



# AIR SHOW OPERATIONS SUPPLEMENT

February 10, 2018 Version 1

## INTRODUCTION

The FFI Air Show Operations Supplement was written to help provide FFI pilots with the knowledge and background information needed to operate safely within the air show environment where a Certificate of Waiver (CoW) is in effect. Although it is a comprehensive learning tool, it is not intended to be the only source of information. Much of the material in this document is taken from FAA Order 8900.1, Volume 3, Chapter 6, entitled ISSUE A CERTIFICATE OF WAIVER OR AUTHORIZATION FOR AN AVIATION EVENT, which is the primary source of information pertaining to all limits, conditions and restrictions associated with airshow and aviation event operations. The other important source of information is the FFI Formation Standards and Proficiency Program Manual, which contains additional information pertaining to FFI air show operations in particular, and in some cases may be more restrictive than FAA Order 8900.1, Volume 3, Chapter 6.

Each FFI pilot operating under a CoW for an airshow or an Aviation Event must have been evaluated and have demonstrated both a knowledge of air show procedures, and in-flight formation competency to meet the standards.

An FFI authorization allows a pilot to participate in Standard Maneuvering (non-aerobatic) formation flybys (defined in FAA Order 8900.1, Volume 3, Chapter 6) before an invited assembly of persons at an air show or an Aviation Event, while a Certificate of Waiver (CoW) is in effect. This privilege is subject to specific restrictions and limitations, which are covered in detail within the Authorization section of this document.

While FFI authorizations are evaluated and administered by FFI, there are additional levels of qualification available to airshow pilots. These levels are Dynamic Maneuvering-Solo, Dynamic Maneuvering-Formation, Solo Aerobatics, and Formation Aerobatics. Each of these qualifications requires a Statement of Aerobatic Competency (SAC). The Dynamic Maneuvering SAC program is administered by the International Council of Air Shows (ICAS) and EAA Warbirds of America, while the Aerobatic SAC program is administered solely by ICAS. ICAS and EAA Warbirds of America make recommendations to the FAA for issuance of a SAC. A SAC is issued by the FAA via Form 8710-7. The Dynamic Maneuvering-Formation qualification allows maneuvers that separate aircraft from the formation inside the Flying Display Area, to include solo or formation opposing or crossing passes, "bomb-bursts", or extended trail maneuvering. It is not a prerequisite to hold an FFI or FAST Card prior to applying to ICAS to be evaluated for a Dynamic Maneuvering qualification. However, the applicant will be required to demonstrate formation flying skills commensurate with FFI / FAST cards, or with extensive formation experience or background, during the evaluation for a SAC card with a formation endorsement. This information is provided to FFI members as supplemental guidance to those wishing to pursue SAC qualifications.

## QUALIFICATIONS AND AUTHORIZATION

- A) AUTHORIZATION** - An FFI card authorizes a pilot to participate in Standard Maneuvering (non-aerobatic) flybys or a series of flybys, performed by one or more aircraft, before an invited assembly of persons during operations under a CoW for an airshow or Aviation Event.

In a formation flight, Standard Maneuvering includes non-abrupt maneuvering, flybys, formation configuration/position changes, and missing-man formation, and the flight may not separate inside the flying display area, except to break for landing or flyby.

Pilots holding an FFI card are authorized to:

- Maneuver in an Aviation Event Demonstration Area to the pitch angle, angle of bank, and altitude limitations of FAA Order 8900.1, Volume 3, Chapter 6. (See definitions beginning page 8 of this document).
- Fly Standard Maneuvering (non-aerobatic) maneuvers by a single aircraft, by multiple aircraft, or aircraft in formation with an energy vector directed towards the primary spectator area provided the aircraft remains beyond the appropriate show line for the aircraft category ( i.e., 500 feet for Category III).
- Fly Standard Maneuvering (non-aerobatic) formation maneuvers (e.g. flyby) that may direct momentary, but not sustained energy toward the primary spectator area, except during any formation separations, formation configuration/position changes, or rejoins.
- Momentarily project energy toward the primary or secondary spectator areas during flybys as long as the formation is stable.
- Perform reversal turns both inside the Flying Display Area and outside of the Flying Display Area.
- Perform Formation Configuration/Position Changes during flybys or reversal turns, as long as the Formation Configuration/Position Change is complete, and the formation is stable, prior to the energy vector being momentarily projected at the spectator areas.
- Perform flybys of multiple aircraft in trail or multiple formations in trail in the Flying Display Area. A formation may execute a pitchout to Extended Trail maneuvering in the Flying Display area that does not include crossing or opposing passes.
- A formation may separate into separate formations while outside the Flying Display Area, and may perform separate flybys, or flybys in trail, within the Flying Display Area, but may not execute maneuvers authorized under Dynamic Maneuvering.
- Perform pitch-outs or pitch-ups to land or to conduct flybys in trail.
- Perform Missing Man Flybys.

