BY ORDER OF THE
SECRETARY OF THE AIR FORCE

AIR FORCE MANUAL 11-2F-22A,
Volume 3

20 SEPTEMBER 2018
Incorporating Change 1, 11 APRIL 2022
Certified Current 11 APRIL 2022
Flying Operations

F-22A--OPERATIONS PROCEDURES

COMPLIANCE WITH THIS PUBLICATION IS MANDATORY

ACCESSIBILITY: Publications and forms are available for downloading or ordering on the e-Publishing website at www.e-publishing.af.mil.

RELEASABILITY: There are no releasability restrictions on this publication.

OPR: ACC/A3TO

Certified by: AF/A3T
(Maj Gen Scott F. Smith)

Supersedes: AFI11-2F-22AV3, 8 December 2009

Pages: 67

This publication establishes effective and safe operations of the F-22A and implements Air Force Policy Directive (AFPD) 11-2, *Aircrew Operations*, AFPD 11-4, *Aviation Service*, and references Air Force Instruction (AFI) 11-200, *Aircrew Training, Standardization/Evaluation, and General Operations Structure.* This Air Force Manual (AFMAN) applies to all F-22A units in the Regular Air Force, Air National Guard and Air Force Reserve. This publication requires the collection and or maintenance of information protected by the Privacy Act (PA) of 1974. The authorities to collect and or maintain the records prescribed in this publication are Title 10 United States Code, Chapter 857 and Executive Order 9397, Numbering System for Federal Accounts Relating to Individual Persons, 30 Nov 1943. Forms affected by the PA have an appropriate PA statement. System of Records Notice F011 AF XO A, Aviation Resource Management System (ARMS) covers required information. The authority for maintenance of ARMS is Title 37 U.S.C. 301a (Incentive Pay), Public Law 92-204, Section 715 (Appropriations Act for 1973), Public Laws 93-570 (Appropriations Act for 1974), 93-294 (Aviation Career Incentive Act of 1974), and Executive Order 9397 as amended by Executive Order 13478, Amendments to Executive Order 9397 Relating to Federal Agency Use of Social Security Numbers, November 18, 2008.. Ensure all records created as a result of processes prescribed in this publication are maintained in accordance with Air Force Manual 33-363, Management of Records, and disposed of in accordance with the Air Force Records Disposition Schedule located in the Air Force Records Information Management System. Refer recommended changes and questions about this publication to the office of primary responsibility (OPR) using the AF Form 847, *Recommendation for Change of Publication*; route AF Forms 847 from the field through the appropriate functional chain of command. Air Combat Command (ACC)/A3 will coordinate all changes to the basic volume with

all major command (MAJCOM)/A3s. This publication may be supplemented at any level, but route all direct supplements to Air Force Flight Standards Agency/A3OF and ACC/A3TO for coordination prior to certification and approval. Field units below MAJCOM/direct reporting unit (DRU)/field operating agency (FOA) level forward copies of their supplements of this publication to their parent MAJCOM/ DRU/FOA OPR for post-publication review. **NOTE:** The above applies only to those DRUs/FOAs that report directly to Headquarters Air Force (HAF). Copies of MAJCOM/DRU/FOA-level supplements, after approved and published, will be made available on the e-Publishing website at **https://www.e-publishing.af.mil**. The authorities to waive wing/unit level requirements in this publication are identified with a Tier ("**T-0**, **T-1**, **T-2**, **T-3**") number following the compliance statement. See AFI 33-360, *Publications and Forms Management*, for a description of the authorities associated with the Tier numbers. Submit requests for waivers through the chain of command to the appropriate Tier waiver approval authority, or alternately, to the requestors commander for non-tiered compliance items. Additional waiver authority to this publication is described in **para 1.2.**

SUMMARY OF CHANGES

This Interim Change (IC) includes the following changes: corrected outdated reference for Low Altitude map requirements, corrected verbiage concerning rejoin directives, added guidance to matching aircraft configuration for chase formation, corrected outdated publication references, updated "min fuel" to 2,100 pounds, added guidance about use of speedbrakes on final/landing phase, deleted references to Mode 4 AAI.

Chapter 1

GENERAL GUIDANCE

1.1. Responsibilities. This manual prescribes procedures for operating the F-22A aircraft under most circumstances. It is not a substitute for sound judgment, or approval to override any existing aircraft limitation. Procedures not specifically addressed may be accomplished if they enhance safe and effective mission accomplishment. Deviations from these procedures require a specific waiver unless an urgent requirement or an aircraft emergency dictate otherwise. In that case, the pilot in command takes the appropriate action to recover safely the aircraft.

1.1.1. **Commanders.** Commanders at their respective tier levels are responsible for complying with guidance in this Manual. F-22A flying unit wing commanders, delegated no lower than the operations group commander (or equivalent), are responsible for providing local operating guidance to supplement the requirements in **Chapter 8** of this manual.

1.1.2. **Pilot in Command Authority.** The pilot in command, regardless of rank, is responsible for, and is the final authority for the operation of the F-22A aircraft. Pilots will use their best judgement to conduct safe flying operations.

1.1.3. **Deviations.** Deviations from these procedures require a specific waiver unless an urgent requirement or an aircraft emergency dictate otherwise. In that case, the pilot in command will take the appropriate action to recover safely the aircraft.

1.1.4. **Supplements.** Comply with applicable supplements to all guidance referenced in this volume. Develop additional supplements IAW AFI 33-360.

1.2. Waivers. Forward waiver requests through appropriate channels to the applicable MAJCOM/A3 or equivalent, or Commander Air Force Forces (COMAFFOR) for those aircrew and assets under the COMAFFOR's oversight, for approval. The COMAFFOR, MAJCOM/A3 (or equivalent) will notify ACC/A3 of waivers within 72 hours of issuance. Wing commanders will notify the publication OPR within 72 hours of waiver approval. IAW AFI 33-360, a copy of the approved waiver must follow within 30 days of issuance. An email to the waived publication OPR that includes a completed AF Form 679, *Air Force Publication Compliance Item Waiver Request/Approval* or equivalent will suffice. Waiver authority for supplemental guidance will be as specified in the supplement and approved through higher-level coordination authority.

Chapter 2

MISSION PLANNING

2.1. Responsibilities. The pilot in command (single-ship) or the designated flight lead (FL) is ultimately responsible for mission planning. The FL coordinates with intelligence, targeteers, and other support agencies to ensure safe mission execution.

2.2. General Procedures.

2.2.1. Accomplish sufficient flight planning to ensure safe mission accomplishment to include fuel requirements, map preparation, communication plan, and takeoff/landing data (TOLD).

2.2.2. **Standards.** The squadron commander (or equivalent) is the approval authority for unit standards. All standards will be reviewed by group stan/eval for standardization and compliance with AFI/AFMAN 11-series guidance **(T-2)**.

2.3. Map/Chart Preparation.

2.3.1. **Local Area Maps.** A local area map is not required if the inflight guide includes jettison areas, divert information, controlled bailout areas, and provides a local area map of sufficient detail to remain within assigned training areas.

2.3.2. **Charts.** Flight Information Publication (FLIP) enroute charts may be used instead of maps on navigational flights within areas that are adequately covered by these charts.

2.3.3. **Low Altitude Maps** . Refer to AFMAN 11-202V3, *Flight Operations* and MAJCOM guidance for low altitude map requirements, marking and procedures.

2.4. Briefing/Debriefing. FLs are responsible for presenting a logical briefing that promotes safe and effective mission accomplishment. All pilots attend the flight briefing and debriefing unless previously coordinated with the FL and/or unit/squadron supervisors. See mission briefing guides in Attachments **3**-**10** as a guide to covering items required to accomplish each mission type.

2.4.1. Items listed in **Attachment 3** are briefed on every sortie, with Attachments **4**-**8**, and **10** adding mission specific details. **Attachment 9** is an all-inclusive briefing guide for Aerospace Control Alert (ACA) missions. Items published in AFIs, Air Force Tactics Techniques and Procedures (AFTTPs), or squadron/wing standards and understood by all participants may be briefed as "standard."

2.4.2. FLs will cover the following items for every sortie:

2.4.2.1. Review weather and other factors effecting flying operations (ref Air Force Handbook (AFH) 11-203V1, *Weather for Aircrew*), TOLD and abnormal situations such as short/wet/icy runway, heavy gross weights, external fuel tank configurations, high density altitude and non-standard cable configurations **(T-3)**. The minimum TOLD required is maximum abort speed (include wet/icy, as applicable, based on location and potential for wet/icy runway surface), takeoff distance, takeoff speed, rotation speed, and normal/heavy weight landing distance (include wet/icy, as applicable, based on location and potential for wet/icy runway surface).

2.4.2.2. When dissimilar aircraft are flown in formation, brief flight responsibilities, proper formation position (to ensure adequate wingtip clearance), and aircraft-unique requirements and emergency considerations for each phase of flight **(T-3).**

2.4.2.3. Automatic ground collision avoidance system (AGCAS) settings for takeoff, tactical airspace, and recovery and when changeovers occur **(T-3)**. Local area AGCAS settings should be covered in unit standards. On cross-country sorties, AGCAS settings must be high enough to provide terrain clearance during the entire flight.

2.4.3. For all low altitude mission briefings, place emphasis on obstacle/ground avoidance, altitude-warning features (low altitude warning), low altitude comfort level, and complacency avoidance.

2.4.4. Flight briefings should be tailored to accommodate the capabilities of each flight member. FLs ensure briefing start time provides adequate time to discuss required briefing items depending on complexity of the mission and pilot capabilities. As a minimum, begin briefings at least 1.5 hours before scheduled takeoff. Complete ACA briefings prior to pilot changeover.

2.4.5. **Alternate Missions.** FLs will brief an appropriate alternate mission for each flight **(T-2)**.

2.4.5.1. The alternate mission will be less complex than the primary mission **(T-3)**. FLs should brief specific mission elements that are different than the primary mission. Mission elements/events may be modified and briefed airborne as long as flight safety is not compromised.

2.4.5.2. **Standard Missions.** Operations group standards may outline alternate missions that do not require a dedicated brief. Standard missions are limited to 'Basic Skill' missions as outlined in *F-22A Ready Aircrew Program Tasking Memorandum* and AFI 11-2F-22AV1, *F-22A Aircrew Training*.

2.4.6. If aircraft turn times do not permit mission brief(s) in addition to the initial flight brief, the following applies:

2.4.6.1. Upgrade missions will be flown on the first sortie (second sortie if the first is non-effective for weather, airspace, or maintenance) **(T-3)**. The squadron operations officer will ensure subsequent missions will be of equal or less complexity with no additional upgrade training **(T-3)**.

2.4.6.2. Continuation training missions may fly their primary or alternate missions in any sequence.

2.4.7. Deployed operations, exercise, and quick turn briefings. If all flight members attend an initial or mass flight briefing, the FL on subsequent flights need brief only those items that have changed from the previous flight(s).

2.4.8. **Debriefing.**

2.4.8.1. FLs will debrief safety of flight on all missions **(T-2)**. Review as much of the tactical portion of each mission as possible; however, FLs will ensure that all learning points of the mission(s) are debriefed **(T-3)**.

2.4.8.2. During the FL review of the tactical portions of the sortie, assess flight member's anti-G straining maneuver (AGSM) effectiveness. Consider not only the G-awareness exercise, but also after the pilot has had time to fatigue--typically when the AGSM breaks down and GLOC occurs. Identify pilots with poor AGSM technique or low G-tolerance to the operations officer or commander for follow-on action as required **(T-3)**.

2.5. In-Flight Guides. Group stan/eval will ensure that unit produced guides will include, as a minimum: **(T-2)**

2.5.1. Briefing Guides.

2.5.2. Local radio channelization and airfield diagrams.

2.5.3. Impoundment procedures, emergency action checklists, no radio (NORDO)/divert information, and search and rescue procedures.

2.5.4. Arresting gear information for standard divert bases.

2.5.5. Divert base information pertaining to navigation, communication, and detailed fuel assumptions. Examples: Bearing and range from home station, optimal cruise altitude, fuel assumptions, Air Traffic Control (ATC)/tower frequencies, Tactical Air Navigation System (TACAN)/Instrument Landing System (ILS), coordinate latitude/longitude, runway orientation.

2.5.6. Visual Flight Rules (VFR) and Instrument Flight Rules (IFR) bingo fuel level from local operating areas, including detailed assumptions.

2.5.7. Bailout and jettison areas.

2.5.8. Cross-country procedures to include: command and control, engine documentation, oil analysis samples, classified media securing procedures and aircraft servicing.

2.5.9. Advanced Programs Office phone number, after-hours cell number, if applicable, and email.

2.5.10. Other non-mandatory information typically includes: stereo flight plans, standard departures, standardized waypoint libraries, local training areas, instrument pre-flight, and alert procedures.

2.6. Advanced Technology Anti-G Suit/upper pressure garment use. IAW AFI 11-301V1, *Aircrew Flight Equipment (AFE) Program*, and AFI 11-301V2, *Management and Configuration Requirements for Aircrew Flight Equipment (AFE),* the following apply:

2.6.1. Pilots will wear anti-G suit during all flights regardless of anticipated Gs **(T-3)**.

2.6.2. Pilots will wear the upper pressure garment if sustained flight above Flight Level (FL) 440 is expected **(T-1)**. Below FL440, if the upper pressure garment is not worn, pilots ensure and confirm that the CRU-122 Vest Port Plug is installed. If for any reason the plug is missing the maximum G limit is 6 Gs.

2.7. Fuel Conservation. Tech order climbs, cruising at max range, max endurance, and idle power 280 knots calibrated airspeed (KCAS) descents should be considered to minimize fuel burn. Administrative phases of flight should be executed IAW optimum fuel profiles.

2.8. Altitude Reservation Planning. Movements that involve air refueling tanker operations may be coordinated through the Federal Aviation Administration Central Altitude Reservation Function. They can be reached through email: **7-AWA-CARF@faa.gov**.

Chapter 3

NORMAL OPERATING PROCEDURES

3.1. Ground Communications. Normally, the pilot and ground crew communicate using the intercom during ground operations. Pilots executing a practice or actual scramble launch are not required to use intercom.

3.2. Ground Visual Signals. To avoid excessive delays, be prepared to immediately transition to visual ground signals when faced with inoperative ground intercom. Visual signals are IAW AFI 11-218, *Aircraft Operations and Movement on the Ground*, and this manual. The visual signals are conducted in a challenge and response fashion. All signals pertaining to the operation of aircraft systems originate with the pilot. The crew chief repeats the given signals when it is safe to operate the system. The pilot will not activate any system that could pose danger to the ground crew prior to receiving proper acknowledgment from ground personnel **(T-1)**. The following signals augment AFI 11-218:

3.2.1. **AUXILIARY POWER UNIT START.** With clenched fist, pilot makes a pulling motion.

3.2.2. **FLIGHT CONTROLS CHECK.** Raise arm, clench fist, and make stirring action.

3.2.3. **LOSS OF BRAKES WHILE TAXIING.** Lower tailhook.

