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Flight Training

LIFT4, A-10C AIR TO AIR REFUELING

COMPLIANCE WITH THIS PUBLICATION IS MANDATORY

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This operating instruction (OI) provides LIFT4 (AR) Special Qualification requirements as well as Standard Operating Procedures for the 25th Virtual Fighter Squadron.

SUMMARY OF CHANGES

Updated information using non sensitive information from real world AFTTP 3-3.A-10 and 1A-10C-1.

1. PURPOSE: The purpose of this document is to outline refueling operations for the A-10C with specific requirements for receiving the Air to Air Refueling Qualification.

2. AIR-TO-AIR REFUELING: In-flight refueling of the A-10 is a common and often critical mission element, both during day and night operations, and in training and combat. This OI discusses planning, procedures, and techniques for day, night, and emergency air-to-air refueling (AR). A-10 Air Refueling Panels, Lights and Switches are shown in **Attachment 1**.

2.1. AIR REFUEL PROCEDURES.

2.1.1. Checklist Requirements. Pilots will use the 25th VFS Normal Operations Checklist AR section prior to commencing AR operations.

2.2. Tanker Rendezvous. The type of rendezvous is dictated by the availability of ground-controlled intercept (GCI), type of aircraft equipment (A/A TACAN, SADL), mission requirements, and weather. For DCS A-10C a RV Delta (point parallel rendezvous) is flown. This is a predictable racetrack pattern flown by the tanker and the receivers, and either the tanker turns (tanker turn-on) to effect the rejoin or the fighters turn (fighter turn-on) to effect the rejoin.

2.2.1. RV Delta (Point Parallel Rendezvous). The RV Delta procedure requires the receiver to maintain an agreed track and the tanker to maintain the reciprocal track, offset a pre-determined distance. The receiver flight will depart the RVIP on course to the RVCP at 230 to 240 KIAS or cruise airspeed, whichever is higher and aim to be at the RVCP at the RVCT. The RV Delta (point parallel rendezvous) method is most commonly used. (See Figure 2.1, Point Parallel Rendezvous.) The receiver flight must maintain a minimum of 1,000 feet below the tanker base altitude until in visual contact with the tanker. The receiver flight will aid the rendezvous with



electronic aids (A/A) starting no later than 50 NM or the RVIP, whichever occurs first, until reaching the astern position. A/A TACAN can provide range information for the KC-135. Following the rendezvous, the receivers should turn the receiver off or change frequency so the tanker can receive distance information from the next set of receivers.



Figure 2.1

2.2.2. Visual Contact. When the fighters have visual contact with the tanker, the fighters' A/A TACAN turned off or frequency changed. The altitude within the assigned refueling block can vary after receiving clearance from the tanker. Rendezvous will normally be in route formation. Other rendezvous formations may be briefed. One technique is to have the wingmen on the inside of the turn as the flight makes the fighter turn on. This gives the wingmen a power advantage and avoids spitting out Number Three and Number Four in a four-ship. The downside to this technique is the sometimes uncomfortable position the wingman is in because of being on the inside of a turn in route formation with up to 45 degrees of bank. The flight will normally join the tanker to the observation position in the echelon left position. The "CLEAR JOIN" flight lead radio call clears the flight to join in the observation position (normally to the left wing) and/or Lead to the astern/precontact position behind the boom. The first receiver may join directly astern the boom with subsequent receivers joining to the left wing in echelon.

2.3. Refueling Sequence. Key areas around the tanker/boom include observation, boom refueling area and reform areas. Receiver flow around the tanker/boom will normally be Lead to the astern position (boom refueling area), with other receivers to the left wing, joining low left (observation area) and departing high right after refueling (reform area). The tanker boom will direct receivers to the formation position they will adopt (observation, refueling or reform). As the rendezvous is completed, the flight will join-up on the tanker as briefed by the flight lead.

Normally, the flight lead will clear Number Two, Number Three, and Number Four to their respective observation positions (left wing echelon) and proceed directly to the astern/precontact position. Refuel sequence will be as briefed. One aircraft at a time is allowed to change formation about the tanker with all others remaining steady. (See Figure 2.2, Key Areas Around Tanker.)



Figure 2.2

2.3.1. Observation Position.

2.3.1.1. Transition to Position. If the flight lead is flying directly to the observation position, the wingman will maintain the assigned formation on lead. When the flight lead transitions to the astern/precontact position, the wingman will remain in the observation position. If the flight lead is flying directly to the astern/precontact position, the wingman will continue to fly the briefed formation off the flight lead until cleared by the flight lead up to the respective wing of the tanker. When cleared to the observation position, maintain a small amount of overtake, while edging away slightly from the tanker, and complete the rejoin to the assigned tanker's wing.