The following restrictions apply:

- With the exception of a pitchout or pitch-up for landing or to conduct flybys in trail that do not include crossing or opposing passes, or a Missing Man Flyby, pilots may not perform Formation Separations while inside the Flying Display Area.
- Dynamic Maneuvering operations, for instance, maneuvers that separate aircraft from formations while in the Flying Display Area, or that include solo or formation crossing or opposing passes, or “bomb-bursts” are NOT authorized.
- To lead a formation, or any formation component within a large (mass) formation, during operations under a CoW for an airshow or Aviation Event, a pilot must have a Flight Lead or Check Pilot qualification.
- In order to lead a large formation of greater than twelve (12) aircraft, an FFI Flight Lead or Check Pilot must have an approved Large Formation Flight Lead Qualification form on file with FFI.

## ***Large Formation Flight Lead Designation***

FFI defines large formations as a single formation of greater than twelve (12) aircraft flying in close formation (within 500'). To lead a large (mass) formation during operations under a CoW for an airshow or Aviation Event, a FFI Flight Lead must submit the Large Formation Flight Lead Qualification Form found in the FFI Evaluations Supplement, to document his / her experience leading large (mass) formations. Upon approval, the applicant will be issued a new FFI card with the following endorsement: LARGE FORMATION FLIGHT LEAD.

**B) TRAINING** - In addition to fundamental formation flying knowledge and skill level development, each pilot seeking an FFI qualification must develop a thorough knowledge of the following areas with respect to operations in the Air Show environment:

- Aircraft and pilot documentation requirements - pilots will utilize the FAA online database
- Airshow briefing requirements
- Conditions and restrictions as they pertain to Standard Maneuvering (non-aerobatic) formations described in FAA Order 8900.1, Volume 3, Chapter 6.
- Weather requirements and considerations
- Certificate of Waiver specifics to include the flying display area, show center, corner markers, the crowd line, the Category I, II, and III show lines, and the list of waived regulations
- Air boss communications - normal and emergency
- Energy projection toward the crowd
- Low level maneuvering in formation, including altitude limitations, awareness of airshow boundaries and control points, such as, but not limited to: crowd line, show lines, corner markers, etc, as well as terrain and obstacle awareness (See Definitions, tables, and diagrams at the end of this document)
- Abnormal and Emergency procedures

**C) AIRSHOW CURRENCY** - FAA Order 8900.1, Volume 3, Chapter 6 requires that each pilot within a formation be able to show evidence of having practiced at least once in the past 45 days, to operate under a CoW for an airshow or Aviation Event.

NOTE: Initial currency may not be attained during a rehearsal or performance in airspace under a CoW. It must be achieved via practice sessions prior to operating in a CoW. Maintaining continued currency during an airshow season may be accomplished via practices, or via rehearsals and/or performances in a CoW.

### ***FFI AIRSHOW CURRENCY RECOMMENDATIONS***

FFI recommends that all participating pilots within a performance meet the following currency requirements:

For maneuvering performances that include multiple flybys with reversal turns inside and/or outside the Flying Display Area:

- have flown in at least three (3) formation practices, rehearsals or performances in the same formation performance, within the last 45 days
- have flown at least one (1) formation practice, rehearsal or performance in the same formation performance, within the last 15 days

For Single-pass flybys and flybys flown as part of a basic racetrack pattern:

- have flown in at least one (1) formation practice, rehearsal or performance in the same formation performance, within the last 45 days

For Large (Mass) Formations of greater than 12 aircraft:

- have flown in at least one (1) formation practice, rehearsal or performance in the same formation performance, within the last 45 days

NOTE: Each pilot participating in a Large (Mass) formation during operations under a CoW for an airshow or Aviation Event, must satisfy the above currency requirements by flying in a practice or rehearsal in the formation configuration to be performed, and in the same role (Lead or Wingman). For this currency requirement, a Large Formation is a formation greater than twelve (12) aircraft that is composed of multiple 4-ship (or other size) elements, flown in close formation together. For a performance or flyby that is flown as separate formations in trail (500' or more), pilots must meet the currency requirements stated above for Large (Mass) formations only in the smaller formation in which they fly.

## **AIRSHOW ENVIRONMENT TRAINING TOPICS**

To meet the directives of FAA Order 8900.1, Volume 3, Chapter 6, the following will provide FFI pilots with the information and knowledge necessary to safely and competently operate in the air show environment, and within airspace where a Certificate of Waiver (CoW) is in effect. This section of the FFI Formation Guidelines and Standard Procedures manual has been developed to educate the prospective FFI airshow performer in the myriad of details that he will need to be familiar with to operate safely in the air show environment and within the limits of a Certificate of Waiver.