3.2.4. **GUN ARMAMENT CHECK.** Point index finger forward with thumb upward simulating a pistol and shake head (yes or no).

3.2.5. **SIDE WEAPONS BAY DOORS OPEN/CLOSE.** Raise upper arms at a 90-degree angle to the body and bend the elbow to place hands in front of shoulders with palms facing down. Extend arm outward at the elbow to signal for door open. Retract arm inward at the elbow, to signal for door close. Extend/retract both arms to indicate the opening/closing of both doors.

3.2.6. **MAIN WEAPONS BAY DOORS OPEN/CLOSE.** Raise upper arm outward at a 90-degree angle to the body and bend the elbow at a 90-degree angle with palm facing down. Extend arm outward at the elbow to signal for door open. Retract arm inward at the elbow, to signal for door close. Extend/retract both arms to indicate the opening/closing of both doors.

3.2.7. **EXPENDABLE COUNTERMEASURE DOOR OPEN/CLOSE.** Raise arm outward at a 45-degree angle to the body with palm facing forward. Maneuver hand at the wrist in an up/down motion. The signal to open or close doors is the same. Complete this signal with both arms to indicate both doors open/close.

3.3. Aircraft Ground Operations.

3.3.1. The minimum taxi interval is 150 feet (ft) staggered or 300 ft in trail **(T-3)**. Spacing may be reduced when holding short of or entering the runway.

3.3.2. Do not taxi during snow and/or icy conditions until the taxi route and runway have been checked for safe conditions **(T-2)**. Under these conditions, taxi on the centerline with a minimum of 300 ft spacing.

3.3.3. Pilots will keep hands in view of ground personnel during quick check, arming or de-arming operations **(T-1)**.

3.3.4. Do not taxi in front of aircraft being armed/de-armed with forward firing ordnance.

3.4. Automatic Backup Oxygen System (ABOS).

3.4.1. For training missions, required minimum pressure for both left and right ABOS bottles is 900 pounds per square inch (PSI). For cross-country, deployment missions, ACA, or wartime missions, ABOS minimum bottle pressure must be in the full range of 1400-1800 PSI for both bottles.

3.4.2. The 900 PSI minimum in both bottles allows for recovery from a rapid decompression at FL600, and up to a 350 nautical mile (NM) divert range.

3.4.3. Ensure the ABOS switch is OFF before start and shutdown **(T-3)**. If the ABOS switch is not in OFF prior to start and electrical power is applied, ABOS may activate and deplete bottle pressure.

3.4.4. Following an aircraft ABOS modification, the ABOS check will be accomplished and the sortie flown by an experienced pilot (ref AFI 11-2F-22AV1) **(T-2)**.

3.4.5. Aircraft may be called in "Code 2 ABOS servicing" for one or both bottles below 900 PSI, however this check is part of normal crew chief post/thru-flight inspections of consumables.

3.4.6. Non-combat flight operations are limited to FL520 or below without the ABOS installed **(T-2)**. In ABOS equipped F-22As, operations are authorized to FL600 **(T-2)**.

3.5. Flight Lineup. Flights line up as appropriate based on weather, runway conditions, and runway width. Use a minimum of 500 ft spacing between separated elements/flights. If runway width precludes line-up with wingtip clearance between all aircraft in the flight, use 500 ft spacing between elements or delay run-up until the preceding aircraft/element releases brakes.

3.5.1. Pilots will review TOLD prior to takeoff **(T-3)**.

3.5.2. Just prior to takeoff, all flight members inspect each other for proper configuration and any abnormalities.

3.6. Takeoff.

3.6.1. Do not takeoff if the RCR is less than 12 (i.e. Braking Action "Medium" at non-Air Force airfields) **(T-3)**. Per MAJCOM guidance, the group commander may waive RCR minimums for specified units operating in cold weather locations, but in no case will pilots takeoff with an RCR of less than 8 (i.e. Braking Action "Poor") **(T-2)**.

3.6.2. Use afterburner (AB) if computed military power takeoff distance exceeds one-half of the available runway **(T-3)**. Minimum runway length is defined using TOLD and expecting an immediate heavy weight landing on the same runway (see **para. 3.20.3.1**).

3.6.3. A departure end arrestment cable must be raised for all takeoffs and landings **(T-3)**. When operating from airfields equipped with compatible, remotely operated cable(s), ensure the departure end cable is in the raised position, unless another departure end cable is rigged in the raised position.

3.6.4. Use a minimum of a 15-second takeoff interval (20 seconds when using AB) between aircraft. Use a 20-second takeoff interval when executing a sensor trail departure. During periods of reduced visibility due to rain/de-ice chemicals, ensure preceding aircraft is visible before releasing brakes.

3.6.5. During rolling takeoffs, align the aircraft with the runway heading prior to advancing the throttles.

3.6.6. Steer toward the center of the runway at the start of the takeoff roll.

3.6.7. Wing or Group commanders may approve intersection takeoffs if operational requirements dictate.

3.6.8. Formation takeoffs are not authorized **(T-3)**.

3.7. Join-up/Rejoin.

3.7.1. Day weather criteria for a VFR join-up underneath: ceiling 1,500 ft and visibility 3 miles.

3.7.2. FLs maintain 350 KCAS until join-up is accomplished unless mission requirements or local standards specify a different airspeed. FLs will ensure the formation is within ATC standard formation if under an IFR clearance **(T-3)**.

3.7.3. FLs should brief abnormal rejoin specifics. In the absence of rejoin specifics rejoin to fluid in accordance with **AFTTP 3-3.F-22A**, *Combat Aircraft Fundamentals F-22A*.

3.7.3.1. DELETED

3.7.3.2. DELETED

3.7.4. **Battle Damage Checks.** When circumstances permit, FLs direct a battle damage check after each mission prior to or during return to base. Except at night/instrument meteorological conditions (IMC), this check is mandatory following the expenditure of any ordnance **(T-2)**. Brief deconfliction responsibilities and position change procedures. Fly no closer than close formation spacing.

3.7.5. For Night join-up procedures, see Night Procedures (**para 3.17**) and **Chapter 4**.

3.8. Formation, Visual and Administrative. Instructor pilots (IPs)/FLs are responsible for ensuring flight roles and responsibilities of each flight member are established, briefed, executed and debriefed. If any flight member cannot fulfill their responsibilities, or other assigned tasks, they will immediately communicate that information to the flight/element lead **(T-2)**. IPs/FLs task element leads/wingmen based on their ability to fulfill basic responsibilities and other assigned tasks. For additional formation considerations, reference AFTTP 3-3.F-22A and AFTTP 3-1.F-22A, *Tactical Employment F-22A*.

3.8.1. In IMC, the maximum flight size in close/route formation is four aircraft except when flying in close formation with a tanker (maximum flight size six, IAW North Atlantic Treaty Organization (NATO) Allied Tactical Publication (ATP)-3.3.4.2, *Air-To-Air Refuelling*, ATP-56, Edition C, Version 1, Nov 2013; and ATP-3.3.4.2, *US Standards Related Document*, 3 May 2018; located at: **https://www.japcc.org/aar/**).

3.8.2. Pilots will not use rolling maneuvers to maintain or regain formation position below 5,000 ft AGL or in airspace where aerobatics are prohibited **(T-2)**.

3.8.3. Use airborne visual signals IAW AFI 11-205, *Aircraft Cockpit and Formation Flight Signals*. For four-ship flights, initiate configuration changes by radio call, when practical. Changes directed over the radio require an acknowledgement if the FL is unable to visually see the wingman reposition to the directed formation. A radio call is mandatory when directing formation changes at night or under instrument conditions.

3.8.4. For non-tactical portions of a sortie (i.e. navigation to/from airspace), ensure each wingman has sufficient ability to navigate (visual, radar, operational Global Positioning System/Inertial Navigation System (GINS), received TACAN or received ILS in the appropriate steering mode) prior to formation break up.

3.8.5. Changing Leads.

3.8.5.1. When flying in limited visibility conditions, pilots will initiate lead changes from a stabilized, wings level attitude **(T-2)**.

3.8.5.2. The minimum altitude for a lead change is 500 ft AGL over land or 1,000 ft AGL over water (for night see **para 3.18.4**).

3.8.5.3. Flight/element leads may not initiate a lead change from a visual formation unless the aircraft assuming the lead is in visual contact and in a safe position to do so.

3.8.5.4. Initiate a lead change by visual signal or radio call.

3.8.5.5. Renumbering the flight or passing the formation lead via the radio requires a verbal acknowledgment. All lead changes at night or in IMC are directed over the radio.

3.8.5.6. Acknowledge receipt of the lead by head nod or radio call, as appropriate.

3.8.5.7. A lead change is effective upon acknowledgment.

3.8.5.8. The former leader then assumes wingman responsibilities unless otherwise briefed.

3.8.6. Visual formation maneuvering.

3.8.6.1. Flight/element leads consider wingman/element position and ability to perform safely the formation maneuver.

3.8.6.2. Wingmen/elements maneuver relative to the FL/lead element and maintain sight. Trailing aircraft/elements are responsible for deconflicting with lead aircraft/elements.

3.8.6.3. Wingmen/elements cross above the lead/lead element when deconfliction is required in the low altitude environment.

3.8.6.4. **Loss of Visual.** Use the following procedures when one or more flight members/elements lose visual contact while flying a visual formation.

3.8.6.4.1. When any flight member/element has lost visual contact, initiate a positive maneuver away from the last known position and call "blind" with altitude (from the heads-up display (HUD) and/or standby flight group (SFG)) (“blind, 24.5”). The remaining flight member/element immediately responds with "visual" and a position report, or "blind” with an altitude (if also not visual).

3.8.6.4.2. If the other flight member/element is also "blind," immediately deconflict from the altitude called and transmit own ship altitude (from the HUD and/or SFG)

ensuring deconfliction. Use a minimum of 1000 ft altitude separation (500 ft below 5,000 ft AGL). Avoid climbs/descents through the deconfliction altitude. All flight members must visually clear their flight path **(T-2)**.

3.8.6.4.3. If visual contact is still not regained, the FL will take additional positive action to ensure flight path deconfliction within the flight to include a "Terminate" or "Knock-It-Off" (KIO) call if necessary **(T-3)**. Consider scenario restrictions such as sanctuary altitudes and/or adversary blocks.

3.8.6.4.4. Maintain altitude separation until visual or until assured deconfliction through communication or beyond visual range formation positions.

3.8.6.5. Two-ship visual formation deconfliction. The following rules apply for flight path deconfliction in 2-ship visual formations:

3.8.6.5.1. The wingman is responsible for deconfliction from the FL.

3.8.6.5.2. The FL becomes responsible for deconfliction when:

3.8.6.5.2.1. Maneuvering places the leader well aft of the wingman's 3/9 line or forces the wingman's primary attention away from the leader.

3.8.6.5.2.2. The wingman calls "blind".

3.8.6.5.2.3. Primary deconfliction responsibility transfers back to the wingman when visual and established in the directed formation position.

3.8.6.6. Three/four-ship (or greater) visual formation deconfliction. When flights of more than two aircraft are in visual formation:

3.8.6.6.1. Formation visual signals performed by a flight/element lead pertain only to the associated element unless specified otherwise by the FL.

3.8.6.6.2. Trailing aircraft/element(s) maintain sufficient spacing so that primary emphasis during formation maneuvering/turns is on deconfliction within elements, not on deconfliction between elements.

3.9. Tactical Formation. Reference AFTTP 3-1.F22A for tactical formation deconfliction and flight-member responsibilities.

3.10. Chase Formation.

3.10.1. **Restrictions.** Any pilot may fly safety chase for aircraft under emergency or duress conditions. Qualified pilots (including initial qualification training /mission qualification training pilots who have successfully completed an Instrument/Qualification evaluation IAW AFI 11-2F-22AV2, *F-22A Aircrew Evaluation Criteria*) may chase as safety observer for aircraft performing simulated instrument flight or hung ordnance patterns. Specialized missions (i.e., developmental test and evaluation, operational test and evaluation, Weapon System Evaluation Program, live weapons delivery, etc.) and training conducted IAW AFI 11-2F-22AV1, may be chased by combat mission ready/basic mission capable pilots designated by group/squadron commanders. All other chase events may only be flown by IP/flight examiners (FEs) or upgrading IPs under the supervision of an IP.

3.10.2. **Procedures:**

3.10.2.1. A safety observer in a chase aircraft, except IP/FE/specialized mission chase, maneuvers in a 30-60 degree cone with nose/tail clearance to 1,000 ft, to effectively clear and/or provide assistance.

3.10.2.2. IP/FE/specialized mission pilots may maneuver as necessary, but maintain nose/tail separation until required to transition to close formation when deemed necessary by the IP/FE.

3.10.2.3. No chase aircraft will stack lower than the lead aircraft when below 1,000 ft AGL **(T-3)**.

3.10.2.4. Consideration should be given to the chase aircraft matching configuration of the aircraft being chased. Doing so allows for easier station keeping, decreased stall margin, and prevents AGCAS fly-ups in the event the chase aircraft accelerates above 250 KCAS within the warning envelope in accordance with 1F-22A-1. If necessary to chase an aircraft in the traffic pattern with gear up, disable AGCAS by setting the LAW to 0, or stay below 250 KCAS.

3.11. Statics / Flyovers / Aerial Demonstrations. Comply with AFI 11-209, *Participation in Aerial Events,* as well as all applicable MAJCOM directives for the specific rules, procedures, and approval processes for aircraft statics and flyovers. Additionally, pilots performing aerial demonstrations are governed by both AFI 11-209 and AFI 11-246V1, *Air Force Aircraft Demonstrations (A-10, F-15, F-16, F-22)* for the specific rules and training requirements.

3.12. Maneuvering Parameters.

3.12.1. **Minimum Altitudes.** For aerobatics, pilots will remain above 5,000 ft AGL **(T-2)**. During nose high/low speed and advanced handling characteristics vertical maneuvering, ensure maneuvers are terminated to allow recovery above 5,000 ft AGL.

3.12.2. Avoid flight through wingtip vortices and jet wash. If it is unavoidable, reduce aft stick pressure prior to entering jet wash to limit excessive G excursions.

3.13. Operations (Ops) Checks.

3.13.1. Accomplish sufficient ops checks to ensure safe mission accomplishment. As a minimum, complete ops checks:

3.13.1.1. Passing 10,000’ ft measured sea level (MSL) or at level off.

3.13.1.2. Prior to each engagement.

3.13.1.3. Following air refueling.

3.13.2. Minimum items to check are Integrated Caution, Advisory, and Warning System messages, total fuel, G-suit connection, oxygen system, cabin altitude, and AGCAS settings.

3.13.3. The FL may initiate ops checks by radio call or visual signal and wingmen response is required.

3.13.3.1. Flight member(s) response to ops checks includes total fuel amount as read on the SFG. If wingmen are within 500 pounds of the FL fuel level, a "same" call may be used, or exact amount if below Joker fuel level (see **para 3.19.1**).

