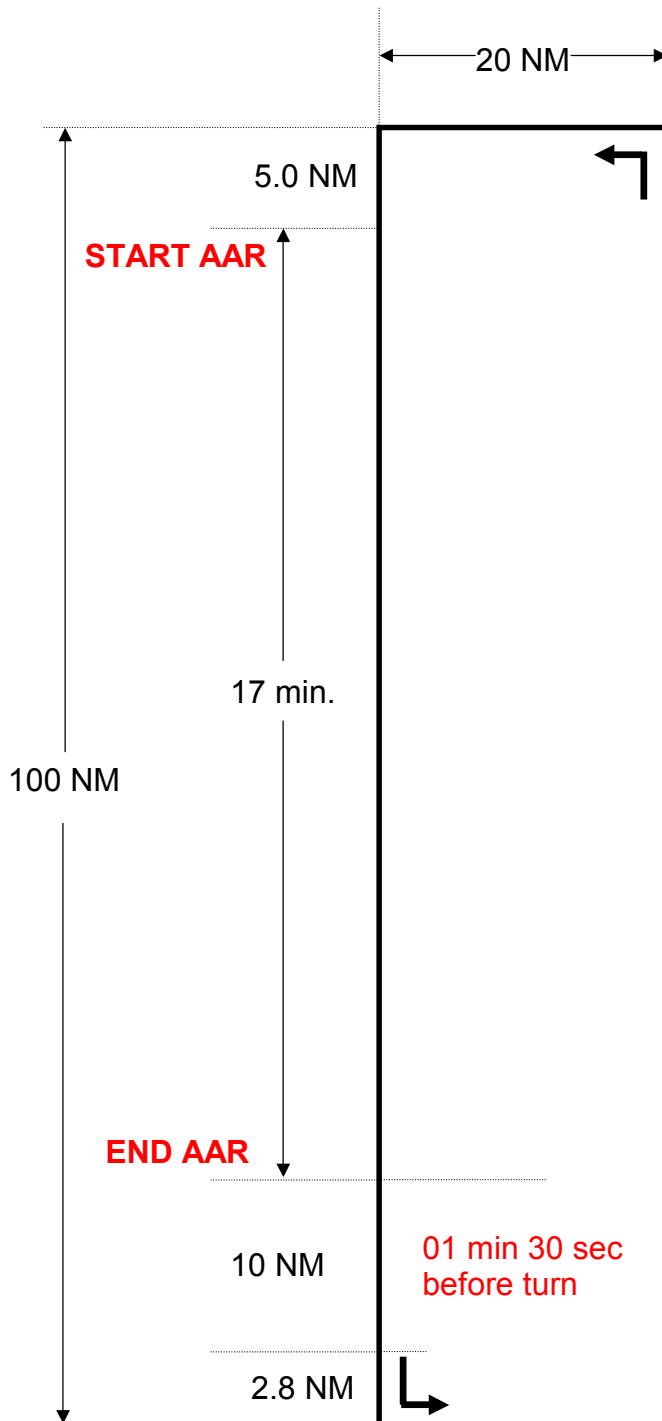
RAFvirtual – AAR QUICK REFERENCES

RACE TRACK OPERATIONS

All racetracks are to be to the LEFT to give the tanker pilot the best lookout

Aircraft: VC10 K3/K4 & C1K
Airspeed: 250 KIAS

GENERAL REFERENCE FOR THE TANKER PILOT



Remark:
Available AAR time \pm 17 minutes

Abort or disconnect at 10 NM from next turning point. You then have still 01 min 30 sec before the autopilot begins the turn.

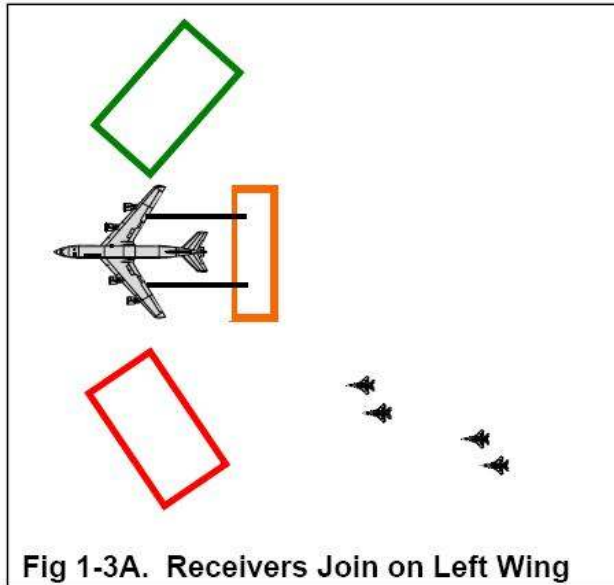
After a turn to the long leg the VC10 will be on the right heading after 5.0 NM and AAR can begin.