## **AIRCRAFT AND PILOT DOCUMENTATION REQUIREMENTS**

To be eligible to participate in an air show, an aircraft must be in an airworthy condition, and the pilots must be qualified for the demonstration conducted. Flight Leads are responsible to ensure that all performers / members of the team comply with all Aviation Event Organizer document submission and inspection requirements. A new system of electronic document submission has been developed by FAA. Performers that comply with electronic document submission may be eligible to have their aircraft inspected one time per season, per the directives of FAA Order 8900.1, Volume 3, Chapter 6, Section 3-145. Performers that do not comply with electronic document submission will have their aircraft inspected at every Aviation Event they participate in. Event organizers will utilize the following forms, found in FAA Order 8900.1, Volume 3, Chapter 6:

- Event Organizer Pre Aviation Event Performer/Parachutist Document Requirements
- Event Organizer Required Aircraft Document Checklist
- Aircraft Status and Inspection Form

A sample of each form is shown on the following pages. Currently, aircraft extraction documents may be submitted to an ICAS database accessible by event organizers. The remainder of the documents on the following forms must be submitted to each Aviation Event organizer. FAA and ICAS are developing a program tracking and reporting system to support submission and storage of all Aviation Event required documents.

**Event Organizer Pre Aviation Event Performer/Parachutist  
Document Requirements (ver 08 2017)**

<b><u>Performer Required Documents</u></b>	<b><u>Yes</u></b>	<b><u>N/A</u></b>
1) Copy of pilot certificate:	<input type="checkbox"/>	-
2) Copy of medical certificate:	<input type="checkbox"/>	-
3) Copy of current/valid government photo I.D.:	<input type="checkbox"/>	-
4) Copy of the LOA/endorsement for pilots operating surplus military aircraft:	<input type="checkbox"/>	<input type="checkbox"/>
5) Copy of Air Race Credential from Race Class/Organization	<input type="checkbox"/>	<input type="checkbox"/>
6) Copy of the statement of aerobatic competency (SAC) for aerobatic (solo/Formation) or dynamic maneuvering (solo/formation) pilots:	<input type="checkbox"/>	<input type="checkbox"/>
7) Copy of the industry formation card for Standard Formation (non-aerobatic) pilots:	<input type="checkbox"/>	<input type="checkbox"/>
8) Copy of Parachutist(s) USPA credential or AFS-800 LOA:	<input type="checkbox"/>	<input type="checkbox"/>
9) Copy of the emergency parachute inspection card:	<input type="checkbox"/>	<input type="checkbox"/>
10) Performers emergency extraction information (mandatory): Listed in ICAS Data Base: Yes <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11) UAS Demo-UAS Operator qualified IAW UAS special provisions: Hobby <input type="checkbox"/> Public <input type="checkbox"/> Civilian <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b><u>Parachutist Required Documents</u></b>	<b><u>Yes</u></b>	<b><u>N/A</u></b>
1) Reserve parachute packing record:	<input type="checkbox"/>	<input type="checkbox"/>

**Note:** Owner/operator must submit a copy of the applicable documents (electronic copy preferred)

**Performer Required Documents References**

- 1:** 14 CFR Part 61.3 (a) (1) or (b)
- 2:** 14 CFR Part 61.3 (c)
- 3:** 14 CFR Part 61.3 (a) (2), Order 8900.1 Volume 6, Chapter 11, Section 10
- 4:** Order 8900.1 Volume 6, Chapter 11, Section 10, Paragraph 6-2379  
Order 8900.1 Volume 5, Chapter 9, Section 2, Paragraph 5-1578 (B)(3)
- 5:** Order 8900.1 Volume 3, Chapter 6, Section 2
- 6:** Order 8900.1 Volume 3, Chapter 6, Section 1, Paragraph 3-145
- 7:** Order 8900.1 Volume 3, Chapter 6, Section 1, Paragraph 3-145
- 8:** Order 8900.1 Volume 3, Chapter 6, Section 1, Paragraph 3-150
- 9:** Order 8130.2, Chapter 4 (Special Airworthiness Certification)
- 10:** 14 CFR Part 105.43.
- 11:** Order 8900.1 Volume 3, Chapter 6, Section 1, Paragraph 3-144 E

**Parachutist Required Documents References**

- 1:** 14 CFR Part 105.43.

## Event Organizer Required Aircraft Document Checklist (ver 08-2017)

<u>Aircraft Required Documents</u>	<u>Yes</u>	<u>N/A</u>
1) Copy of airworthiness certificate:	<input type="checkbox"/>	-
2) Copy of registration certificate:	<input type="checkbox"/>	-
3) Copy of operating limitations:	<input type="checkbox"/>	<input type="checkbox"/>
4) Copy of the following current inspections: <ul style="list-style-type: none"> <li>• Annual/100 Hour/Progressive/Condition</li> <li>• 91.411 (Altimeter/Static)</li> <li>• 91.413 (Transponder)</li> <li>• 91.207 (ELT)</li> <li>• 91.417 (Recurring Airworthiness Directives status)</li> </ul>	<input type="checkbox"/>	-
5) Copy of program letter:	<input type="checkbox"/>	<input type="checkbox"/>
6) Copy of Special Flight Authorization (SFA) for foreign registered aircraft:	<input type="checkbox"/>	<input type="checkbox"/>
7) Authority to carry passengers for hire: 1) Exemption 91.317/91.319 2) 91.146/91.147:	<input type="checkbox"/>	<input type="checkbox"/>
8) Copy of parachutist aircraft modification paperwork: <ul style="list-style-type: none"> <li>• Current Weight and Balance</li> <li>• FAA 337 forms for aircraft modifications</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>
9) Copy of operating certificate or letter of deviation authority for large (Part 125) aircraft used in sport parachuting:	<input type="checkbox"/>	<input type="checkbox"/>
10) Copy of the log book sign off for maneuvers being performed in the airshow, documenting the maneuvers were satisfactory accomplished. (Per the Operating Limitations for Special Airworthiness Certificate Aircraft):	<input type="checkbox"/>	<input type="checkbox"/>
11) Copy of valid signed and dated Air Racing Flight Demonstration Form (Required after any major modification):	<input type="checkbox"/>	<input type="checkbox"/>
12) UAS Demo-UAS Aircraft qualified IAW UAS special provisions Hobby <input type="checkbox"/> Public <input type="checkbox"/> Civilian <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13) Ejection Seat installed – Training Program	<input type="checkbox"/>	<input type="checkbox"/>