3.13.3.2. When external tanks are feeding, add a "tanks feeding" call to the normal ops check reply. Make a "tanks dry" call once the external tanks are confirmed dry. Once the "tanks dry" call has been made, no further reference to tanks need be made on subsequent ops checks. In the event of trapped fuel, an ops check indicates usable fuel.

3.13.4. **G-awareness Exercise.** Reference AFI 11-214, *Air Operations Rules and Procedures*, and AFTTP 3-3.F-22A. Unless performing a syllabus-required event (e.g. chase of a G-awareness exercise), flight members maintain a minimum of 6,000 ft separation between aircraft during the execution of all G-awareness exercises. During maneuver execution, use visual lookout and briefed formation position responsibilities as primary means of ensuring aircraft deconfliction. Set the intercom volume appropriately to evaluate execution of the AGSM for debrief purposes.

3.13.4.1. Flight/element leads ensure the airspace intended for conducting the G-awareness exercise is free from potential traffic conflicts. Use ATC services to the maximum extent practical to make sure the airspace is clear. Conduct the G-awareness exercise in the following airspace with preference to the order as listed:

3.13.4.1.1. Special Use Airspace (e.g. Restricted/Warning areas, Air Traffic Control Assigned Airspace, Military Operating Areas and MAJCOM approved large-scale exercise/special mission areas).

3.13.4.1.2. Above 10,000 MSL outside of Special Use Airspace.

3.13.4.1.3. Inside the confines of a Military Training Route.

3.13.4.1.4. Below 10,000 ft MSL outside of Special Use Airspace.

3.13.4.2. Flight/element leads flying outside of the continental United States follow gaining MAJCOM, theater or host nation guidance on airspace in which G-awareness exercises may be performed. If no gaining MAJCOM, theater, or host nation guidance is available, follow the guidance in **para 3.13.4.1** to the maximum extent practical.

3.14. Radio Procedures.

3.14.1. Preface all communications with the complete flight call sign unless stated below. Transmit only that information essential for mission accomplishment or safe flight. Use visual signals when practical.

3.14.2. Acknowledge radio checks that do not require the transmission of specific data, and that cannot be visually confirmed by flight the lead, by individual flight members in turn (Example: "2," "3," "4"). Acknowledgment indicates the appropriate action is complete, in the process of being completed, or the flight member understands.

3.14.3. In addition to the radio procedures outlined in AFMAN 11-202V3, specific mission guides, and FLIP publications, the following radio transmissions are required: Report gear down in accordance with AFMAN 11-202V3. A wingman or chase need not make this all during a formation or chased approach.

3.14.3.1. All flight members will acknowledge understanding the initial ATC clearance. Acknowledge subsequent ATC instructions when directed by the FL **(T-3)**.

3.14.3.2. Report gear down IAW AFI 11-202V3. A wingman or chase need not make this call during a formation or chased approach.

3.15. General Low Altitude Procedures.

3.15.1. Fly low-level formation positions/tactics using AFTTP 3-1.F-22A and AFTTP 3-3.F-22A, as guides.

3.15.2. All day formations positions are authorized at or above 500 ft AGL.

3.15.3. During flight briefings, review low altitude flight maneuvering and observation of terrain features/obstacles in the low altitude training area. FLs will emphasize AGCAS and "low altitude warning" settings and considerations, as well as AGCAS "paddle-off" considerations **(T-3)**. For low altitude training over water/featureless terrain, include specific considerations with emphasis on minimum altitudes and spatial disorientation (SD).

3.15.4. Conduct all obstacle avoidance planning for low altitude map requirements in accordance with **AFMAN 11-202V3**. During the briefing, emphasize critical areas where obstacle awareness should be heightened.

3.15.5. At altitudes below 1,000 ft AGL, wingmen will not fly at a lower AGL altitude than lead **(T-3)**.

3.15.6. When crossing high or hilly terrain maintain positive G, and pilots will not exceed approximately 120 degrees of bank **(T-3)**. Maneuvering at less than 1 G is limited to upright bunting maneuvers.

3.15.7. Pilots will go no higher than 12 degrees angle of attack when conducting ACA and Low/Slow visual identification procedures **(T-3)**.

3.15.8. The minimum airspeed for low-level navigation is 300 KCAS.

3.15.9. Minimum airspeed during low altitude tactical maneuvering (< 5000ft AGL) is 350 KCAS.

3.15.10. Minimum Altitudes. The squadron commander determines and certifies pilots' minimum altitude IAW AFI 11-2F-22AV1, as supplemented by MAJCOM. The following minimum altitudes apply to low altitude training unless national rules or a training syllabus specifies higher altitudes:

3.15.10.1. 500 ft AGL for low altitude (LOWAT) Category I qualified pilots (ref AFI 11-2F-22AV1).

3.15.10.2. For night (without night vision devices (NVDs) or IMC operation, the minimum altitude is 1,000 ft above the highest obstacle within 5 NM of aircraft position.

3.15.11. During all low altitude operations, the immediate reaction to task saturation, diverted attention, knock-it-off, or emergencies is to climb to a pre-briefed safe altitude (minimum 1,000 ft AGL).

3.15.12. Weather minimums for low-level training are 1,500 foot ceiling and 3 miles visibility, or national rules if higher.

3.16. Air Refueling. Pilots undergoing initial training in air refueling will not refuel with a student boom operator **(T-2)**. Pilots will inform boom operators when refueling from a particular tanker type (KC-46, KC-10 or KC-135) for the first time.

3.17. Night Procedures.

3.17.1. **Night Lighting Requirements.**

3.17.1.1. Wingtip position lights: Only one position light on each wing is required. However, if each wing only has one light, they must be on opposite sides; one upper, one lower (ex: top left, bottom right) **(T-2)**.

3.17.1.2. Landing and Taxi Lights: The landing light must be operational prior to takeoff **(T-2)**. If the taxi light is not operational, reassess if the landing light provides sufficient lighting to allow safe taxi. The taxiing aircraft will come to a stop if the area cannot be visually cleared without the taxi light **(T-3)**.

3.17.1.3. Anti-collision light: One operational anti-collision light (ANTI-COLL/BRT) is required for night operations (ground and air). The anti-collision light can be turned off if it causes distraction to the pilot. If the anti-collision light is turned off while outside operational airspace, then at least one aircraft within a standard formation must have POSN/ANTI-COLL switch in the FLASH setting. Position lights in the FLASH setting meet AFMAN 11-202V3 requirements for anti-collision.

3.17.1.4. **Night Ground Operations** (for detailed explanation, refer to AFTTP 3-3.F-22A).

3.17.1.5. When ground personnel are working under the aircraft, ensure the POSN/ANTI-COLL switch is placed in BRT (position lights 100%, steady, anti-collision light off).

3.17.1.6. Pilots will taxi on the taxiway centerline with a minimum of 300 ft spacing **(T-3)**.

3.17.1.7. Use the taxi light while taxiing unless it might interfere with an aircraft landing or taking off. The taxiing aircraft will come to a stop if the area cannot be visually cleared without the taxi light **(T-3)**.

3.17.1.8. For taxi, pilots set the POSN/ANTI-COLL in accordance with AFTTP 3-3 F-22A.

3.17.2. **Night Takeoff.** Set the POSN/ANTI-COLL switch to ANTI-COLL for takeoffs. Following takeoff, each aircraft/element climbs on runway heading to 1,000 ft AGL before initiating turns, except where departure instructions specifically preclude compliance.

3.17.3. **Night Join-up.** Weather criteria for night join-up underneath is a ceiling of 3,000 ft and 5 miles visibility. FLs direct lighting adjustments for the flight based on environmental conditions and flight member feedback.

3.17.4. **Night Formation Procedures.**

3.17.4.1. When in non-visual formations at night, maintain aircraft spacing primarily by flying the published departure, sensors/data link, and timing. If aircraft spacing cannot be ensured, establish altitude separation (1,000 ft minimum) through communication. Pilots will crosscheck instruments at all times to ensure ground clearance **(T-1)**.

3.17.4.2. Do not change lead or wing formation positions below 1,500 ft AGL unless on radar downwind. Direct lead and position changes using the radio and from a stabilized, wings-level attitude.

3.17.4.3. **Night Formation Parameters.** References and parameters for night formation positions are specified in AFTTP 3-3.F22A.

3.17.5. **Night Break-up.** Prior to a formation break-up at night, the FL transmits attitude, altitude, airspeed, and altimeter setting, which is acknowledged by wingmen. Wingmen will confirm their onboard systems required for independent night navigation are functional (GINS, Communications, Navigation, and Identification (CNI)) **(T-3)**.

3.17.6. Night Landing. Normally land from an instrument straight-in approach. Refer to AFMAN 11-202V3, as supplemented by MAJCOM, and AFTTP 3-3.F-22A for specific procedures.

3.18. Night Vision Device (NVD) Procedures.

3.18.1. HAF/MAJCOM guidance (including AFI 11-202V3, and AFI 11-214) outline NVD procedures. AFTTP 3-1.F-22A and AFTTP 3-3.F-22A incorporates expanded tactical guidance.

3.18.1.1. NVDs are only worn by qualified flight members or when upgrading with NVDs with a qualified NVD instructor in the flight.

3.18.1.2. FLs brief the appropriate time to don/doff NVDs for the sortie. Pilots will ensure deconfliction while donning/doffing **(T-1)**. Minimize time with NVDs in the "up" position due to the potential to liberate off the helmet under G and damage displays.

3.18.1.3. When operating in a visual formation outside of NVD route position, ensure a more frequent crosscheck of instruments (approximately every 4-6 seconds) to reduce possibility of SD.

3.18.1.4. FLs brief the appropriate NVD-compatible formation lighting levels for each flight member to set.

3.18.2. Pilots will preflight, test, and adjust NVDs in the unit eyelane prior to NVD operations **(T-3)**. Stow NVDs for takeoff. Do not don NVDs until at least 2,000 ft AGL in climbing or level flight. Pilots will doff NVDs no later than 5 minutes prior to landing unless NVDs are necessary to handle an emergency and will stow NVDs prior to the instrument approach final approach fix. **(T-3)**.

3.18.3. With NVDs, pilots may operate below the route abort altitude/minimum safe altitude (MSA) down to a minimum of 1,000 ft AGL during high-illumination periods (as defined by AFI 11-214). The FL or individual pilot is the final authority to assess actual illumination for a particular mission element, based on visibility and terrain features/resolution.

3.18.4. NVDs may be worn for night tanker rejoins, but are raised or stowed no later than the astern position.

3.18.5. **NVD Battle Damage Checks.** Fly no closer than NVD route formation (reference AFTTP 3-3.F-22A).

3.18.6. **In-flight emergencies with NVDs.** During in-flight emergencies, immediately assess whether the NVDs aid or hinder completing emergency procedures. If they are a hindrance or the emergency may deteriorate into an ejection situation, remove and stow the NVDs.

3.18.7. **Abnormal Procedures.**

3.18.7.1. Lost sight. If sight is lost within a visual formation, execute appropriate lost wingman procedures. Consider highlighting position by increasing exterior lighting level, activating AB, or deploying chaff/flares as airspace allows.

3.18.7.2. In the event of NVD failure, pilots will ensure separation from other aircraft and the ground before attempting to remedy an NVD failure **(T-2)**. Appropriate steps are:

3.18.7.2.1. Transition to instruments,

3.18.7.2.2. Perform lost wingman procedures if appropriate,

3.18.7.2.3. Route abort/climb above MSA if appropriate,

3.18.7.2.4. Terminate/KIO (as applicable),

3.18.7.2.5. If other aircraft are in the vicinity, direct them to raise their external lights to non-NVD visible levels,

3.18.7.2.6. Attempt to regain NVD operation by switching to the opposite battery. If NVDs are still inoperable, once clear of other aircraft and terrain, change the battery. If these steps do not solve the problem, stow NVDs and proceed with non-NVD plan.

3.18.7.3. **Inadvertent flight into weather.** Encountering poor weather conditions during NVD operations may cause loss of situation awareness and pilot distraction/disorientation.

3.18.7.3.1. Single ship or separated from flight members:

3.18.7.3.1.1. Transition to instruments,

3.18.7.3.1.2. Route abort if LOWAT, otherwise climb/descend to Visual Meteorological Conditions (VMC),

3.18.7.3.1.3. Terminate/KIO (as applicable).

3.18.7.3.2. Formation flight. If entering weather in formation or close proximity to other aircraft, perform the first five steps under NVD failure (**para 3.18.7.2**), as appropriate, then climb/descend to attempt to regain VMC.

3.19. Fuel Requirements.

3.19.1. **Joker Fuel.** A pre-briefed fuel state needed to terminate an event and proceed with the remainder of the mission.

3.19.2. **Bingo Fuel.** A pre-briefed fuel state that allows the aircraft to return to the base of intended landing or alternate, if required, using preplanned recovery parameters and arriving with normal recovery fuel as listed below.

3.19.3. **Normal Recovery Fuel.** The fuel on initial or at the final approach fix at the base of intended landing or alternate, if required. Fuel quantity is established locally or 2,500 pounds, whichever is higher.

3.19.4. Pilots declare the following when it becomes apparent that an aircraft may land at the intended destination or alternate (if required) with:

3.19.4.1. Minimum Fuel. Minimum Fuel 2,100 pounds or less. This is based on 20 minute reserves at 10,000 ft MSL flying max endurance airspeed (fulfilling AFMAN 11-202V3 requirements).

3.19.4.2. **Emergency Fuel.** 1,200 pounds or less.

3.20. Approaches and Landings.

3.20.1. The desired touchdown point for a VFR approach is 500-1,000 ft from the runway threshold or the glideslope interception point for a precision approach.

3.20.2. Minimum pattern and touchdown spacing between landing aircraft is 3,000 ft for similar aircraft (e.g. F-22A versus F-22A), 6,000 ft for dissimilar aircraft (e.g. F-22A versus F-16) or as directed by MAJCOM or the landing base, whichever is higher. When wake turbulence is expected due to calm winds (winds less than or equal to 5 knots) or when landing with a light tail wind, pilots will increase pattern/touchdown spacing to 6,000 ft minimum **(T-3)**. Under these conditions, moderate to severe wake turbulence has been reported out to 7,000 foot touchdown spacing. Pilots will land in the center of the runway and clear to the cold side of the runway when speed/conditions permit **(T-1)**. Do not delay clearing to the cold side. Delaying may create a conflict for subsequent landing aircraft.

3.20.3. **Landing Restrictions.**

3.20.3.1. When the computed landing roll exceeds 80 percent of the available runway, pilots will land at an alternate **(T-3)**. Aircraft landing at preplanned destinations or preplanned alternate airfields with less than 8,000 ft of runway length and without a compatible arresting gear (defined as any cable/arresting gear on the departure end or in the overrun capable of stopping the aircraft), requires specific approval of the group commander.