Short leg = from fix point to fix point the VC10 needs about 6 minutes.

Note:
2.8 NM before reaching the fix point the autopilot will begin its turn to the next fix point.
With a bank angle of 30° the VC10 need 01 min 30 sec to level off again.

RAFvirtual – AAR QUICK REFERENCES POSTIONS

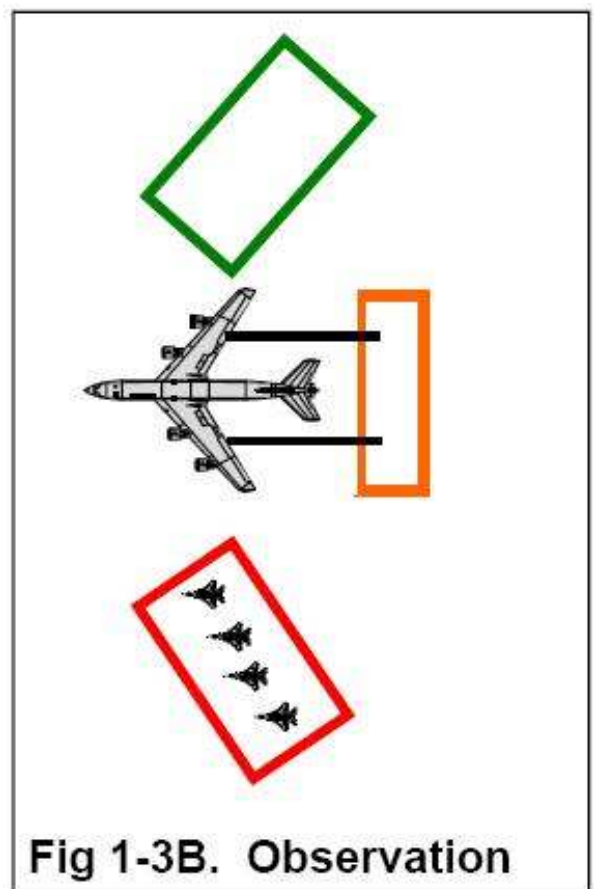
JOIN POSITION



OBSERVATION POSITION

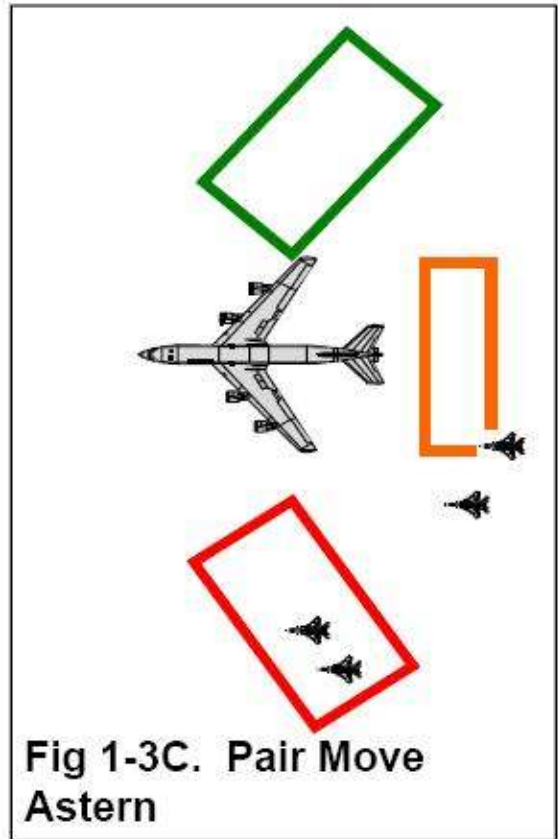


the receivers must move forward ahead of the wingline to the observation position in order to be seen and identified by the tanker pilots.