### Aircraft Documentation Requirement References

- 1: 14 CFR Part 91.203.
- 2: 14 CFR Part 91.203.
- 3: Order 8130.2, Chapter 4 (Special Airworthiness Certification)
- 4: 14 CFR Part 91.411, 14 CFR Part 91.413, 14 CFR Part 91.207, 14 CFR Part 91.417, Order 8900.1 Volume 3, Chapter 6, Section 1, Paragraph 3-145 (F), Figure 3-38. Order 8900.1 Volume 6, Chapter 11, Section 10
- 5: Order 8130.2, Chapter 4 (Special Airworthiness Certification / Exhibition/Air Racing).
- 6: 14 CFR Part 91.715 and Order 8130.2 Chapter 7
- 7: Reference Exemption Letter issued to the operator (91.317/91.319).
- 8: Order 8900.1 Volume 6, Chapter 11, Section 10
- 9: Order 8900.1 Volume 6, Chapter 11, Section 10
- 10: Order 8130.2, Chapter 4 (Special Airworthiness Certification)
- 11: Order 8900.1. Volume 3, Chapter 6, Section 1 and Section 2
- 12: Order 8900.1 Volume 3, Chapter 6, Section 1, Paragraph 3-144 E
- 13: Order 8130.2, Chapter 4 (Special Airworthiness Certification)

**Note:** Owner/operator must submit a copy of the applicable documents (electronic copy preferred)

## Aircraft Status and Inspection Form (ver 08-2017)

N- \_\_\_\_\_ S/N: \_\_\_\_\_ Make: \_\_\_\_\_ Model: \_\_\_\_\_

<b><u>Inspection</u></b> (Check the Inspection that Applies)	<b><u>Compliance Date &amp; Hours</u></b>	<b><u>Next Due</u></b>	
<input type="checkbox"/> Annual			
<input type="checkbox"/> Condition			
<input type="checkbox"/> 100 Hour (If Required)			
<input type="checkbox"/> Progressive			
<input type="checkbox"/> 91.411 (Altimeter/Static)			
<input type="checkbox"/> 91.413 (Transponder)			
<input type="checkbox"/> 91.207 (ELT Inspection)			
<b><u>Recurring AD's</u></b>	<b><u>Description</u></b>	<b><u>Compliance Date &amp; Hours</u></b>	<b><u>Next Due</u></b>

Note: Foreign Aircraft - Provide in accordance with SFA and CAA requirements

I certify this information accurately represents the applicable information documented in the aircraft maintenance records and the records were reviewed on this day to verify the inspection and airworthiness directive status of this aircraft. This form is valid until the next inspection or airworthiness directive is due.

Owner/Operator (Print Name): \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

**Reference Information:**

8900.1 Volume 3, Chapter 6, Section 1, Paragraph 3-145 F.  
 8900.1 Volume 6, Chapter 11, Section 10  
 14 CFR Part 91.715 and 8130.2, Chapter 7

# AIRSHOW BRIEFING REQUIREMENTS

## AIR BOSS BRIEF

Airshow Participants Safety Briefings are conducted each day of the airshow by the Air Boss and are attended by representatives from each group, team or act. The Air Boss will brief the overall plan with respect to all the acts participating in the airshow. Details of the Airshow Demonstration Area, the Flying Display Area, the Aerobatic Box, Airshow timing, altitudes, launch sequence, recovery, the communications plan, emergency equipment, and other details will be briefed. The FAA Certificate of Waiver and special provisions will be discussed. The FAA CoW and special provisions, and Emergency Response Plan, will be discussed. Coordination of CFR (Crash Fire Rescue) extraction briefings between individual performers and CFR should be made. Only the team leader is required to attend the brief, however, a delegate may represent the team leader, provided the person is a pilot member of the team. It is recommended that all members of a team attend the Air Boss brief, if possible, and allowed by the Air Boss or Airshow Coordinator.