2.3.1.2. **Observation and Reform Position References.** Maintain position along the tanker's wing line with a minimum of one receiver's wingspan clearance from the tanker (unless instrument flight rules (IFR) or night operations require less spacing). Fly high enough to see some of the tanker's opposite wing and slightly forward of an imaginary line connecting the trailing edge of the tanker's wingtips. In turns away, maintain the references for wings-level flight. This will keep the A-10 up on the tanker's wing line, out of the plane of the aircraft in the contact position. Do not use echelon references. During turns toward you, stack comfortably high. Stay above the horizontal plane of the aircraft in the contact position, if practicable.

2.3.1.2.1. KC-135. Align the tanker's wingtip formation light with the door or window behind the wing root. (See **Figure 2.3**, KC-135 Observation Position.)



Figure 2.3

2.3.2. Astern/Precontact Position.

2.3.2.1. The Flight Lead will call "CLEAR ASTERN" (only required during EMCON 1) and the flight lead will clear the receiver to the astern/precontact position. Open the AR door and transition to the astern/precontact position. (See **Figure 2.1**, Key Areas Around Tanker and **Figure 2.4** KC-135 Astern/Precontact Position) The transition to astern/precontact is similar to the first half of a crossunder. Reduce power slightly and drop below the tanker. Move the A-10 at a controlled rate, to a position approximately 50 feet (one ship length) behind and slightly below the boom. Use 50 feet as a guide to avoid excessive power reductions and positioning too far aft. Pilots will inform the boom operator when it is their first time refueling on that tanker type.



Figure 2.4

2.3.2.2. **Stabilize in the Astern/Precontact Position.** Make the appropriate radio call (e.g., "Ready Precontact"). The astern/precontact call assumes the receiver is stabilized and ready. A-10 formal training unit (FTU) students and wingman should make radio calls as briefed. The boom operator will then state when the tanker is ready for the pilot to move the A-10 to the contact position. Slowly move to the contact position.

2.3.3. Contact Position.

2.3.3.1. Transition to Contact Position. The key to a successful hookup is to move slowly and smoothly to a position that places the end of the boom directly in front of the receptacle. (See **Figure 2.5**, Contact Position for KC-135.) The boom operator will issue visual signals on the director lights located on the underside of the tanker directly aft of the nosewheel door.



Figure 2.5

WARNING: Moving to the contact position may be easier if the nose of the aircraft is placed level with or very slightly below the boom knuckle (the boom knuckle is the joint at the end of the boom that allows the nozzle to rotate.) Look directly at the knuckle for alignment and rate of closure. Approach the knuckle slowly. When the knuckle is 2 to 3 feet in front of the receptacle, stabilize the aircraft with a very small reduction in power. Now select a reference point on the tanker (not the knuckle) and maintain this position. A typical mistake is getting too much overtake approaching the contact position. If started from an "excessive" astern/precontact position (100 feet or more), the A-10 is placed in a position from which it is possible to build up excessive overtake. Not only does this make the boom operator nervous, but it makes power control difficult for even the most experienced A-10 pilot. Remember, the more overtake the aircraft develops, the more overtake the pilot will have to kill to stabilize in the contact position. Note the exact airspeed of the tanker while in the observation position and use a maximum of 1 to 2 KIAS overtake while moving to the contact position. The objective is to stabilize just behind the boom with zero overtake.

WARNING: The receiver will stabilize with zero rate of closure in the astern position. If the receiver fails to attain stabilized position or it becomes apparent that a closure underrun will occur, breakaway procedures will be initiated. Failure to do so can result in a mid-air collision. Furthermore, the majority of damaged booms result from receivers closing too fast and exceeding the AR envelope (inner limit). It is critical for receivers to stabilize with a zero rate of closure prior to the boom/AR systems operator clearing the receiver to contact.

2.3.3.1.1. The boom operator will "fly" the boom into the receptacle and make contact. When the boom is latched, the Ready light (windshield bow) will extinguish and the Latched light will

illuminate indicating a good hookup. The boom operator will confirm the hookup and expect acknowledgement over the radio or intercom. Once latched, quickly glance at the fuel gauge to confirm fuel transfer.