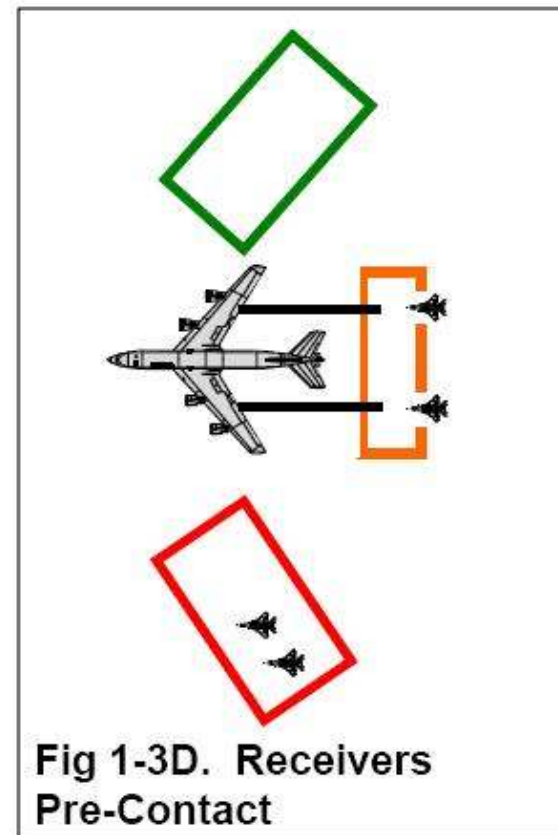


ASTERN POSITION

Moving in pairs or single.

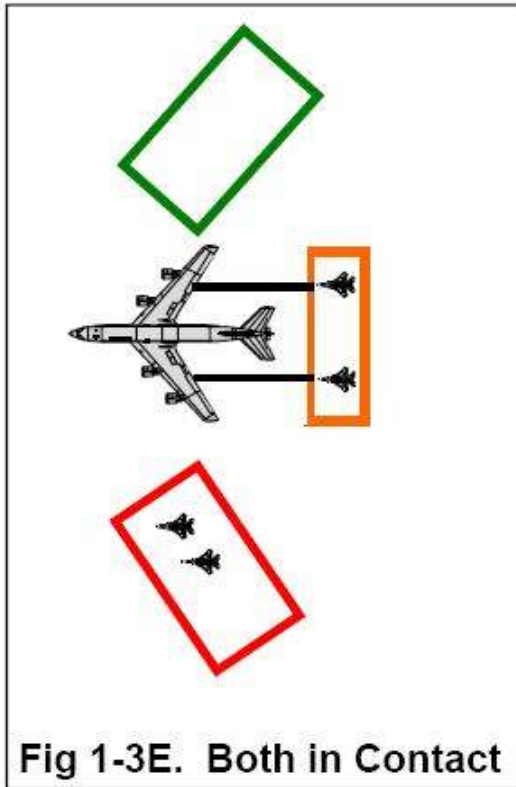


PRE-CONTACT POSITION



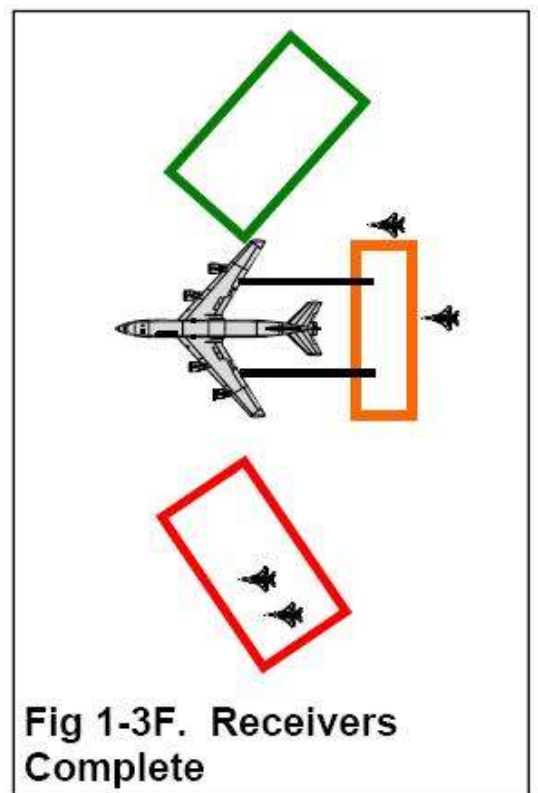
CONTACT POSITION

Contact in pairs or single.