## FLIGHT LEAD PREFLIGHT BRIEF

All members of a formation team must attend the briefing given by the team Flight Lead. In cases where the formation will fly more than once during a single day, for example, a day show and twilight show, a Flight Lead brief is required for each performance. The following items must be briefed:

- Mission parameters / Performance Sequence of Events
- Weather considerations - to include crosswind corrections, ceiling, and visibility.
- Field elevation and density altitude
- Alternate fields - heading, distance, frequencies, and runways
- Lead responsibilities
- Wingman responsibilities
- Requirements and restrictions of the Certificate of Waiver (CoW) in effect
  - Show line, crowd line, and corner markers
  - Altitude limits during flybys, reversals, and maneuvering
- Boundaries, field layout and markings, holding areas, and taxi routes
- Deconfliction
- Radio communication plan
- Obstacles
- Emergencies
  - Structural failure / Midair
  - Engine failure
  - Fire
  - Aborted takeoff
  - Broken formation / lost sight
  - Communication during an emergency
    - radio calls during emergencies
    - Lost comm
    - Lead responsibilities

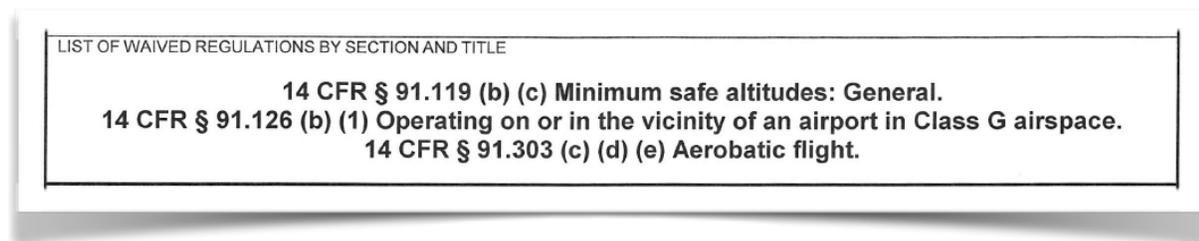
## CERTIFICATE OF WAIVER

A Certificate of Waiver is an official document issued by the FAA that authorizes certain operations of aircraft to deviate from regulation but under conditions that ensure an equivalent level of safety.

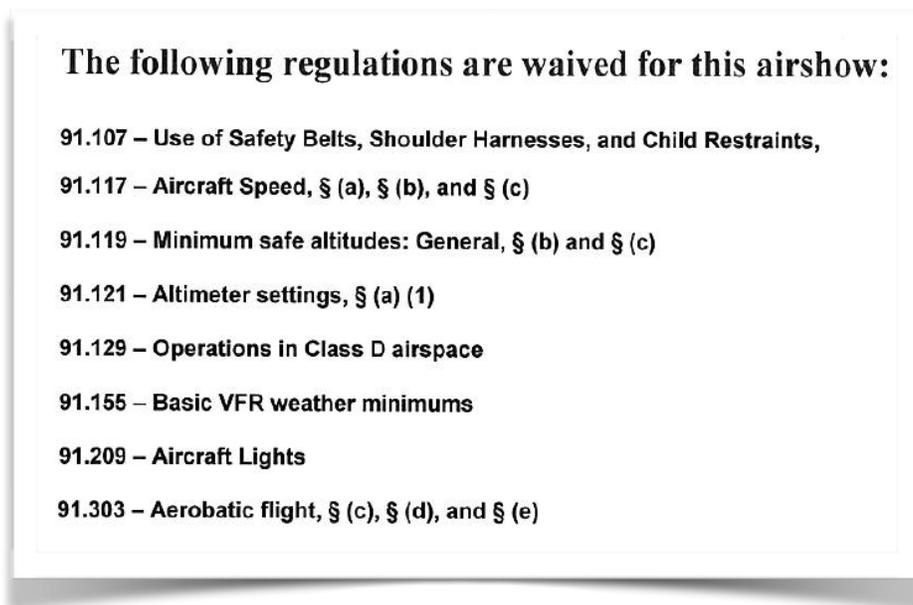
Each performer / formation team should be provided with a copy of the Certificate of Waiver in advance of the airshow, in order to provide access to the operational information pertinent to the event, before arriving at the site. A copy of the CoW, along with diagrams, maps, charts, photos, etc. of the airshow site, should be forwarded to participants.

FAR Section 91.905 lists the sections of part 91 than can be waived.

The waived items may be listed of the first page of the Certificate of Waiver as depicted in the following example:



Or the waived items may be on an attached page of the Certificate of Waiver as depicted in this example:



## AIR SHOW CONDITIONS, RESTRICTIONS AND BASIC DEFINITIONS

FAA Order 8900.1, Chapter 6, Section 1 is the guiding document for all performers who operate under a Certificate of Waiver, which is often referred to as waived, or waived, airspace. All pilots, flight leads and wingmen are required to be familiar with the conditions and restrictions contained within FAA Order 8900.1, Chapter 6, Section 1 as they pertain to non-aerobatic formations, as well as operations within waived airspace. The following are some particularly important areas.