2.3.3.2. **Contact Position References.** Fly formation position off the tanker, not just the boom, and reference the receiver director lights. Cockpit references vary with pilot sitting height and should always be cross-checked against the director lights. The director lights do not give true vertical and horizontal information. The up-and-down lights change because of angular movement of the boom, and the fore-and-aft lights change because of in-and-out movements of the boom. If a receiver exhibits an appreciable acceleration in the envelope, the director lights will go to the full forward, aft, up, or down indication, as appropriate, even though the receiver has not reached the respective edge of the envelope. (See Figure 2.5, Contact Position for KC-135.)

2.3.3.2.1. The boom may block the view of the director lights when in the middle of the envelope. If so, move the head slightly to one side in order to see around the boom. The optimum position is indicated by both the DOWN-UP and FORWARD-AFT "Captain's Bars" being illuminated. Receiver pilots may also sense a slight delay before boom movement begins.

2.3.3.2.2. A disconnect will occur if the limits of the refueling envelope are exceeded. If this happens, move aft to the astern/precontact position, press the AR disconnect/reset button on the control stick, and check that the Ready light is illuminated. Maintain this position while the boom operator recycles the boom to prepare for another contact. Avoid drifting too far back. Slowly returning to the contact position.

2.3.3.3. **Maintaining Contact.** Fly formation references on the tanker in order to prevent over controlling while in the contact position. Chasing the boom should be avoided. This makes the boom operator's job more difficult. As the aircraft safely arrives at the contact position, freeze the position on the tanker by focusing on the tanker references and let the boom operator do his job (plugging in to the aircraft).

2.3.3.3.1. Depending upon altitude and aircraft weight/drag, power response may be limited. Anticipate a higher power setting as the aircraft takes on more fuel; it is not unusual to be in maximum power while in the contact position.

2.3.3.3.2. While on the boom, make small flight control and power changes. Do not delay corrections but make them slowly. Avoid over controlling and **be patient**.

2.3.3.3.3. When looking at the director lights, imagine the word "go" in front of the letters. When a light is on in a particular quadrant, then simply go in the direction indicated. It is probably easier to maintain fore/aft positioning with the colored bands on the boom and up/down positioning with the left-hand set of director lights.

2.3.4. Disconnects.

2.3.4.1. Normal Disconnects.

2.3.4.1.1. Disconnect after receiving the briefed off-load or when the tanks are full. Disconnect can be initiated by either the boom operator or the receiver pilot.

2.3.4.1.2. Disconnect by depressing the AR disconnect/reset button on the stick grip. *Do not pull back on the stick*. After disconnecting, pulling back on the stick before drifting aft of the tanker may result in collision with the boom.

2.3.4.1.3. Fuel spray may cover the front windscreen and hamper forward visibility for several seconds after disconnecting. The amount of spray may be reduced by maintaining contact with the tanker for 30 seconds after fuel flow has stopped. The amount of spray is typically a function of the time allowed for the remaining fuel to gravity feed.

2.3.4.1.4. As soon as the boom is free of the receptacle, the Latched light will extinguish, and the Disconnect light will illuminate.

2.3.4.1.5. If another contact is desired, reestablish the astern/precontact position, actuate the AR disconnect/reset button, and confirm the Ready light is ON. The boom operator will recycle the boom and clear the aircraft to the contact position. *CAUTION:* If an inadvertent (not boom limit, pilot, or boom operator initiated) disconnect occurs during normal AR, when 90 percent full, do not attempt further contact. It is possible to build up excessive pressure in the AR manifold during further contact attempts.

2.3.4.2. Limit Disconnects.

2.3.4.2.1. If boom envelope limits are exceeded, an automatic disconnect will normally occur. Boom limits are indicated when the director lights and/or markings on the boom are RED. (See **Figure 2.6**, KC-135 Director Lights.) If the outer limits of the boom are approached at relatively high speeds, structural damage can result from an inability to disconnect due to binding action of the boom nozzle.

2.3.4.2.2. Azimuth limits are 10 degrees left and right (KC-135), the elevation limit is a total of 20 degrees, 10 degrees up or down. The inner limit of the boom is 6 feet, and the outer limit is 18 feet (KC-135). The "captain's bars" indicate an elevation of 26 to 34 degrees and indicate approximate extensions of 11 to 13 feet (KC-135).

2.3.4.2.3. Disconnect if yaw or pitch oscillations become violent, cannot be controlled, and/or if a possibility exists of exceeding the boom limits.