3.20.3.2. Do not land over any raised web barrier (e.g. MA-1A, 61QSII; definitions found in DoD FLIP, *IFR Supplement*).

3.20.3.3. When the RCR at the base of intended landing is less than 12 (Braking Action "Medium"), land at an alternate. If an alternate is not available, consider an approach end or midfield arrestment. Per MAJCOM guidance, the group commander may waive RCR minimum for specified units operating in cold weather locations, but in no case will pilots land with an RCR of less than 8 (Braking Action "Poor") **(T-2)**.

3.20.3.4. Unless executing a short field landing, do not fly the final approach and landing using full speedbrake. This creates stagnant wake turbulence over the landing zone that can affect aircraft in excess of 6,000 foot spacing.

3.21. Overhead Traffic Patterns.

3.21.1. Overhead patterns can be made with unexpended live/inert ordnance. This does not apply to hung or misfired ordnance (secure or unsecure).

3.21.2. Initiate the break over the touchdown point or as directed.

3.21.3. Execute individual breaks in a level 180 degree turn to the downwind leg at minimum intervals of 5 seconds (except IP/FE chase or when in line abreast formation).

3.21.4. Aircraft are wings level on final at approximately 250 ft AGL and 1 mile from the planned touchdown point (i.e. 2.5-degree glide path).

3.22. Tactical Overhead Traffic Patterns. Tactical entry from any direction and any altitude is permitted when specifically approved by the tower. To expedite recovery, conserve fuel, and aid in aircraft sequencing, pilots should consider non-standard pattern entries.

3.22.1. Typically, tactical overheads are flown at an altitude and airspeed directed by local guidance or published. This procedure will be coordinated with ATC **(T-2)**.

3.22.2. No more than four aircraft are permitted in a tactical recovery formation. Aircraft/elements more than 6,000 ft in trail are considered a separate flight.

3.22.3. Normal spacing and parameters are established by base turn.

3.23. Touch-and-Go Landings.

3.23.1. Fly touch-and-go landings in accordance with AFMAN 11-202V3, as supplemented by MAJCOM. Touch-and-go landings flown to regain landing currency require squadron commander approval.

3.23.2. Do not fly touch-and-go landings with hung ordnance, live external ordnance, or with fuel remaining in any external tank.

3.24. Low Approaches.

3.24.1. Observe the following minimum altitudes:

3.24.1.1. Normal single ship low approaches - so that touchdown does not occur.

3.24.1.2. IP/FE flying chase position - 50 ft AGL.

3.24.1.3. Formation low approaches and non-IP/FE chase - 100 ft AGL.

3.24.1.4. Chase aircraft during an emergency - 300 ft AGL unless safety or circumstances dictate otherwise.

3.24.2. During go-around, remain 500 ft below VFR overhead traffic pattern altitude until crossing the departure end of the runway unless local procedures, missed approach/climbout procedures, or controller instructions dictate otherwise.

3.25. Closed Traffic Patterns. Initiate the closed pattern at the departure end of the runway unless cleared otherwise by the controlling agency. From a formation approach or chase position, a sequential closed may be flown with ATC concurrence at an interval to ensure proper spacing. Plan to arrive on downwind at 200-250 KCAS.

3.26. Formation Approaches.

3.26.1. **General.**

3.26.1.1. Fly a published instrument approach or a VFR straight-in approach using the visual approach slope indicator, if available. In all cases, use a rate of descent similar to a normal precision approach.

3.26.1.2. Aircraft must be within 3,000 pounds weight of each other and symmetrically loaded **(T-3)**.

3.26.1.3. Position the wingman on the upwind side if crosswind exceeds 5 knots.

3.26.1.4. Formation approaches will not descend below 100 ft AGL **(T-3)**.

3.26.2. Formation landings are not authorized.

3.26.3. Formation drag procedures.

3.26.3.1. Formation drag landings are restricted to:

3.26.3.1.1. Daytime.

3.26.3.1.2. Weather: 1,500 foot ceiling/3 miles visibility.

3.26.3.1.3. Formation: two-ship maximum.

3.26.3.2. When directed to take spacing, the wingman reduces power, extends the speed brake and slows to no less than 200 KCAS while achieving 1.5 to 2.5 NM spacing.

3.26.3.3. Designate the preceding aircraft as a Next to Shoot (NTS).

3.27. After Shutdown Procedures. All flight members will accomplish a post flight walk-around **(T-3)**. The intent of this inspection is to find evidence of birdstrike, lost panels, damaged ordnance, identify unexpended chaff/flare, and structural damage resulting from over-Gs or other in-flight abnormalities.

3.28. Mission Recording Operations.

3.28.1. Pilots will record missions from takeoff through landing if able (e.g. not applicable to missions/facilities unable to store/secure video data cartridges/data transfer cartridges properly) **(T-2)**. For missions exceeding 120 minutes, record takeoff, landing, and applicable tactical events. Additionally, time, space, and position information should normally be recorded from takeoff through landing.

3.28.2. Unit commanders will develop F-22A mission recording and deletion procedures, and/or create storage procedures, to store content from every flight temporarily, which provides sufficient opportunity to identify and archive abnormal flight occurrences **(T-2)**.

3.29. DELETED

3.30. Weather Minimums. Refer to **Table 3.1** for a summary of weather minimums affecting F-22A operations.

Table 3.1. Weather Minimum Summary.

Event	**Minimum (ceiling in ft and visibility in NM or kilometers (KM))**
VFR Rejoin (Day)	1,500 ft/ 3 NM / 4.8 KM
VFR Rejoin (Night)	3,000 ft/ 5 NM / 8 KM
Low Level Navigation (Day)	1,500 ft/ 3 NM / 4.8 KM (notes 1&2)
Low Altitude Intercepts (Day)	3,000 ft/ 5 NM / 8 KM (note 3)

Notes:
1. Unless national rules are higher.
2. 2,000 ft/8 KM in countries where the minimum altitude is 1,000 ft AGL.
3. 3,500 ft/8 KM in countries where minimum altitude is 1,000 ft AGL.

3.31. Summary of Minimum Altitudes. Refer to **Table 3.2** for a summary of minimum altitudes that affect F-22A operations.

Table 3.2. Minimum Altitude Summary.

Event	**Minimum (in ft AGL)**
Aerobatics/Air Combat Training/Advanced Handling	5,000
Lead Change	See note
Chase (Emergency)	300
Chase (FE / IP)	50
Formation Low Approach	100
Low Approaches	So as to not touchdown
KIO	1,000
Note: 500 ft over land; 1,000 ft over water; 1,500 ft at night /IMC unless on radar downwind.	

Chapter 4

INSTRUMENT PROCEDURES

4.1. Approach Category.

4.1.1. The F-22A is Approach Category E (ref. AFMAN 11-202V3, Flight Operations). Accomplish missed approach in accordance with flight manual procedures. Missed approach airspeed is 250 KCAS.

4.1.2. Pilots will use approach Category D minimums at airfields where Category E minimums are not published **(T-1)**. Airfields with Category D minimums may be designated as an alternate (divert) airfield. Practice instrument approaches may be flown using Category D minimums if VMC can be maintained throughout the procedure. Under these circumstances, approach Category D minimums may be used provided:

4.1.2.1. A straight-in approach is flown.

4.1.2.2. The aircraft is flown at final approach airspeed of 165 KCAS or less.

4.1.2.3. The aircraft is flown at 255 knots true airspeed or less for the missed approach segment of the approach. At high-pressure altitudes and/or temperatures (see AFH 11-203V1), 255 knots true airspeed may not be compatible with published missed approach airspeeds and Category D approaches should not be flown.

4.1.3. The F-22A GINS is approved for enroute area navigation. The enroute navigation may not exceed 1.5 hours between INS updates. An update is defined as establishing a positive position using visual, TACAN, GPS, or on-board radar. NAV STATUS block indicating GPS HIGH suffices as a positive GPS update.

4.1.4. Terminal area navigation procedures: The terminal portion of navigation begins at an established initial approach fix. Area navigation inside the initial approach fix is not authorized. Missed approach procedures are not part of the final approach segment and NAV databases (e.g. Digital Aeronautical Flight Information File latitude/longitude data) may be used to adhere to missed approach procedures.

4.2. Takeoff and Join-up. If weather is below 1,500 ft and 3 miles, pilots will climb on runway heading until above 1,000 ft AGL before initiating turns, except when departure instructions specifically preclude compliance **(T-3)**.

4.3. Trail Procedures.

4.3.1. **General.**

4.3.1.1. During sensor trail formations, basic instrument flying is the first priority and not sacrificed when performing secondary tasks. To ensure proper spacing requires strict adherence to the briefed airspeeds, power settings, altitudes, headings, and departure routing. If task saturation occurs, prioritize aviate (airspeed, altitude and attitude), then navigate (fly published departure) and lastly communicate (e.g. “Raptor 2 negative contact,” “blind,” etc.). The FL will be directive to ensure safety of flight **(T-1)**. If unable to remain in a safely spaced formation the FL coordinates for separate ATC clearances.

4.3.1.2. Request non-standard formation from ATC if anticipated to remain greater than 6,000 ft in trail.

4.3.1.3. ATC instructions issued to the lead aircraft apply to the entire flight.

4.3.1.4. FLs will brief aircraft/element spacing **(T-3)**. Minimum spacing between aircraft when in non-standard formation is 9,000 ft and will be maintained using on board systems.

4.3.2. If flight member is unable to attain a NTS:

4.3.2.1. Transmit, “negative contact.” The FL communicates the initiation of turns. Subsequent aircraft delay turns to maintain the desired spacing.

4.3.2.2. Each aircraft/element maintains 1.5-2.5 mile spacing using all available aircraft systems.

4.3.2.3. During climbs and descents, each aircraft/element calls passing each 5,000 foot altitude increment with altitude and heading (or heading passing) until join-up, level-off, or the following aircraft/element communicates sensor or visual contact (e.g. "tied" or “visual”).

4.3.2.4. Each aircraft/element calls initiating any altitude or heading change. Acknowledgments are not required; however, it is imperative that preceding aircraft/elements monitor the radio transmissions and progress of the succeeding aircraft/elements and immediately correct deviations from the planned route.

4.3.2.5. Each aircraft/element maintains at least 1,000-foot vertical separation from the preceding aircraft/element until establishing sensor/visual contact, except in instances where departure instructions specifically preclude compliance. Pilots may reduce vertical separation to 500 ft if necessary to comply with MSA restrictions.

4.3.2.6. In the event a visual join-up cannot be accomplished on top or at level off, the FL will request altitude separation for each succeeding aircraft/element to meet the requirements of the above para. **(T-3)**.

4.3.2.7. Pilots with known aircraft sensor instability should receive separate IFR clearances.

4.3.3. **With NTS.**

4.3.3.1. Each aircraft/element calls “tied” when a NTS is established with the preceding aircraft. Once all aircraft are tied, no further radio calls are required, unless contact is lost. FLs will ensure all aircraft acknowledge any changes to clearance **(T-2)**.

4.3.3.2. In flights of three or more aircraft, use all available aircraft systems (i.e. radar, data link, TACAN, AAI, etc.) to ensure that trail is maintained on the correct aircraft.

4.3.4. **Sensor Trail Departures.** Unless otherwise briefed, instrument trail departures are defined as:

4.3.4.1. 20-second takeoff spacing.

4.3.4.2. Military/AB power until 350 KCAS.

4.3.4.3. Set 90% RPM in the climb while holding 350 KCAS or 0.88 Mach (expect transition to 0.88 Mach around 25,000 ft) until reaching level-off altitude.

4.3.4.4. Once level, transition to max range airspeed until directed otherwise.

4.3.4.5. Limit all turns to a maximum of 30 degrees of bank unless local or published procedures demand higher bank angles.

4.3.5. **Enroute Trail.** FLs ensure deconfliction through briefed airspeeds and power settings as necessary.

4.3.6. **IFR Trail Recovery.**

4.3.6.1. Limit trail recoveries to a maximum of four aircraft.

4.3.6.2. Before beginning the recovery, FLs ensure that weather at the base of intended landing is at or above the highest pilot weather category in the flight or approach minimums, whichever is higher.

4.3.6.3. Do not terminate trail recoveries in simultaneous precision approach radar or airport surveillance radar approaches. Recoveries to separate approaches are authorized, however, split flights prior to final.

4.3.6.4. Regardless of flight number, the lead aircraft squawks the assigned Mode 3. '-subsets-' Flight members will set Mode 3 subset (4^{th} digit) IAW unit/local procedures or as directed by ATC.

4.3.6.5. Normally use a maximum of 30 degrees of bank in turns unless more is required to adhere to a published procedure or ATC instruction.

4.3.6.6. Once established on a segment of a published approach, each aircraft complies with all published altitudes and restrictions while maintaining trail separation.

4.3.6.7. Unless local procedures establish defined reference points for airspeed/configuration changes, the FL directs changes by radio.

4.3.6.8. Report the final approach fix or glide slope intercept on a precision approach.

4.3.6.9. Prior to the published approach, if contact is lost with the preceding aircraft, transmit "call sign, lost contact." The preceding aircraft responds with altitude, airspeed and heading. FLs will establish altitude deconfliction and coordinate a separate clearance with ATC **(T-3)**. If contact is lost while established on a segment of a published approach, flight members should continue the approach, but must confirm separation via navigation aids. If separation cannot be confirmed, pilots will execute missed approach or climb out as instructed by ATC **(T-2)**.

4.4. Formation Break-up. Formation break-up is defined as obtaining separate clearances and separate squawks. Formation break-up from a visual formation should be accomplished in VMC to the maximum extent possible. If IMC is unavoidable, breakup from a visual formation occurs with the FL maintaining a predictable flight path. Prior to a formation break-up, the FL ensures deconfliction by directing altitude, heading and airspeed. Prior to flight break-up, communicate any navigation stability issues (e.g. inoperable CNI, GINS, TACAN/ILS).

4.5. Formation Penetration. If the overhead traffic pattern is closed but visual straight-ins are permitted, restrict penetrations to two aircraft in route/close formation.

4.6. Formation Lead Change. In IMC conditions, pilots will not change lead position below 1,500 ft AGL unless on radar downwind **(T-2)**.

4.7. Simulated Instrument Flight. Follow the simulated instrument flight restrictions defined in AFMAN 11-202V3.

Chapter 5

AIR-TO-AIR WEAPONS EMPLOYMENT

5.1. References. AFI 11-214 contains air-to-air procedures, to include operations with live ordnance applicable to all aircraft. This chapter specifies procedures or restrictions applicable to F-22A operations. For abnormal operating procedures (e.g. NORDO) see **Chapter 7**.

5.2. Simulated Gun Employment. Missions may be flown with a loaded gun provided the gun is safe IAW Technical Order (TO) 1F-22A-34-1-1, *Non-Nuclear Weapons Delivery Flight Manual—F-22A* and a trigger check is first performed with the master arm switch in arm, Embedded Training deselected, and rounds count G0 in the HUD and stores management display. Point the aircraft away from other aircraft and inhabited areas during the trigger check. Pilots will not perform a trigger check with a hot gun **(T-1)**. Reference AFI 11-214 for hot gun and live missile procedures.