- Aviation Event - Airshows, aerobatic competitions, closed course air races, cross-country air races, parachute demonstration jumps, balloon meets, flyovers, and fly-ins conducted before an invited assembly of persons, for which the FAA issues a Certificate of Waiver or Authorization (CoW/A).
- Aviation Event Demonstration Area - The total airspace (lateral and vertical limits) identified by the CoW/A, temporary flight restriction (TFR), or the Notice to Airmen (NOTAM) issued for an aviation event (sometimes referred to as the waived airspace).
- Compensation at Air Shows - To receive any type of compensation (fuel, oil, lodging, rental cars, etc.), for flight activities at an air show, an airman must have a commercial pilot certificate and at least a second-class medical certificate.
- Corner Markers - An easily identifiable marker or landmark from the air, 500 feet or more right and left of the primary spectator area along the crowd line to provide performers with a 500 foot reference point for proper separation from the spectators. The corner markers must be highly visible with a distinct contrast to the background. Corner markers are annotated on the field diagram in the waiver.
- Critical Aircraft - In a formation, the aircraft closest to the primary spectator area. The formation leader must adjust his or her ground track so that the wingtip of the critical aircraft remains the appropriate distance from the spectator areas and clear of the appropriate show line.
- Crowd Line - a physical barrier or line marked on the ground that serves as a restraining line for the designated spectator areas.
- Flying Display Area – The airspace at an aviation event where participating aircraft, UAS, and rockets have authorization to perform under a CoW/A. This area begins at the surface and includes all the aerobatic boxes, racecourse area, and show lines, but does not include ingress/egress routes.
- Formation Flight - When two or more aircraft under the command of a flight leader are flown solely with reference to another aircraft and are within 500 feet of the referenced aircraft.
- Formation Separation - aircraft separate into solo flight or multiple formations (e.g. bomb-burst, 8-ship to two 4-ships, 4-ship to two 2-ships, etc).
- Formation Configuration / Position Change - aircraft maintain formation while maneuvering to a new formation configuration (e.g. Fingertip to Diamond) via the movement or repositioning of one or more aircraft within the flight (e.g. aircraft #4 moves from outside right wing to slot).

Note: Formation Separation in the flying display area and Formation Configuration / Position Change is authorized during Formation Dynamic Maneuvering. Only Formation Configuration / Position Change is authorized during Formation Standard Maneuvering.

- In-Trail - A solo aircraft or aircraft in formation that are flown solely with reference to another solo aircraft or formation and are more than 500 feet from the referenced aircraft or formation. (e.g. during a parade overflight, a flyby, or a racetrack pattern of flybys).
- Practice session - flying a dedicated event with a planned series of maneuvers. Up to, but no more than three (3) practice sessions may be accomplished in one flight, with the exception of a large (mass) formation. For the purposes of currency for a large (mass) formation, a practice session is defined from engine start-up to shut-down. Therefore, only one practice session may be accomplished in a single flight.

- Show Center – a visible reference point that denotes the center of the flying display area. Show Center is annotated on the field diagram in the waiver.
- Show Line - a line on the surface of the ground (often the centerline of the runway, or runway edge), intended to provide the performer with a clear visual reference to the minimum safety distance. The Show line is annotated on the field diagram in the waiver.
- Show Line categories - Show Line categories and required distances from the Show Line for aircraft are determined by the speed of the aircraft. Minimum show line distances are measured from the crowd line.
  - Category I - more than 245 knots. The minimum show line distance from the spectator area for Category I aircraft is 1500 feet.
  - Category II - more than 156 knots but 245 knots or less. The minimum show line distance from the spectator area for Category II aircraft is 1000 feet.
  - Category III - 156 knots or less, and 2250 pounds or less gross takeoff weight. The minimum show line distance from the spectator area for Category III aircraft is 500 feet. All FFI flybys are performed at Category III limits.
- Standard Maneuvering-Formation - includes non-abrupt maneuvering, flybys, formation configuration/ position changes, and missing-man formation, and the flight may not separate inside the flying display area, except to break for landing or flyby. The pitch and bank limitations are when the aircraft pitch attitude is less than or equal to 45 degrees above or below the horizon and/or the bank angle is less than or equal to 60 degrees in reference to the horizon.
- Standard Maneuvering-Solo - includes non-abrupt maneuvering and flybys in solo flight. The pitch and bank limitations are when aircraft pitch attitude is less than or equal to 60 degrees above or below the horizon and/or the bank angle is less than or equal to 75 degrees in reference to the horizon.
- Restriction - Flight over the primary spectator area is only permitted when at or above 1,000 feet above the airport elevation.
- Restriction - Flight over a secondary spectator area is only permitted when at or above 500 feet above the airport elevation and the flight will be non-maneuvering and wings level in a normal climb.
- Restriction - For formation flights, Standard Maneuvering flybys may be conducted no lower than 250 feet AGL, using a bank angle of no more than 60 degrees, a pitch angle of no more than 45 degrees, and a maximum airspeed of no more than 250 knots.