2.3.5. Reform After Disconnect. After completing refueling, perform a normal disconnect, then smoothly drop aft and downthen receiver to the right and the reform area. When well clear of the boom, switch attention to the aircraft in the observation position. Perform a crossunder on the wingman and move to a route position. The crossunder should be done slowly. Pay attention to the aircraft being overtaken. Vertigo may result when trying to fly off the tanker and the fighter simultaneously. Forward visibility may be limited if any fuel is sprayed on the canopy, so be conservative during the crossunder. Subsequent receivers will reposition to the outside of their respective element after refueling.



Figure 2.6

2.4. Post Air Refueling Procedures.

2.4.1. Post Air Refueling Checks. Once finished refueling, complete the post air refueling checks IAW the 25th VFS Normal Operating Procedures checklist. The flight lead will verbally

verify completion of the post air refueling checklist and conduct an operations check after the entire flight has refueled. Be aware that the Ready light may stay on for up to 3 minutes after the refueling door lever is moved forward. The checklist is not complete until the Ready light goes out.

2.4.2. Departure. After refueling, the Flight Lead will give the clearance for departure. The flight lead will deconflict the departure from the tanker, reform the flight as briefed, and proceed with the departure clearance. Receivers can normally expect to climb a minimum of 1,000 feet above the tanker altitude after completing AR.

3. NIGHT AIR REFUELING. The differences between day and night AR procedures are subtle and, in most cases, insignificant. Director lights are easier to see, but tanker lighting can complicate formation flying. A thorough review of day AR procedures should be accomplished prior to the mission.

3.1. A-10 Lighting. Preflight of the AR system is the same as day operations. Ensure the slipway lights, nose illumination, nacelle floodlights, and refueling status lights are operable, and be familiar with the location and operation of the AR light rheostat and nose illumination switch. Remember, nacelle floodlights are controlled by the same rheostat as the slipway lights. (See Figure 2.1, A-10 Air Refueling Panels, Lights and Switches.)

3.2. Tanker Lighting. Tanker exterior lighting consists of the normal complement of aircraft lights such as wing lights and anticollision beacons. Tankers are also equipped with other lights known as underbody, underwing, overwing, and nacelle lights. These lights are adjustable and are used by the tanker's crew to observe their wings and engines. These lights, when turned up bright, can impair night vision. Nacelle lights are particularly annoying in the observation position and most tankers will turn these lights down or off upon request.

3.3. Refueling. Fighter formation procedures do not change. On tanker join-up, flight leads should avoid splitting into elements too early. This requires the element leader to divide attention between the fighters and the tanker.

3.3.1. At night, move into the contact position by edging forward only at a 1- to 2-knot closure rate. A fast closure rate is difficult to perceive at night and one of the most common errors in night hookups.

3.3.2. The receiver director lights are easier to see at night. Remember, when in the proper contact position, the boom may block one side of the director light set.

3.3.3. The end of the boom does not have a light; however, the A-10's nose illumination lights will begin to illuminate the end of the boom during the approach to the contact position.

3.3.4. Once in the correct contact position, maintain this sight picture using the whole tanker. The sight picture will be a dim silhouette, and at times, quite hard to see. Because of this, slight movements are extremely difficult to detect visually. Use the director lights and boom operator's guidance to assist in maintaining proper position. There is a tendency to be impatient while awaiting results from small power and control changes. Resist this temptation and the night AR will go much smoother.

3.3.5. After receiving the briefed off-load, disconnect normally and slowly move aft to the astern/precontact position. Acquire the wingmen in the observation position with peripheral vision or with a quick glance. Quickly scan the cockpit instruments and fuel gauges for anomalies before moving across and under to the observation position.

4. QUICK FLOW PROCEDURES.

4.1. General. Fighter type receivers may use quick flow (QF) procedures to expedite AR operations. QF allows receivers to minimize refueling time with maximum fuel, but may be employed only during DAY or NIGHT under VMC conditions. Left echelon formation is normally used for QF; however, variations are authorized and briefed by the Flight lead prior to joining with tanker.