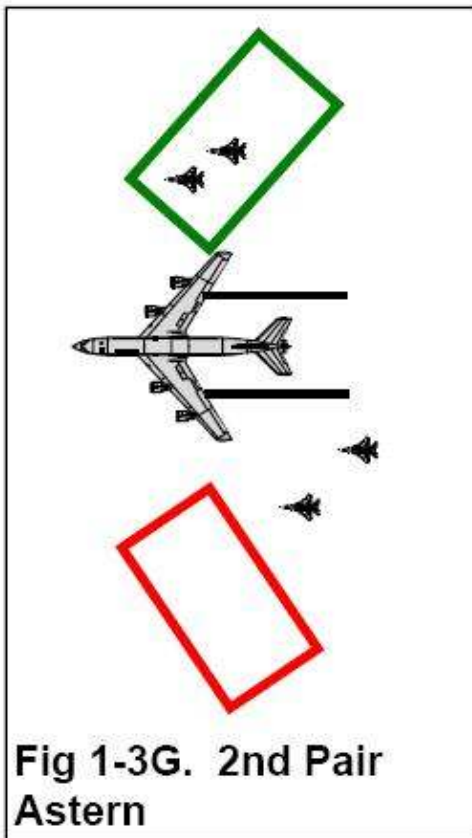
DISCONNECT POSITION

After disconnect
Receiver(s) maintain Astern



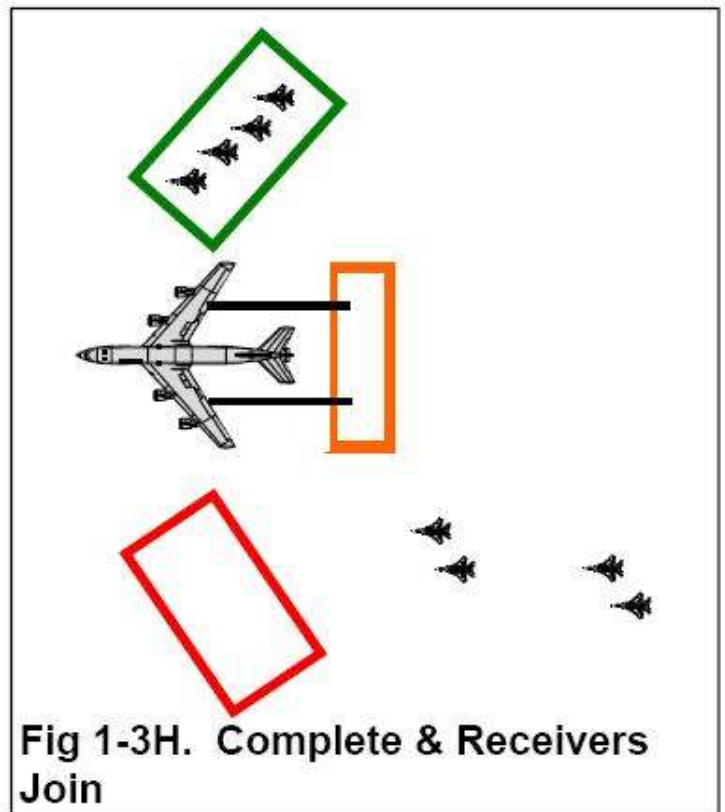
REFORM POSITION

After being cleared by tanker, refuelled aircraft(s) move to the Reform Area. Other receivers can now move to Astern.



NEW RECEIVERS

Example of positions if more than one flight is coming for refuel.



CLEAR TO LEAVE

Receiver(s) leave the tanker either level with the tanker or climbing. Normally, receivers must NOT descend from a tanker unless coordinated with an ATC or other controlling unit as other receivers are likely to be joining the tanker from below.

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AAR RV BRAVO – General Procedure