## **WEATHER REQUIREMENTS AND CONSIDERATIONS**

- Flight demonstrations will not be conducted unless the ceiling is at least 1500 feet, and the visibility is at least 3 statute miles at the time of the demonstration. The FAA monitor may adjust the minimum ceiling and visibility requirements at his or her discretion, but no less than 1,000 feet and 3 miles if certain conditions exist.
- Wind direction and wind velocity must be considered as it affects the flight path of the formation. The Flight Lead must ensure the critical wingman in the formation never drifts inside of the show line, or within the minimum distance of the spectator areas, as dictated by the aircraft category (I, II, or III).
- Temperature and the effect of density altitude upon true airspeed in relation to indicated airspeed is an important consideration. High density altitudes also have a serious effect on the performance of aircraft and engines, and on the ability to gain and / or maintain energy.

## **AIR BOSS COMMUNICATIONS**

Communications with the Air Boss should be simple and straightforward. Aircraft operating in the Flying Display Area will be using the briefed "Air Boss" frequency. This is the primary frequency. With multiple aircraft using the same frequency, radio discipline is critical, and communication may become difficult. For formation teams, it is common for the team to operate on a discrete frequency or "tactical" frequency, that is only used by that team while they are performing. The discrete frequency will be monitored by the Air Boss, or the Lead should monitor the Air Boss primary frequency on a second radio.

### **NORMAL OPERATIONS**

After engine start, the flight lead will typically check all pilots in on the briefed discrete frequency. The Flight Lead will advise the formation of the weather / ATIS, and communicate any changes. The Flight Lead will then typically direct the flight to the Air Boss frequency for taxi and takeoff. Once airborne, and with the permission of the Air Boss, the Flight Lead will direct the flight to the discrete frequency, if desired. Communications must be available with the Air Boss on the assigned discrete frequency, or the Lead should monitor the Air Boss primary frequency on a second radio.

### **EMERGENCY OPERATIONS**

In an emergency situation, the affected pilot, if at all possible, must communicate the situation immediately on the briefed frequency. The Air Boss must be informed, so that all efforts can be made toward the safe recovery of the emergency aircraft. If the distressed aircraft is unable, or has not made the radio call, the Flight Lead, or the chase pilot, will coordinate with the Air Boss.

### **KNOCK IT OFF (KIO) CALL**

During a performance, the Air Boss or any member of the formation flight may feel it is necessary to make a Knock-it-off call. It may be due to an intruder aircraft that has wandered into the area creating a conflict, or an emergency situation somewhere in the formation or on the airfield. Once a Knock-it-off call has been initiated by the Air Boss or by any member of the flight, all members of the formation shall cease maneuvering. The Flight Lead or the Air Boss, or both in coordination, as appropriate, will decide the appropriate course of action, to include any prearranged procedures as briefed during the Airshow Participants Safety Briefing.

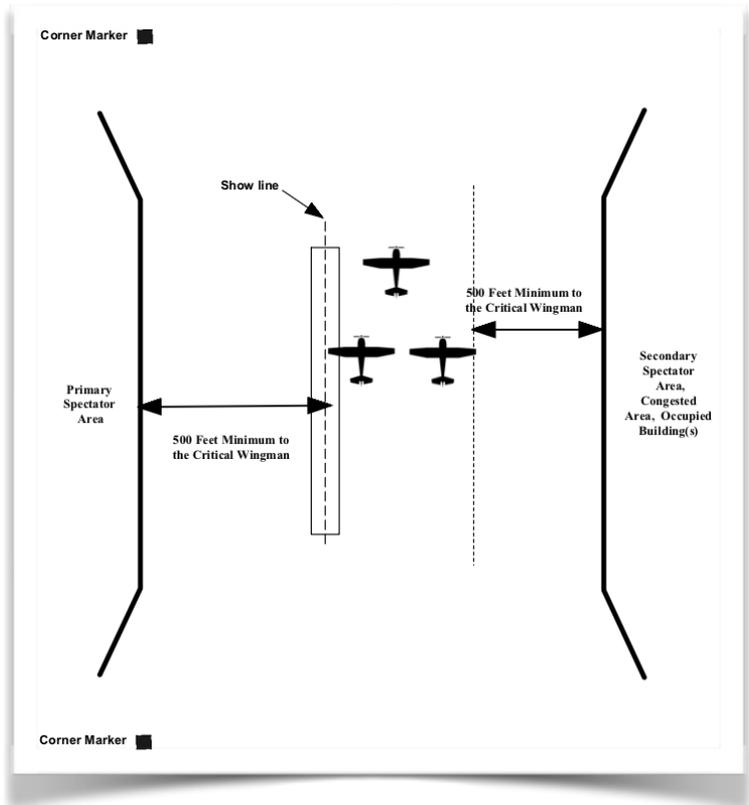
## **ABNORMAL AND EMERGENCY PROCEDURES**

When operating within a Certificate of Waiver, during an abnormal situation or airborne emergency, every possible consideration must be made for the safety and well-being of the spectators on the ground. Typically airshows are held over airports, and a suitable runway is within gliding distance.