5.3. Maneuvering Limitations. Negative-G gun defense is prohibited.

5.4. Aerial Gunnery Tow Procedures. AFI 11-214 applies. In addition:

5.4.1. **Aerial Gunnery Banner Chase.** Enroute to the range, chase aircraft ensures a stable flying banner. While in straight and level flight, the chase pilot passes the direction of "banner lean" (if any) in clock position to the tow pilot. This establishes the best turn direction for employment (if banner is flying at the 10 o'clock position, the tow turns right).

5.4.2. **Abnormal Procedures.**

5.4.2.1. **Unable to Release Banner.** If possible, provide the tow aircraft with a chase (shooter desired), proceed to local jettison area and attempt jettison. If banner still remains, recover IAW local procedure.

5.4.2.2. **Banner Shot Off, Cable Remaining.** Release cable in working area. The shooter rejoins with the tow aircraft to ensure no cable remains. If the cable remains, recover IAW local procedures.

Chapter 6

AIR-TO-SURFACE WEAPONS EMPLOYMENT

6.1. References. AFI 11-214 contains air-to-surface procedures applicable to all aircraft. This chapter specifies procedures or restrictions applicable to F-22A operations. Qualification and scoring criteria are contained in AFI 11-2F-22AV1.

6.2. Simulated Off-Range Weapons Employment While Carrying Ordnance. Off-range is defined as an area or range in which ordnance release is either not authorized or in which unintentional or inadvertent release could result in ordnance impacting an area not authorized for that ordnance. AFI 11-214 and the following apply:

6.2.1. Pilots will NOT press the weapon release button with inert air-to-ground ordnance loaded unless the following conditions are met: **(T-1)**

6.2.1.1. Embedded Training Mode On.

6.2.1.2. Air-to-Air Master Mode selected.

6.2.1.3. INHIBIT selected on the stores management display

6.2.1.4. No "Next to Bomb" (nothing in Bomb List)

6.2.2. Pilots will not conduct off-range simulated weapons employment with hung ordnance **(T-1)**.

6.2.3. Pilots will not conduct any off-range simulated weapons employment with live ordnance (except 20mm IAW AFI 11-214) aboard the aircraft **(T-1)**.

6.2.4. With live ordnance loaded (other than 20mm with a safe gun), pilots will ensure the Master Arm switch stays safe unless the aircraft is in appropriate airspace and preparing to employ live ordnance **(T-1)**.

6.3. Weather Minimums. Basic weather minimums established in AFI 11-214 apply.

6.4. Night Weapons Delivery/Range Operations. All procedures in AFI 11-214 apply.

6.5. Target Identification. Pilots will positively identify the target prior to weapons release **(T-1)**. Reference the aircraft's displayed data to confirm the proper coordinates, elevation, and weapons data is loaded correctly for the assigned target(s) and that these values match the desired point of impact for air-to-ground weapons. Weapons delivery requires a complete understanding of how target(s) coordinates and elevation were generated, and that use of this data is in compliance with all range procedures or Rules of Engagement.

6.6. Live Ordnance Procedures. When carrying live air-to-ground munitions, pilots will:

6.6.1. Comply with AFI 11-214.

6.6.2. Not make simulated weapons delivery passes on manned targets with live air-to-ground munitions loaded on the aircraft **(T-1)**.

6.6.3. Apply the following procedures when Ground Controllers are on Class B/C ranges:

6.6.3.1. Be familiar with applicable range weapons delivery procedures, appropriate targets and weapons footprints.

6.6.3.2. Ground personnel locations are briefed and acknowledged by all pilots **(T-1)**.

6.6.3.3. Do not expend ordnance if any doubt exists as to the ground personnel or intended target locations **(T-1)**.

Chapter 7

ABNORMAL OPERATING PROCEDURES

7.1. General. These procedures do not supersede flight manual guidance.

7.1.1. Pilots will not accept an aircraft with a safety of flight malfunction. **(T-2)**.

7.1.2. Do not use a malfunctioning system unless it is required for safe recovery of the aircraft. Do not continue troubleshooting a malfunction after completing flight manual emergency procedures and the aircraft may be safely recovered.

7.1.3. Do not taxi the aircraft with nose wheel steering or brake malfunctions unless authorized by TO 1F-22A-1, *Flight Manual—F-22A*.

7.1.4. For actual or perceived flight control malfunctions, terminate maneuvering and take appropriate action.

7.2. Ground Aborts.

7.2.1. If a flight member aborts prior to takeoff, the FL normally renumbers the flight. FLs advise the appropriate agencies of such changes.

7.2.2. If the scheduled FL(s) abort, wingmen may not operate as a coordinated formation unless there is a qualified FL remaining in the formation. Wingmen may depart as singles and execute the ‘no FL’ briefed plan. In the absence of a briefed wingmen-only game plan, execute a sympathetic abort or proceed with a pre-briefed single-ship mission.

7.2.3. Delayed aircraft either contacts the FL, or executes a pre-briefed game plan prior to entering the fight.

7.3. Takeoff Aborts.

7.3.1. If an abort occurs during takeoff roll, notify tower and flight members when practical. Following aircraft alter takeoff roll to ensure clearance or abort takeoff if adequate clearance cannot be maintained. The phrase "Cable, Cable, Cable" indicates a departure-end cable arrestment. The phrase "Barrier, Barrier, Barrier" indicates a departure-end net arrestment. Local procedures will address net barrier raising procedures.

7.3.2. When applying the brakes during a takeoff abort and hot brakes are suspected (suspect hot brakes if aborting airspeed is in “caution zone” IAW TO 1F-22A-1, Figure 5-5., Brake Energy Limits – nominally 120 KCAS), declare a ground emergency, taxi the aircraft to the designated hot brake area, and follow hot brake procedures.

7.3.3. If aborting a takeoff at or below 100 KCAS, consider lowering the tailhook. If aborting above 100 KCAS, lower the tailhook if there is any doubt about the ability to stop on the runway.

7.4. Air Aborts.

7.4.1. If an abort occurs after takeoff, all aircraft maintain their original numerical call sign.

7.4.2. Emergency aircraft should obtain a chase aircraft. The FL determines if minor malfunctions require a chase aircraft. It is critical to consider compounding factors such as the nature of the emergency, local area familiarity, and weather conditions.

7.4.3. Pilots will abort the mission and land out of a straight-in approach, regardless of apparent damage, for any of the following:

7.4.3.1. Birdstrike/Foreign Object Damage.

7.4.3.2. Flight control system anomalies. This does not include flight control system Integrated Caution, Advisory, and Warning System notifications that reset IAW flight manual procedures.

7.4.3.3. Single engine.

7.4.4. If an aircraft experiences an over-G, pilots will use the following procedures: **(T-3)**

7.4.4.1. Perform a battle damage check.

7.4.4.2. Terminate the mission and land as soon as practical from a straight-in approach.

7.4.4.3. Document over-G in Integrated Maintenance Information System after flight.

7.5. Engine Malfunctions. Report all engine anomalies during maintenance debriefing.

7.6. Radio Failure.

7.6.1. General. Individual aircraft experiencing radio failure comply with procedures outlined in FLIP, AFI 11-205, AFMAN 11-202V3, this manual, and local directives.

7.6.2. **Formation.**

7.6.2.1. Flight members who experience total radio failure while in close or route formation should maneuver within close/route parameters to attract the attention of another flight member and pass the appropriate visual signals. Terminate the mission as soon as practical and lead the NORDO aircraft to the base of intended landing or a divert base (if required). Perform a formation approach to a drop-off on final with clearance to land on the intended runway unless safety considerations dictate otherwise.

7.6.2.2. If flying other than close/route formation when the radio failure occurs, the pilot of the NORDO aircraft should attempt to rejoin to a route position at approximately 500 ft on another flight member. The NORDO aircraft is responsible for maintaining deconfliction from other flight members until aircraft presence is acknowledged by a wing rock, signifying clearance to join. Once rejoined, the NORDO aircraft passes the appropriate visual signals.

7.6.2.3. If unable to rejoin with another aircraft and pre-briefed, the NORDO aircraft may proceed to a rendezvous point and hold. If no one has rejoined prior to reaching Joker fuel, the NORDO aircraft should proceed to the base of intended landing or a divert base. Aircraft experiencing any malfunctions/emergency in addition to NORDO, proceeds as required by the checklist.

7.6.3. **Aerial Gunnery/Missile Firing NORDO Procedures:**

7.6.3.1. Pilots will not fire without two-way radio contact **(T-1)**.

7.6.3.2. Shooting aircraft: safe the armament switches, rejoin on another member of the flight or the tow aircraft, IAW **para 7.6.2.**

7.6.3.3. Aerial gunnery tow aircraft: wing rock and continue the turn if an attack is in progress. The FL of the attacking aircraft will "knock off" the attack and rejoin on the tow's

wing, remaining clear of the target in the event the banner is cut **(T-1)**. The tow pilot passes standard hand signals to indicate any difficulty. The FL signals when the target is cleared for cut with a slicing motion across the throat. After the target is away and the FL determines there is no remaining cable, the tow aircraft recovers with an escort following the briefed NORDO recovery procedures. If cable remains, follow local procedures.

7.6.4. **NORDO Recovery.**

7.6.4.1. Apply the procedures in FLIP, AFI 11-205, AFMAN 11-202V3, and this manual, and local directives.

7.6.4.2. If a formation straight-in approach is flown and a go-around becomes necessary, the pilot flying chase will go-around, pass the NORDO aircraft and rock wings **(T-2)**. The NORDO aircraft executes a go-around, if the situation allows. If the NORDO aircraft is in formation as a wingman, the lead aircraft initiates a gentle turn into the wingman and begins the go-around.

7.6.4.3. A pilot flying a NORDO aircraft intending to make an approach-end cable engagement signals the escorting aircraft by extending the tailhook. If the NORDO aircraft is not escorted, fly a straight-in approach flashing the landing light on final to signal the tower.

7.7. Severe Weather Penetration. Avoid flight through severe weather. If unavoidable, FLs will ensure formation break-up and obtain separate clearances prior to severe weather penetration **(T-1)**. Set airspeed IAW TO 1F-22A-1 thunderstorm penetration airspeed for flight through rain showers or thunderstorms.

7.8. Lost Wingman Procedures. In any lost wingman situation, immediate separation of aircraft is essential.

7.8.1. Upon losing sight of the lead aircraft or if unable to maintain formation, the wingman will:

7.8.1.1. Simultaneously execute the applicable lost wingman procedures, transition to primary flight instruments, and inform lead by transmitting “call sign is lost wingman" **(T-1)**. Refer to **para 7.9** for specific SD considerations. Smooth application of control inputs is imperative to minimize the effects of SD.

7.8.1.2. After executing a lost wingman procedure, do not attempt rejoining with the flight until obtaining permission from the FL **(T-2)**.

7.8.1.3. When able, obtain a separate clearance.

7.8.1.4. Observe all published terrain clearance limits.

7.8.2. Two- or Three-Ship Flights (three-ship echelon, refer to four-ship procedures):

7.8.2.1. Wings-level flight (climbing, descending, or straight and level). Turn away using 15 degrees of bank for 15 seconds, then resume original heading.

7.8.2.2. **Turns.**

7.8.2.2.1. **Outside the Turn.** Reverse the direction of turn using 15 degrees of bank for 15 seconds. Continue straight ahead to ensure separation prior to resuming the turn.

7.8.2.2.2. **Inside the Turn.** Momentarily reduce power to ensure nose-tail separation and direct the FL to roll out of the turn. Maintain the original turn. The lead aircraft may only resume the turn when separation is ensured.

7.8.2.3. **Final Approach.** Momentarily turn away from lead to ensure clearance and execute the published missed approach procedure.

7.8.2.4. **Missed Approach.** Momentarily turn away from lead to ensure clearance and continue the published or assigned missed approach procedure. Climb to 500 ft above missed approach altitude.

7.8.3. **Four-Ship Flights.** Number 2 and 3 follow the procedures outlined in **para 7.8.2** above. Number 4's initial action assumes that number 3 has also gone lost wingman. In addition to **para 7.8.1**, aircraft number 4 applies the following:

7.8.3.1. **Wings-Level Flight (climbing, descending, or straight and level).** Turn away using 30 degrees of bank for 30 seconds, then resume the original heading.

7.8.3.2. **Turns.**

7.8.3.2.1. **Outside the Turn.** Reverse direction of turn using 30 degrees of bank for 30 seconds to ensure separation from lead and number 3.

7.8.3.2.2. **Inside the Turn.** Momentarily reduce power to ensure nose-tail separation and increase bank angle by 15 degrees. Direct the lead aircraft to roll out. The lead only resumes the turn when separation is ensured.

7.8.4. FLs must acknowledge the lost wingman's radio call and, when appropriate, transmit attitude, altitude, heading, and airspeed **(T-2)**.

7.8.5. If a wingman becomes separated and any aircraft experiences radio failure, the aircraft with the operational radio obtains a separate clearance. The NORDO aircraft turns the IFF Mode 3C to 7600 while proceeding with previous clearance. If an emergency situation arises along with radio failure, set the IFF to EMERGENCY for the remainder of the flight.

7.8.6. Only practice lost wingman procedures in VMC.

7.9. Spatial Disorientation. Conditions that prevent a clear visual horizon or increase pilot tasking are conducive to SD. To prevent SD, an increased instrument crosscheck rate is paramount. If SD symptoms are encountered:

7.9.1. **Single Ship.**

7.9.1.1. Concentrate on flying basic instruments with frequent reference to the HUD. The SFG may be used as an alternate attitude reference if it is using a different GINS source than the HUD (i.e. HUD on GINS 1 and SFG on right upfront display). Consider selecting attitude mode on the primary multi-function display.

7.9.1.2. If symptoms persist and conditions permit, fly straight and level flight until symptoms abate, usually within 60 seconds. Consider using the autopilot.

7.9.1.3. If necessary, declare an emergency and advise ATC.

7.9.1.4. NOTE: It is possible for SD to proceed to the point where the pilot is incapacitated and unable to see or interpret the flight instruments. In this situation, aircraft control may be impossible. If this occurs, the pilot should consider ejecting.

7.9.2. **Formation Lead.**

7.9.2.1. Advise the wingmen that FL has SD and comply with procedures in **para 7.9.1.**

7.9.2.2. Use the wingmen to confirm attitude and provide verbal feedback.

7.9.2.3. If symptoms persist, terminate the mission and recover the flight by the simplest and safest means possible.

7.9.3. **Formation Wingman.**

7.9.3.1. Advise lead of the disorientation.

7.9.3.2. Lead transmits aircraft attitude, altitude, heading, and airspeed.

7.9.3.3. If symptoms persist and conditions permit, establish straight and level flight for 30-60 seconds.

7.9.3.4. If the above procedures are not effective, lead should consider passing the lead to the wingman, provided the leader is able to maintain situational awareness from a chase position. Transfer lead while in straight and level flight. Once assuming the lead, maintain straight and level flight for 60 seconds. If necessary, terminate the tactical mission and recover by the simplest and safest means possible.