ATP-56(B)
Part 2 Annex 1B

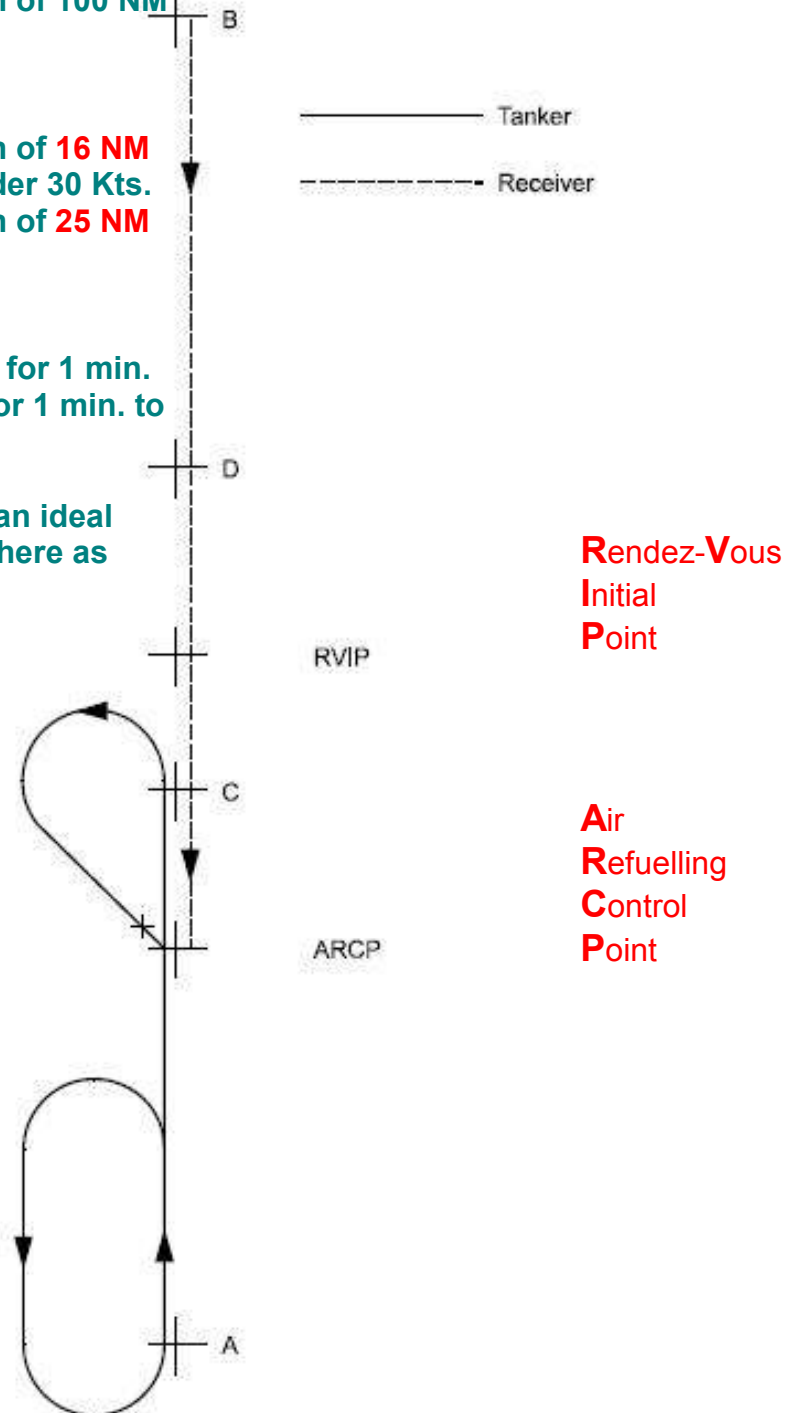
Figure 1B-1. Diagram of RV Bravo

A / B = radiocontact Tanker & Receiver.
Both a/c adjusting speed to 250 KIAS.
A minimum initial head-on separation of 100 NM should be planned.

C / D = **turn range**.
A **minimum** initial head-on separation of **16 NM** should be planned – windspeeds under 30 Kts.
A **minimum** initial head-on separation of **25 NM** should be planned – strong winds.

C = Tanker makes left turn of 180°
Then followed by an extra turn of 45° for 1 min.
Then followed by a right turn of 45° for 1 min. to come on the heading of the receiver.

A = the tanker racetrack is shown in an ideal position but it may be planned elsewhere as required.



Introduction

The RV Bravo is a heading based procedure that utilises air to air equipment of both tanker and receiver. It has a further advantage in that it does not require a pre-briefed AAR track. It is also suitable for large or battle-damaged receivers, because the tanker performs all turns during the procedure.

As this procedure is heading rather than track based, it may not be suited to a busy ATC environment.

Procedure

1. A reciprocal head-on approach without lateral displacement is set up. To give sufficient time to correct any heading error, a minimum initial head-on separation of 100 nm is desirable.
2. Tanker and receiver will fly (until this document is updated) both at 250 KIAS.
3. Radar should be active on screen for both a/c.
4. The RV BRAVO is to be controlled throughout by the tanker unless the tanker makes a positive handover of control to the receiver.

Help Diagram

Tanker	Receiver	Left turn to	Tanker	Receiver	Left turn to
360	180	135	190	010	325
010	190	145	200	020	335
020	200	155	210	030	345
030	210	165	220	040	355
040	220	175	230	050	005
050	230	185	240	060	015
060	240	195	250	070	025
070	250	205	260	080	035
080	260	215	270	090	045
090	270	225	280	100	055
100	280	235	290	110	065
110	290	245	300	120	075
120	300	255	310	130	085
130	310	265	320	140	095
140	320	275	330	150	105
150	330	285	340	160	115
160	340	295	350	170	125
170	350	305	360	180	135
180	360	315			

= Tankers heading during the RV Bravo procedure

= Backcourse to be hold by the receiver

= Tankers heading when reaching the Turn Range Point