4.2. QF Procedures. Normally, the receiver flight will join on the tanker with the flight lead moving to the astern position. Remaining aircraft will proceed to the left observation, visual position. Once the flight lead commences refueling, the second aircraft in the air refueling sequence will move to the "On-Deck Position." (See Figure 4.1, Quick Flow Air Refueling.) The "On-Deck Position" is echelon formation on the receiver in the contact position. When the flight lead completes refueling, that aircraft moves to an observation position on the tanker's right wing. The second receiver moves from the "On-Deck Position" to the astern and contact position. If three or more receivers are part of the fighter formation, the third receiver moves to the "On Deck" position. The left to right flow continues until all fighters have refueled. When AR is complete, the aircraft will depart the tanker or remain in echelon formation on the tanker's right wing for additional AR. If further refueling is required, reverse the above procedures with a right to left flow. The second receiver can assume a right "On Deck Position" and Quickflow will continue in order. If additional receivers arrive prior to the first flight completion, they will remain in trail position until cleared by the tanker or observe the first flight departing the tanker.

4.3. Breakaway Procedures. In the event of a breakaway, the "On-Deck" receiver follows the receiver on the boom. Any receivers on the wing will remain with the tanker. In the event a breakaway is initiated while a receiver is transitioning from the observation position to the "On-Deck" position, that receiver will follow the receiver on the boom.

5. CONTINGENCIES.

5.1. Breakaway Procedures. When a crew member aboard either the tanker or receiver determines that an emergency exists during refueling operations, the crew member will transmit on the AR frequency the word "BREAKAWAY" three times. receivers will immediately initiate breakaway procedures.

5.1.1. Initially, the tanker will maintain heading or established angle of bank (AOB) and assigned FL/altitude/height and subsequently, increase power and accelerate. The receiver on the boom will immediately disconnect, reduce power and establish a definite rate of descent. Move down and aft keeping the whole tanker in sight until clear of the tanker and the refueling equipment. The aircraft does not have to be in the contact position for anyone to call a breakaway.



Figure 4.1

5.1.2. If a breakaway is called prior to any receiver reaching the observation position, the entire receiver flight will execute the breakaway procedure. If a breakaway is called after a receiver has reached the observation position, only the receiver in the astern/precontact or contact position will execute the breakaway procedure. In the event the receiver loses visual contact

with the tanker during the breakaway, the receiver will descend at least 500 feet below the tanker. Receivers in the observation position will maintain formation on the tanker. If unable to stay with the tanker, follow the procedures for a receiver in the contact or astern/precontact position if in visual meteorological conditions or applicable lost wingman procedures if in instrument meteorological conditions.

5.2. Loss of Visual Contact/Lost Wingman. Any aircraft in close formation that loses visual contact with the tanker or the receiver is to take immediate action to achieve safe separation from the tanker, and if necessary, other receivers. This will be achieved by executing Loss of Visual Contact/Lost Wingman procedures whilst simultaneously transitioning to flight instruments. The receiver will call: "WARTHOG 1, LOSS OF VISUAL CONTACT" or "WARTHOG 1, LOST WINGMAN."

5.2.1. Procedures.

5.2.1.1. Tanker procedures: with a "(Call-sign) LOSS OF VISUAL CONTACT" call.

5.2.1.2. Procedures for receiver in astern/precontact position. Call "LOSS OF VISUAL CONTACT." Slow 10 knots, descend 500 feet, hold tanker heading and after 30 seconds resume normal airspeed.

5.2.1.3. Receiver closest to tanker (Number Two). Turn away using 15 degrees of bank for 15 seconds (15, 15). Resume tanker heading to parallel track.

5.2.1.4. Next receiver (Number Three) on wing of Number Two. Attempt to maintain formation. Turn away using 30 degrees of bank for 30 seconds (30, 30). Resume tanker heading to parallel track.

5.2.1.5. Next receiver (Number Four) on wing of Number Three. Attempt to maintain formation. Turn away using 45 degrees of bank for 30 seconds (45, 30). Resume tanker heading to parallel track.

6. AR SPECIAL QUALIFICATION REQUIREMENTS.

- 6.1. Air to Air Refueling (page 488 thru 490 DCS A-10C Flight Manual).
- 6.2. Must utilize TACAN to navigate to tanker's location.
- 6.3. Must form up correctly on tanker as outlined in this OI.
- 6.4. Must communicate intentions to refuel to tanker.
- 6.5. Set up fuel system panel as required to account for damaged fuel tanks.
- 6.6. Make successful connection and take on at least 4000 pounds of fuel.
- 6.7. Multiple connections are OK as long as pilot maintains formation with the tanker.

6.7. Communicate aborting refueling with the tanker.

6.8. Upon satisfactory completion of these items the pilot will be awarded the A-10 AR Qualified patch (**Figure 4.1**) and training updated in the training log.



Figure 4.1 A-10 AR Qualified Patch

Attachment 1