7.9.4. **Greater than 2-Ship Formation.** Lead should separate the flight into elements to more effectively handle a wingman with persistent SD symptoms. Establish straight and level flight IAW **para. 4.4** (Formation Break-up). Plan to keep the element with the SD pilot straight and level while the other element separates.

7.10. G-Induced Loss of Consciousness (GLOC). Pilots of sustained high-G aircraft such as the F-22A are at risk of GLOC during flight. If a GLOC occurs or is suspected:

7.10.1. Immediately terminate all tactical maneuvering.

7.10.2. If part of a formation, advise lead, or their wingman of the GLOC.

7.10.3. Restrict flight to no more than 2 Gs and 60 degrees of bank.

7.10.4. Declare an emergency and advise ATC.

7.10.5. Recover the aircraft utilizing a straight in approach (visual or instrument).

7.10.6. Await the arrival of Medical, Safety, and AFE personnel after landing. Unless medically necessary, leave life support switches and connections in place until documented by Medical, Safety and AFE personnel.

7.10.7. Report any suspected or confirmed life support system malfunctions to maintenance and any life support equipment issues to AFE.

7.10.8. Pilots will archive the mission recording of the entire sortie for review **(T-1)**.

7.10.9. Complete and submit an in-flight emergency report to the flight safety office.

7.10.10. Notify unit leadership of the incident.

7.11. Armament System Malfunctions.

7.11.1. **Inadvertent Release.** Release due to a malfunction of the armament system. In the event of a suspected inadvertent release:

7.11.1.1. Record switch positions at the time of inadvertent release and provide to armament and safety personnel. Record the impact point, if known.

7.11.1.2. Safe the armament switches and do not attempt further release. Treat remaining stores as hung ordnance and follow hung ordnance procedures during recovery.

7.11.1.3. If remaining stores present a recovery hazard, jettison them in a suitable area on a single pass, if practical.

7.11.2. **Failure to Release/Hung Ordnance.** If ordnance fails to release when all appropriate switches are set:

7.11.2.1. Attempt to release store(s) IAW TO 1F-22A-34-1-1. If unsuccessful, and there is NOT an unsafe condition, then follow hung ordnance recovery procedures.

7.11.2.2. If an unsafe condition exists (attached by 1 lug, etc.), attempt to jettison store(s) using selective jettison procedures.

7.11.3. **Hangfire/Misfire.**

7.11.3.1. A missile that fires but fails to depart the aircraft is a hangfire. If this occurs, the missile should be closely observed and safety checked by a chase pilot.

7.11.3.2. A missile that fails to fire when all appropriate switches were selected is a misfire. If this occurs, safe the Master Arm switch and follow the hung ordnance recovery procedures, or comply with pre-briefed procedures.

7.11.4. **Hung Ordnance/Weapons Malfunction Recovery.**

7.11.4.1. If practical, visually inspect the area for damage to aircraft, weapons bay doors, or ordnance.

7.11.4.2. Declare an emergency for hung live ordnance (not required for hung practice/inert ordnance or when no attempt was made to expend live ordnance).

7.11.4.3. If available, obtain a chase aircraft (not applicable at night unless NVD capable chase is available) and avoid populated areas and close trail formations.

7.11.4.4. Close weapons bay doors prior to landing IAW TO 1F-22A-34-1-1.

7.11.4.5. Land from a straight-in approach.

7.11.5. Miscellaneous Procedures.

7.11.5.1. Do not attempt to expend ordnance using a delivery system with a known weapons release malfunction.

7.11.5.2. When abnormal missile launch or erratic missile flight is noted after launch, obtain a chase aircraft for a visual inspection (if possible) to determine if any damage has occurred.

7.12. Post Arresting Gear Engagement Procedures.

7.12.1. Do not shut down the engine(s) unless directed by the ground crew, there is a fire, or other conditions dictate.

7.12.2. Raise the tailhook on the ground crew's signal.

7.12.3. Do not taxi until directed.

7.12.4. Comply with local directives.

7.13. Practice of Emergency Procedures.

7.13.1. Simulated Emergency Procedures will not be accomplished in-flight. Pilots will only practice emergency procedures in a simulator full mission trainer, weapons and tactics trainer, or other accredited F-22A simulators **(T-2)**.

7.13.2. **Aborted Takeoff Practice.** Pilots will only practice aborted takeoffs in a simulator **(T-2)**.

7.14. Search and Rescue Combat Air Patrol (SARCAP) Procedures. If an aircraft crashes, immediately attempt to locate possible survivors and initiate rescue efforts. Expect that the survivors may initially suffer from shock or have delayed reactions due to ejection injuries. The following procedures are by no means complete and should be adjusted to meet each unique search and rescue situation:

7.14.1. Knock off maneuvering.

7.14.2. Establish a SARCAP commander.

7.14.3. Squawk 7700 to alert ATC/ground controlled intercept (GCI) of the emergency situation.

7.14.4. Communicate the emergency situation and aircraft/flight intentions immediately to applicable control agencies. Use guard frequency if necessary.

7.14.5. Mark the last known position of survivors/crash site using any means available (Markpoint, TACAN, GINS, ATC/GCI position and/or visual references).

7.14.6. Remain above the highest ejection altitude, if known, or the highest observed parachute until determining the position of all possible survivors.

7.14.7. Deconflict from other aircraft assisting in the SARCAP by altitude to preclude midair collision. Establish high/low altitude deconfliction as necessary to facilitate communications.

7.14.8. Revise Bingo fuels or recovery bases as required to maintain maximum SARCAP coverage. Do not overfly the adjusted Bingo fuel.

7.14.9. Relinquish SARCAP operation to designated rescue forces upon their arrival.

7.14.10. Follow local or briefed procedures.

Chapter 8

LOCAL OPERATING PROCEDURES

8.1. General. This chapter provides a consolidated framework for wings to supplement (IAW AFI 33-360) local operating procedures. Units composed of multiple aircraft types may publish guidance in a single, stand-alone local operating instruction/manual instead of supplementing this AFMAN. Added or stand-alone procedures will not be less restrictive than those contained elsewhere in this volume. This chapter is not intended to be a single source document for procedures contained in other directives or regulations. Avoid unnecessary repetition of guidance provided in other established directives; however, reference to those directives is acceptable when it serves to facilitate the location of information. This chapter is authorized to be issued to each pilot. Units may supplement the following paragraphs for local operating guidance:

8.1.1. Section A. Introduction.

8.1.2. Section B. General Policy.

8.1.3. Section C. Ground Operations.

8.1.4. Section D. Flying Operations.

8.1.5. Section E. Weapons Employment.

8.1.6. Section F. Abnormal Procedures.

8.1.7. Attachments (Illustrations).

8.2. If Applicable Procedures. If applicable, include procedures for the following in the appropriate section above:

8.2.1. Command and Control.

8.2.2. Fuel Requirements and Bingo Fuels.

8.2.3. Diversion Instructions.

8.2.4. Jettison Areas, Procedures and Parameters (IFR/VFR).

8.2.5. Controlled Bailout Areas.

8.2.6. Local Weather Procedures.

8.2.7. Unit Standards.

8.2.8. Approved Alternate Missions.

8.2.9. Cross-Country Procedures.

8.2.10. Search and Rescue and On-Scene Commander Procedures.

8.2.11. Bird/Wildlife Aircraft Strike Hazard (BASH) program guidance IAW AFI 91-202, *The US Air Force Mishap Prevention Program* and AFI 91-212, *Bird Aircraft Strike Hazard (BASH) Management Program*.

8.2.12. Environmental Restrictions to Flight Operations (winds, sea state, temperature, etc.) applicable to unit operating locations.

8.3. Distribution of Local Supplements. When published, units will forward copies of the local supplement to MAJCOM and appropriate subordinate agencies, who will review and return comments back to the unit(s) **(T-2)**. Distribution of local supplements may begin before the review process is complete unless otherwise specified by MAJCOM or appropriate subordinate agency. If a procedure is deemed applicable to all F-22A units, it will be incorporated into the basic AFMAN volume.

MARK C. NOWLAND, Lt Gen, USAF
Deputy Chief of Staff, Operations

Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

References

AFPD 11-2, *Aircrew Operations*, 19 Jan 2012

AFPD 11-4, *Aviation Service*, 1 Sep 2004

AFI 11-200, *Aircrew Training, Standardization/Evaluation, and General Operations Structure*, 19 Jan 2012; incorporating Change 1, 10 Apr 2012

AFMAN 33-363, *Management of Records*, 1 Mar 2008

AFI 33-360, *Publications and Forms Management*, 1 Dec 2015; incorporating AFGM2018-02.01, 15 Feb 2018

Federal Aviation Administration Advisory Circular 91-79A, *Operational (Pilots) Runway Condition Assessment Matrix (RCAM) Braking Action Codes and Definitions*, 17 Sep 2014; incorporating Change 2, 20 Feb 2018

AFMAN 11-217V2, *Visual Flight Procedures*, 22 Oct 2010

AFH 11-203V1, *Weather for Aircrew*, 12 Jan 2012

F-22A Ready Aircrew Program Tasking Memorandum, updated annually

AFI 11-2F-22AV1, *F-22A Aircrew Training*, 19 May 2006

AFI 11-301V1, *Aircrew Flight Equipment (AFE) Program*, 10 Oct 2017

AFI 11-301V2, *Management and Configuration Requirements for Aircrew Flight Equipment (AFE)*, 20 Dec 2013: incorporating Change 2, 13 Jun 2017; corrected 6 Dec 2017

AFI 11-218, *Aircraft Operations and Movement on the Ground*, 28 Oct 2011; incorporating Change 2, 14 May 2015

AFTTP 3-3.F-22A, *Combat Aircraft Fundamentals F-22A*, 12 Jul 2016; at: **https://intelshare.intelink.gov/sites/561jts/SitePages/Home.aspx**

AFTTP 3-1.F-22A, *Tactical Employment F-22A*, 12 Jul 2016; at: **https://intelshare.intelink.sgov.gov/sites/561jts/default.aspx**

NATO ATP-3.3.4.2, *Air-To-Air Refuelling, ATP-56, Edition C, Version 1*, Nov 2013

ATP-3.3.4.2, *US Standards Related Document*, 3 May 2018

AFI 11-205, *Aircraft Cockpit and Formation Flight Signals*, 19 May 1994; certified current, 3 Nov 2009

AFI 11-2F-22AV2, *F-22A Aircrew Evaluation Criteria*, 25 Aug 2003; incorporating Change 2, 5 May 2008; certified current, 19 Oct 2009

AFI 11-209, *Participation in Aerial Events*, 22 May 2018

AFI 11-246V1, *Air Force Aircraft Demonstrations (A-10, F-15, F-16, F-22)*, 19 Jul 2016

AFI 11-214, *Air Operations Rules and Procedures*, 14 Aug 2012; incorporating Change 1, 23 Mar 2016

AFI 11-202V3, *General Flight Rules*, 10 Aug 2016; incorporating AFGM2017-01, 2 Oct 2017

DoD FLIP, *IFR Supplement*, updated cyclically

AFMAN 11-217V1, *Instrument Flight Procedures*, 22 Oct 2010

TO 1F-22A-34-1-1, *Nonnuclear Weapons Delivery Flight Manual—F-22A*, updated periodically

TO 1F-22A-1, *Flight Manual—F-22A*, updated periodically

AFI 91-202, *The US Air Force Mishap Prevention Program*, 24 Jun 2015; incorporating Change 1, 15 Feb 2017; incorporating AFGM2018-01, 21 May 2018

AFI 91-212, *Bird/Wildlife Aircraft Strike Hazard (BASH) Management Program*, 31 May 2018

AFTTP 3-4, *Airman's Manual*, 5 Feb 2018

AFTTP 3-1.GP, *General Planning and Employment Considerations*, 11 Jan 2016; at: **https://intelshare.intelink.sgov.gov/sites/561jts/default.aspx**

AFTTP 3-2.5, *Brevity*, Jul 2016

Adopted Forms

AF Form 679, *Air Force Publication Compliance Item Waiver Request/Approval*

AF Form 847, *Recommendation for Change of Publication*

Abbreviations and Acronyms

AAI—Air-to-Air Interrogator

AB—After Burner

ABOS—Automatic Backup Oxygen System

ACA—Aerospace Control Alert

ACC—Air Combat Command

AFE—Aircrew Flight Equipment

AFH—Air Force Handbook

AFI—Air Force Instruction

AFMAN—Air Force Manual

AFTTP—Air Force Tactics, Techniques and Procedures

AFPD—Air Force Policy Directive

AGCAS—Automatic Ground Collision Avoidance System

AGL—Above Ground Level

AGSM—Anti-G Straining Maneuver

ATC—Air Traffic Control

ATP—Allied Tactical Publication

C2—Command and Control

CBRNE—Chemical, Biological, Radiological, Nuclear, and High Yield Explosive

CFR—Code of Federal Regulations

CNI—Communications, Navigation, and Identification

COMAFFOR—Commander Air Force Forces

DRU—Direct Reporting Unit

FE—Flight Examiner

FL—Flight Lead

FLxxx—Flight Level xxx

FLIP—Flight Information Publication

FOA—Field Operating Agency

FT—Feet

G—Gravitational Load Factor

GCI—Ground Controlled Intercept

GINS—Global Positioning System/Inertial Navigation System

GLOC—G—Induced Loss of Consciousness

HAF—Headquarters United States Air Force

HAS—Hardened Aircraft Shelter

HUD—Heads-Up Display

IAW—In Accordance With

IFF—Identification Friend or Foe

IFR—Instrument Flight Rules

ILS—Instrument Landing System

IMC—Instrument Meteorological Conditions

IP—Instructor Pilot

KCAS—Knots Calibrated Airspeed

KIO—Knock-It-Off

KM—Kilometers

LOWAT—Low Altitude Training

MAJCOM—Major Command

MOPP—Mission Oriented Protective Posture

MSA—Minimum Safe Altitude

MSL—Mean Sea Level

NATO—North Atlantic Treaty Organization

NM—Nautical Miles

NORDO—No Radio

NTS—Next to Shoot

NVD—Night Vision Device

OPR—Office of Primary Responsibility

OPS—Operations

PSI—Pounds Per Square Inch

RCR—Runway Condition Reading

SARCAP—Search and Rescue Combat Air Patrol

SD—Spatial Disorientation

SFG—Standby Flight Group

TACAN—Tactical Air Navigation

TOLD—Takeoff and Landing Data

TO—Technical Order

USAF—United States Air Force

VFR—Visual Flight Rules

VMC—Visual Meteorological Conditions

Terms

Other References—See AFI 11-214, AFI 11-2F-22AV1, AFTTP 3-1.F-22A, AFTTP 3-3.F-22A, and AFTTP 3-2.5, *Brevity* for further clarification on definitions/terms throughout the publication. If there is a conflict, AFI 11-214 will take precedence.

Pilot Reported Braking Action (Braking Action)—Control/braking assessment criteria as determined by the FAA on non-Air Force airfields

Attachment 2

CHEMICAL, BIOLOGICAL, RADIOLOGICAL, NUCLEAR, AND HIGH YIELD EXPLOSIVE (CBRNE) OPERATIONS

A2.1. General Information. Potential adversary use of CBRNE weapons against a friendly airfield presents a serious threat to flying operations. Although the most effective way for pilots to avoid this threat is to be airborne before those weapons are detonated/dispersed and then land at a field that has not been contaminated, all personnel must be prepared to operate from a field that has come under CBRNE attack.

A2.2. Mission Preparation. Be aware of the status of the CBRNE environment at the planned launch and recovery airfields, potential divert bases, and throughout the area in which the sortie may fly. Know the current and forecast surface wind direction and the Mission Oriented Protective Posture (MOPP) level in effect for relevant sectors of the airfield. Don appropriate aircrew chemical defense ensemble or ground crew ensemble to match the appropriate MOPP level (reference AFTTP 3-4, *Airman's Manual*) and carry individual protective equipment as required.

A2.3. Stepping to Fly and Aircraft Preflight. This may entail donning the aircrew chemical defense ensemble or transitioning from the ground crew to the aircrew ensemble. Take precautions to protect aircrew from injury and or contamination while in transit from the squadron facility to the aircraft. If possible, transport aircrew in a vehicle that provides overhead cover (enclosed vehicle). If aircrew travel on foot is unavoidable, choose a route that takes maximum advantage of available overhead cover (sunshades, buildings, etc.) to avoid agents that may be settling from the air. If extra aircrew members are available for preflight duties, consider assigning them to do so wearing the ground crew ensemble. This allows pilots actually flying to minimize exposure.

A2.3.1. **Alarm Red (or Theater Equivalent) Prior to Engine Start.** If Alarm Red occurs during the step or preflight process, take cover and don appropriate MOPP. This may require use of the ground crew mask. A hardened aircraft shelter (HAS) provides optimum protection, if available. Use caution if entering a HAS that contains aircraft and/or equipment. Close doors after entry. If a HAS or other overhead cover is not immediately available, accept the best rapidly reachable cover.

A2.4. Engine Start to Takeoff. If a HAS is available, use it to minimize exposure time by accomplishing aircraft arming and end of runway procedures inside it (if local procedures permit) and by delaying taxi time as long as possible prior to takeoff.

A2.4.1. **Aircraft Launch to Survive.** Units develop local procedures to provide this option to the commander. In general, aircraft may launch any time after engine start if they have sufficient fuel and safe, expeditious access to a runway. This option may only be practical for aircraft that are near end of runway prior to takeoff or that have just landed.

A2.4.2. **Alarm Red Prior to Taxi.** If in a HAS, the normal procedure is to shut down. Engine noise may preclude effectiveness of normal alert notification procedures, so ensure ground personnel are aware of the alarm warning, assume proper MOPP, and close HAS doors. Use hand signals if necessary.

A2.4.3. **Alarm Red (or Theater Equivalent) After Taxi.** Units typically establish procedures for this contingency depending on whether additional protection is available along the taxi route (empty HAS, for instance). Ideally, ground crew sheltering in such a HAS would

be available to assist in normal engine shutdown procedures and to close HAS doors. If protection is not available, the best option may be to launch for survival. Maintain contact with command and control (C2) entities (Wing Operations Center, Maintenance Operations Center, Supervisor of Flying, etc.) to ensure unity of effort in the overall plan.

A2.5. Takeoff to Landing.

A2.5.1. **Contamination.** If Chemical Warfare agent contamination occurred prior to takeoff, flying the aircraft will dissipate the agent to some degree. The total amount of dissipation will be greater with lower flight altitudes and longer flight times. Because the agent may have entered wheel wells, flaps, etc., consider flying in landing configuration to increase airflow to these areas. In any circumstances, merely flying the aircraft is unlikely to achieve complete decontamination.

A2.5.2. **Preparing to Land.** Pilots should remain aware of the status of primary and alternate landing locations. Do not attempt to land during Alarm Red situations unless there is no other option. Follow C2 directions and either hold or divert. If mission needs preclude divert, hold until the Alarm Red (or theater equivalent) has cleared or become an Alarm Black. Prior to landing, gain awareness of contaminated sectors of the airfield and of current/forecast surface winds. Use this information in conjunction with C2 direction to plan a route from landing to engine shutdown. The liquid deposition phase following a chemical airburst attack can extend up to 1 hour. If landing during Alarm Black, expect a contaminated environment and MOPP 4.

A2.6. Landing to Engine Shutdown. Take advantage of any protection available, minimizing taxi time and distance. Maintain contact with C2 in order to remain aware of unexploded ordnance and/or damage to airfield movement surfaces. If a HAS is available and local procedures permit, accomplish aircraft de-arm and end of runway procedures there. If Alarm Red (or Theater Equivalent) occurs between landing and engine shutdown, considerations are similar to those discussed in the engine-start-to-takeoff section.

A2.7. After Engine Shutdown. Don appropriate MOPP if not already worn. If circumstances permit, accomplish normal post-flight inspection procedures. If the aircraft is not contaminated, close the canopy. If there is any suspicion of personnel contamination, aircrew process through an aircrew contamination control area. Accomplish maintenance debriefings under cover to the maximum extent possible.

Attachment 3

GENERAL & SPECIAL SUBJECT BRIEFING GUIDE

A3.1. This guide is meant to highlight general flight briefing considerations, and provides a reference for an aircraft coordination and safety briefing. See the briefing guides in Atch 4-10 for other considerations and mission specific details for the type mission being flown.

A3.2. MISSION DATA

A3.2.1. Time Hack

A3.2.2. Emergency Procedure/Threat of the Day

A3.2.3. Mission Objective(s)

A3.2.4. Mission Overview

A3.2.5. Mission Data Card

A3.2.5.1. Mission Commander/Deputy Lead

A3.2.5.2. Joker/Bingo Fuel

A3.2.5.3. Takeoff and Landing Data (as required: short/wet/icy runway, heavy gross weights, external fuel tank configurations, high-density altitude and non-standard cable configurations)

A3.2.5.4. AGCAS Settings

A3.2.5.5. Working Area

A3.2.6. Weather/Sunrise/Sunset/Moon Illumination

A3.2.7. Notices to Airmen/Bird Strike Potential

A3.2.8. Personal Equipment

A3.2.9. Flight Crew Information File/Pubs/Maps

A3.3. GROUND PROCEDURES

A3.3.1. Pre-Flight

A3.3.1.1. Aircraft

A3.3.1.2. Armament

A3.3.2. Check-In

A3.3.3. Taxi/Marshaling/Arming

A3.3.4. Spare Procedures

A3.4. TAKEOFF

A3.4.1. Runway Lineup

A3.4.2. Takeoff/Takeoff Interval

A3.4.3. Abort

A3.4.4. Jettison Procedures

A3.4.5. Low Altitude Ejection

A3.4.6. Landing Immediately After Takeoff

A3.5. DEPARTURE/ENROUTE

A3.5.1. Routing

A3.5.2. Trail Departure

A3.5.3. Join-Up/Formation

A3.5.4. Systems/Ops Checks

A3.6. RECOVERY

A3.6.1. Rejoin

A3.6.2. Battle Damage Check

A3.6.3. Type Recovery

A3.6.4. Flight Break-Up

A3.6.5. Pattern and Landing

A3.6.6. After Landing/De-Arm

A3.6.7. Emergency/Alternate Airfields

A3.7. SPECIAL SUBJECTS (as applicable)

A3.7.1. Instructor Responsibilities

A3.7.2. Chase Procedures

A3.7.3. IFF Procedures

A3.7.4. Radar/Visual Search Responsibilities/Midair Collision Avoidance

A3.7.5. Dissimilar Formations

A3.7.6. Carriage / Jettison Limitations

A3.7.7. Terrain Avoidance

A3.7.7.1. Departure/Enroute/Recovery

A3.7.7.2. Altitude Warning Settings

A3.7.8. Bird Strike Procedures/Use of Visor(s)

A3.7.9. Hazards Associated with Human Factors (i.e., Channelized Attention, Task Saturation/Prioritization, and Complacency)

A3.7.10. G-Awareness

A3.7.10.1. G-Suit connection/G-tolerance/G-Awareness Turn

A3.7.10.2. Use of AGSM

A3.7.11. Visual Illusions/Perceptions

A3.7.12. Spatial Disorientation/Unusual Attitudes

A3.7.13. Lost Wingman

A3.7.14. Radio Inoperative

A3.7.15. SARCAP

A3.7.16. Recall Procedures

A3.7.17. Special Interest Items

Attachment 4

AIR REFUELING BRIEFING GUIDE

A4.1. This guide is meant to highlight general aerial refueling considerations, and provides a reference for coordination of aircraft participating in air-to-air refueling. All applicable air refueling considerations should be incorporated into the specific briefing for the mission being flown.

A4.2. GENERAL

A4.2.1. Tanker Call Sign(s)/Receiver Assignments

A4.2.2. Refueling Track(s)

A4.2.2.1. Altitude

A4.2.2.2. Airspeed

A4.2.2.3. Airspace Restrictions

A4.2.3. Air Refueling Points and Times

A4.2.4. Radio Frequencies

A4.3. BUDDY PROCEDURES

A4.3.1. Departure

A4.3.2. Join-Up ENROUTE

A4.3.2.1. Route of Flight

A4.3.2.2. Formation

A4.3.2.3. Ops Checks

A4.4. RENDEZVOUS

A4.4.1. Type Rendezvous

A4.4.2. Holding Procedures/Formation

A4.4.3. Ground Radar Assistance

A4.4.4. Tanker Identification - TACAN/Radar/AAI/Visual

A4.4.5. Radar Procedures/Techniques

A4.4.6. Wingman/Deputy Lead Responsibilities

A4.4.7. Receiver Formation/Join-Up Procedures

A4.4.8. Rendezvous Overrun

A4.5. REFUELING

A4.5.1. Checklist Procedures

A4.5.2. Radio Calls

A4.5.3. Refueling Order

A4.5.4. Techniques

A4.5.5. Radio Silent Procedures

A4.5.5.1. Emissions Control

A4.5.5.2. Visual Signals

A4.5.6. Fuel Off-Load

A4.5.7. Bingo Fuel (Abort Points/Abort Bases)

A4.5.8. Drop-Off Procedures

A4.5.9. Wake Turbulence

A4.6. REFORM AND EXIT

A4.6.1. Formation

A4.6.2. Clearance

A4.7. EMERGENCY PROCEDURES

A4.7.1. Breakaway Procedures

A4.7.2. Systems Malfunctions

A4.7.3. Damaged Receptacle

A4.8. IMC/NIGHT CONSIDERATIONS

A4.8.1. Lost Wingman Procedures

A4.8.2. Aircraft Lighting

A4.9. SPECIAL SUBJECTS

A4.9.1. Fuel Awareness/AB Use/Consumption Rates

A4.9.2. Flight Path Deconfliction/Other Receiver Considerations

A4.9.3. Hazards Associated with Human Factors (i.e., Channelized Attention, Task Saturation/Prioritization, and Complacency)

Attachment 5

ADVERSARY COORDINATION

A5.1. This guide is meant to highlight general adversary aircraft considerations, and provides a reference for coordination of adversary aircraft participant safety briefing. All applicable adversary considerations should be incorporated into the specific briefing for the mission being flown.

A5.1.1. Call Signs

A5.1.2. Number and Type Aircraft

A5.1.3. Scenario/Theater discussion

A5.1.4. Objective(s)-Blue, C2, Intel/Space, Red

A5.1.5. Weather/Notices to Airmen

A5.1.6. Mission Overview

A5.1.7. Ground Ops

A5.1.7.1. Taxi/Marshall/Arming deconfliction and timing

A5.1.7.2. Check-in time/Freq

A5.1.7.3. Minimum numbers

A5.1.7.4. How much delay available

A5.1.8. Takeoff

A5.1.8.1. Times

A5.1.8.2. Military Authority Assumes Responsibility for Separation of Aircraft options

A5.1.9. Departure

A5.1.9.1. Routing

A5.1.9.2. Weather Check

A5.1.9.3. Late entries

A5.1.10. Area

A5.1.10.1. Airspace times

A5.1.10.2. Restrictions

A5.1.10.2.1. Altitude

A5.1.10.2.2. Supersonic

A5.1.10.2.3. Chaff/Flare

A5.1.10.2.4. Noise Sensitive

A5.1.10.3. Points / Marshall and Cap Limit Lines

A5.1.10.4. Average terrain (Controlled/Uncontrolled bailout altitudes)

A5.1.10.5. Ground references

A5.1.10.6. Emergency airfields

A5.1.11. Recovery

A5.1.11.1. Order / Military Authority Assumes Responsibility for Separation of Aircraft

A5.1.11.2. Dissimilar formations

A5.1.12. Abnormal Procedures

A5.1.12.1. Emergency Procedures (similar/dissimilar aircraft)

A5.1.12.1.1. Cruise / Gear / Final Approach Airspeeds

A5.1.12.2. NORDO

A5.1.12.3. Lost Wingman

A5.1.12.4. SARCAP

A5.1.13. Special Subjects

A5.1.13.1. Mid-Air Collision Avoidance

A5.1.13.2. "G" Awareness

A5.1.13.3. Fuel Awareness/AB Use/Consumption Rates

A5.1.13.4. Flight Path Deconfliction

A5.1.13.5. Channelized Attention, Task Saturation/Prioritization, and Complacency

A5.1.14. Special Interest Items

A5.1.15. Ladder

A5.1.16. Special Instructions/Setups

A5.1.16.1. Red-air replications

A5.1.16.2. Regeneration criteria

A5.1.17. Fight Administration

A5.1.17.1. Desired Setup Range (if applicable)

A5.1.17.2. Fight's On / Knock-it-off (KIO) per engagement or Continuous Vul

A5.1.17.3. Vul times (if applicable)

A5.1.17.4. Timeout / Kill Criteria

A5.1.17.4.1. Range Training Officer / Non-Range Training Officer option

A5.1.17.4.2. Pk Option (IAW AFTTP 3-1.GP, *General Planning and Employment Considerations*)

A5.1.17.4.3. Timeout, Timeout Tally and Kill Passage, acknowledgement, relays and repeats

A5.1.17.4.4. Kill removal procedures

A5.1.17.5. Terminate (reasons and procedures)

A5.1.17.6. KIO (reasons and procedures)

A5.1.18. Training Rules

A5.1.18.1. IAW AFI 11-214

A5.1.18.2. Highlights

A5.1.18.2.1. Maneuvering limits (limited / unlimited)

A5.1.18.2.2. Bubble

A5.1.18.2.3. Blocks

A5.1.18.2.4. LOWAT transition altitude (if applicable)

A5.1.18.2.5. Floor

A5.1.19. Contingencies

A5.1.19.1. Weather

A5.1.19.2. GCI / Airborne Warning and Control System / Control Reporting Center fallout

A5.1.19.3. Aircraft fallout (min numbers)

A5.1.19.4. Alternate missions

A5.1.20. Debrief

A5.1.20.1. Time / Location

A5.1.20.2. Required information

A5.1.21. Questions

Attachment 6

AERIAL GUNNERY TOW COORDINATION BRIEFING GUIDE

A6.1. This guide is meant to highlight general aerial gunnery target tow considerations, and provides a reference for coordination of an air-to-air, 20mm gun target tow safety briefing. All applicable aerial gunnery considerations should be incorporated into the specific briefing for the mission being flown.

A6.1.1. Ground/Takeoff/Departure

A6.1.2. Rendezvous

A6.1.3. Airspace Data

A6.1.4. GCI Support

A6.1.5. Target Launch/Chase

A6.1.6. Shooter Order

A6.1.7. Type Pattern

A6.1.8. Tow Altitude Block(s)/Flight Parameters

A6.1.9. Intercept Phase/Pattern Set-Up

A6.1.10. Arming Procedures

A6.1.11. Timing

A6.1.12. Tow Maneuvering Parameters

A6.1.13. Shooter/Firing Plan

A6.1.14. Radio Procedures

A6.1.15. Termination

A6.1.15.1. Timing

A6.1.15.2. Minimum Altitude

A6.1.15.3. Joker/Bingo Fuel

A6.1.15.4. Winchester

A6.1.15.5. Fouls

A6.1.16. Armament Safety Check

A6.1.17. Scoring

A6.1.18. Subsequent Set-Ups

A6.1.19. Target Drop Procedures

A6.1.20. Recovery Order

A6.1.21. Abnormal Procedures

A6.1.21.1. Erratic Target

A6.1.21.1.1. During Deployment

A6.1.21.1.2. During Employment

A6.1.21.2. Target Drag-Off

A6.1.21.3. Recovery With Target/Cable

A6.1.21.4. NORDO

A6.1.21.4.1. During Engagement

A6.1.21.4.2. Target Drop

A6.1.21.4.3. Visual Signals

A6.1.21.4.4. Recovery

Attachment 7

AERIAL GUNNERY BRIEFING GUIDE

A7.1. This guide is meant to highlight general aerial gunnery considerations, and provides a reference for an air-to-air, 20mm gun employment briefing. All applicable aerial gunnery considerations should be incorporated into the specific briefing for the mission being flown.

A7.2. GENERAL

A7.2.1. Formation

A7.2.2. Area Information

A7.2.2.1. Controlling Agency

A7.2.2.2. Airspace Restrictions

A7.2.2.3. Frequencies

A7.2.3. Switch Positions

A7.2.4. Arming Procedures

A7.2.5. Intercept / Set-Up

A7.2.6. Shooter Sequence

A7.2.7. Position Changes

A7.2.8. Chase Procedures

A7.2.9. Timing

A7.3. EMPLOYMENT

A7.3.1. Firing Parameters

A7.3.1.1. Minimum Range

A7.3.1.2. Overtake

A7.3.1.3. Angle-Off

A7.3.1.4. Error Analysis

A7.3.2. Contingencies

A7.3.2.1. Avionics Malfunctions

A7.3.2.2. Gun Malfunctions

A7.3.2.3. Range Estimation Without Radar

A7.3.3. Safety Considerations

A7.3.3.1. Target Fixation

A7.3.3.2. Debris Avoidance

A7.3.3.3. Fouls

A7.4. TRAINING RULES/SPECIAL OPERATING INSTRUCTIONS. Refer to AFI 11-214.

A7.5. ALTERNATE MISSION

A7.5.1. Type Mission (refer to appropriate mission briefing guide)

A7.5.2. Mission Objectives

A7.6. SPECIAL SUBJECTS

A7.6.1. Minimum Altitudes

A7.6.2. "G" Awareness

A7.6.3. Fuel Awareness/Ops Checks/AB Use/Consumption Rates

A7.6.4. Maneuvering Limitations

A7.6.4.1. Airspeed/"G"/Stress

A7.6.4.2. Recognition/Prevention/Recovery From Out of Control

A7.6.5. Hazards Associated with Human Factors (i.e., Channelized Attention, Task Saturation/Prioritization, and Complacency)

Attachment 8

LOW-LEVEL NAVIGATION BRIEFING GUIDE

A8.1. This guide is meant to highlight general low altitude navigation flight considerations, and provides a reference for a basic low-level navigation briefing. All applicable low-level navigation considerations should be incorporated into the specific briefing for the mission being flown.

A8.2. GENERAL

A8.2.1. Route/Clearance/Restrictions

A8.2.2. Flight Responsibilities

A8.2.2.1. Navigation

A8.2.2.2. Radar/Visual Search

A8.2.3. Entry/Spacing /Holding/Initial Altitude (MSA)

A8.3. ROUTE PROCEDURES

A8.3.1. Fence Checks

A8.3.2. Tactical Formation/Turns

A8.3.3. Low Level Navigation

A8.3.3.1. Dead Reckoning/Use of Navigation Aids/ Equipment (i.e. GINS)

A8.3.3.2. Radar Procedures/Techniques

A8.3.3.3. Visual Procedures/Techniques

A8.3.3.4. Updates/Calibrations

A8.3.3.5. Time/Fuel Control

A8.3.3.6. Terrain Following/Avoidance/Wingman Considerations

A8.3.3.7. Leg Altitudes/ Obstacles (MSL/AGL)

A8.3.4. Threat Reactions

A8.3.4.1. Radar Warning/Electronic Warfare/Expendable Countermeasures

A8.3.4.2. Engagement Criteria

A8.3.4.3. Flight Path Deconfliction

A8.3.4.4. Termination

A8.4. EMERGENCIES

A8.4.1. Aircraft Malfunctions

A8.4.2. Route Abort Procedures (Route Abort Altitude/MSA)/ATC Frequencies

A8.5. TRAINING RULES/SPECIAL OPERATING INSTRUCTIONS ALTERNATE MISSION

A8.5.1. Type mission (refer to appropriate mission briefing guide)

A8.5.2. Mission Objectives

A8.6. SPECIAL SUBJECTS

A8.6.1. Airspace Restrictions

A8.6.2. "G" Awareness/Ops Checks

A8.6.3. Fuel Awareness/AB Use/Consumption Rates

A8.6.4. Flight Path Deconfliction

A8.6.5. Maneuvering Limitations

A8.6.5.1. Airspeed and "G"

A8.6.5.2. Recognition/Prevention/Recovery From Out of Control

A8.6.6. Time to Ground Impact

A8.6.6.1. Wings Level

A8.6.6.2. Overbank/Under "G"

A8.6.7. Night Considerations

A8.6.8. Hazards Associated with Human Factors (i.e., Channelized Attention, Task Saturation/Prioritization, and Complacency)

Attachment 9

AEROSPACE CONTROL ALERT (ACA) BRIEFING GUIDE

A9.1. This ACA guide is all-inclusive and is designed to incorporate all the applicable items from the General Briefing Guide. If a specialized mission such as air refueling is anticipated, the specific briefing guide for that mission should also be used.

A9.2. MISSION DATA

A9.2.1. Time Hack

A9.2.2. Mission Data Card

A9.2.2.1. Call Signs

A9.2.2.2. Aircraft/Location / Status

A9.2.2.3. Takeoff/Landing Data (Worst Case, as required: short/wet/icy runway, heavy gross weights, external fuel tank configurations, high-density altitude and non-standard cable configurations)

A9.2.2.4. Joker/Bingo Fuel

A9.2.3. Actual/Forecast Weather

A9.2.3.1. Home base

A9.2.3.2. Alternates

A9.2.3.3. Individual Weather Category/Mandatory Status

A9.2.4. Notices to Airmen

A9.2.5. Flight Crew Information File/Pubs/Maps

A9.2.6. Personal Equipment

A9.2.7. Alert Packet

A9.2.7.1. Authenticators/Duress Code

A9.2.7.2. Security Procedures

A9.2.8. Airfield Status

A9.2.8.1. Actual versus Max Allowable Tailwind

A9.2.8.2. Barriers

A9.2.8.3. Navigation Aids

A9.2.8.4. Hazards to Taxi/RCR

A9.3. GROUND PROCEDURES

A9.3.1. Aircraft/Armament Preflight

A9.3.2. Cockpit Set-Up

A9.3.3. Engine Run/Hot Preflight

A9.3.4. Crew Chief Briefing

A9.3.4.1. Act only on pilot's instructions

A9.3.4.2. Ground emergency procedures

A9.3.4.3. Hand signals

A9.3.4.4. Aircraft danger areas

A9.3.5. Quick Check Procedures

A9.4. LAUNCH PROCEDURES

A9.4.1. Notification/Radio Frequencies/Authentication Requirement

A9.4.2. Status

A9.4.2.1. Airborne Order

A9.4.2.2. Battle Stations

A9.4.2.3. Runway Alert

A9.4.2.4. Scramble

A9.4.3. Taxi

A9.4.4. Takeoff/Runway Lineup/Interval/Formation

A9.4.4.1. Day VMC

A9.4.4.2. Day IMC

A9.4.4.3. Night VMC

A9.4.4.4. Night IMC

A9.4.5. Join-up/Trail Formation/Power Settings/Airspeeds

A9.5. IN-FLIGHT PROCEDURES

A9.5.1. Formation

A9.5.2. Airspeeds

A9.5.3. Weapons Safe Checks

A9.5.4. Radar Search Responsibilities

A9.5.5. Degraded Fire Control System

A9.5.6. Transfer of Lead Procedures

A9.5.7. Ops Checks

A9.5.8. Emissions Control Procedures

A9.5.9. Region MSA

A9.5.10. Visual Identification Procedures

A9.5.10.1. Authority Required to Close

A9.5.10.2. Formation/Tactics

A9.5.10.3. Range/Altitude Separation Requirements on Target Prior Permission to Close With/Without Visual Contact

A9.5.10.4. Radar Lock-On Requirements

A9.5.10.5. Maximum Closure Speed

A9.5.10.6. Minimum Airspeed

A9.5.10.7. Loss of Contact Procedures

A9.5.10.8. Breakaway Procedures

A9.5.10.9. Restrictions

A9.5.11. Aircraft in Distress

A9.5.11.1. Minimum Closure Distance

A9.5.11.2. Visual Signals - Day/Night

A9.5.11.3. Escort Procedures

A9.5.11.4. Recovery/Landing Visual Signals

A9.5.11.5. Dissimilar Formation Procedures

A9.5.12. Jettison Procedures

A9.5.13. Lost Wingman

A9.5.14. SARCAP

A9.5.15. Emergency Airfields

A9.6. SPECIAL SUBJECTS

A9.6.1. Emergency of the Day

A9.6.2. Fuel Awareness

A9.6.3. Maneuvering Limitations

A9.6.4. Recognition/Prevention/Recovery from Loss of Control

A9.6.5. Spatial Disorientation

A9.6.6. Recall Procedures

A9.6.7. Rules of Engagement

A9.6.8. Hazards Associated with Human Factors (i.e., Channelized Attention, Task Saturation/Prioritization, and Complacency)

Attachment 10

NIGHT VISION DEVICE (NVD) BRIEFING GUIDE

A10.1. This guide is meant to highlight general NVD considerations, and provides a reference for a basic NVD briefing. All applicable NVD considerations should be incorporated into the specific briefing for the mission being flown.

A10.2. WEATHER/ILLUMINATION

A10.2.1. Civil/Nautical Twilight

A10.2.2. Moon Rise/Set Times/Phase/Elevation/Azimuth

A10.2.3. Ceiling/Visibility

A10.2.4. Illumination Levels/Electro-Optical Tactical Decision Aid

A10.2.5. Obscurants to Visibility

A10.3. NVD PREFLIGHT

A10.3.1. Check Adjustments/Helmet Fit and Security

A10.3.2. Batteries

A10.3.3. Resolution/Focus

A10.3.4. NVD Compatible Flashlight

A10.4. COCKPIT PREFLIGHT

A10.4.1. Cockpit Setup

A10.4.2. Cockpit Lighting (Leaks)

A10.4.3. Cockpit Familiarization

A10.4.4. Check Focus and Stow for Taxi

A10.5. BEFORE TAKEOFF

A10.5.1. Don NVDs/Check and Adjust/Disconnect

A10.5.2. Stow for Takeoff

A10.6. AIRBORNE

A10.6.1. Exterior Lights

A10.6.2. Donning and Doffing Procedures

A10.6.3. Scan Pattern

A10.6.3.1. Forward Scan

A10.6.3.2. Narrow Field of View

A10.6.3.3. Peripheral Vision

A10.6.3.4. Scan Techniques

A10.6.4. Join-up and Enroute Considerations

A10.6.4.1. Rejoin/Closure

A10.6.4.2. Data Link / Air-to-Air TACAN

A10.6.4.3. G-Awareness Considerations

A10.6.4.3.1. Lighting

A10.6.4.3.2. Deconfliction/Separation

A10.6.5. Route Study/Scene Interpretation

A10.6.5.1. NVD Predictions/Albedo

A10.6.5.2. Terrain/Shadowing/Visual Illusions/Visible Horizon

A10.6.5.3. City/Cultural Lighting

A10.6.5.3.1. Direction/Orientation of Lighting

A10.6.5.3.2. Aggressive Formation Maneuvering

A10.6.5.3.3. Terrain Avoidance

A10.6.5.3.4. Map Reading

A10.7. TARGET AREA

A10.7.1. Holding Procedures (NVD Differences)

A10.7.2. NVD Lost Wingman

A10.7.3. Deliveries/Pattern Procedures

A10.7.3.1. Minimum Altitudes

A10.7.3.2. Flight Member Responsibilities

A10.7.3.3. Moth Effect

A10.7.3.4. Deconfliction

A10.7.3.5. External Lighting/Deconfliction Procedures

A10.7.4. AB, Flares, and Infra-Red Detection Considerations

A10.7.5. Threat Identification and Reaction

A10.7.6. Egress

A10.8. NVD SAFETY

A10.8.1. NVD Lost Sight

A10.8.2. NVD Lost Wingman

A10.8.3. Depth Perception

A10.8.4. Visual Illusions

A10.8.5. NVD Failure

A10.8.6. Battery Failure/Swap Out

A10.8.7. Overconfidence in NVD Capabilities

A10.8.8. Entering Weather/Transition to Instruments

A10.8.9. Correct Lighting of Primary/Secondary Flight Instruments

A10.8.10. Disorientation/Misorientation/Vertigo

A10.8.11. Deconfliction Contracts

A10.8.12. Transference

A10.8.13. Target Fixation

A10.8.14. Lack of Dive Information

A10.8.15. Fatigue

A10.8.16. Aircraft Emergency and NVD Battle Damage Assessment Considerations

A10.8.17. Ejection/Goggles Off

A10.8.18. Laser Eye Protection Use

A10.8.19. NVD Foreign Object Damage Considerations (Batteries, Equipment, Filters, etc.)