The priorities are: Aviate, Navigate, and Communicate. Fly the airplane first. If it is an immediate-action type of emergency, pull the airplane up and out of the formation and turn in the shortest direction to the most suitable place to land. Call a May-Day or Knock-It-Off, and announce your intentions over the radio to the extent possible, within workload constraints. If the distressed aircraft is unable, or has not made the radio call, the Flight Lead, or the chase pilot will coordinate with the Air Boss.

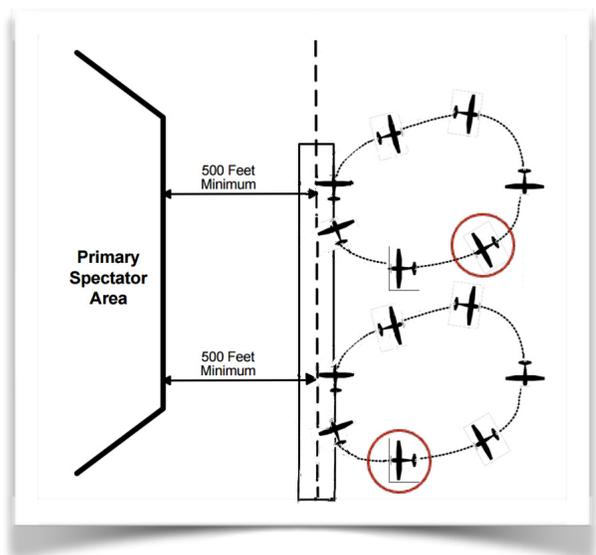
## AIRCRAFT POSITIONING WITH REFERENCE TO THE SHOW LINE

Flight Leads must insure that no aircraft in the formation crosses the appropriate limiting show line. Flight Leads must adjust their track to ensure that the wingtip of the critical aircraft closest to the Primary Spectator Area or Secondary Spectator Area does not cross the applicable limiting Category I, II, or III show line. The diagram to the right depicts this scenario for a Category III show line.



## ENERGY PROJECTION TOWARD THE SPECTATOR AREAS

Flight Leads should always align their flight path so as not to direct energy toward the primary spectator area for any extended period of time. FFI formations are authorized to momentarily pass their energy vector through the spectator area, provided the formation remains beyond the appropriate CAT I, II, or III show line, and the formation is stable during the entire period that the energy vector is passing through the spectator area. Formation changes are not authorized while the energy vector is projected toward the primary spectator area.



## TYPICAL STANDARD MANEUVERING AIRSHOW MANEUVERS

Each pilot should become familiar with the following Airshow Competency Elements:

Flat Pass  
Corner to Corner (Photo or Banana) Pass

Reverse Banana Pass  
Inclined 360° Turn

**Reversal Turns** - After each pass down the showline, the formation will do an appropriate reversal turn to reposition the formation for the next pass. This reversal turn may be a 90°/270° (dogbone) turn in either direction, or some type of 180° reversal turn to reposition the formation with reference to the reciprocal showline for the next pass.

**A formation transition** moves from one formation configuration to another. The following are some typical basic formation configurations:

Fingertip left  
Fingertip right

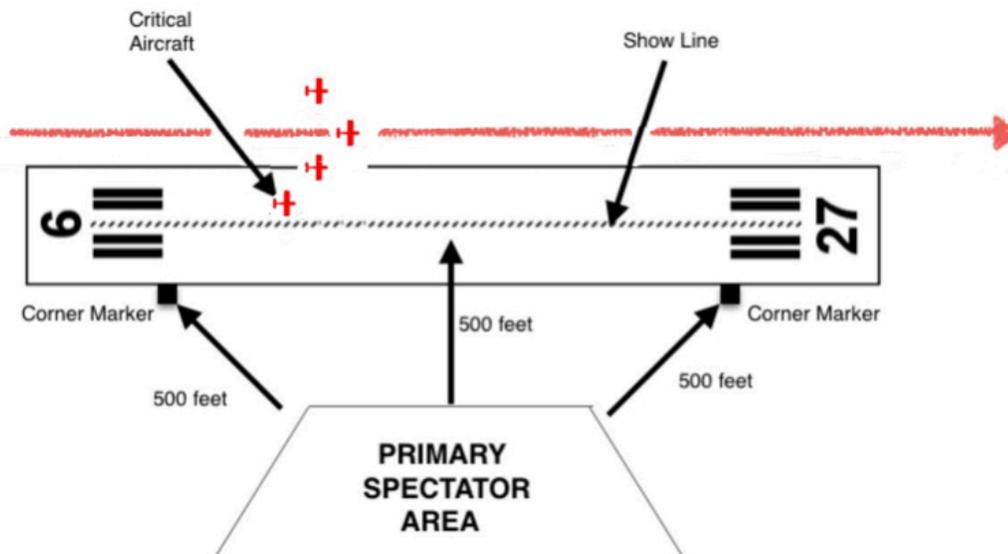
Diamond  
Close trail

Echelon left  
Echelon right

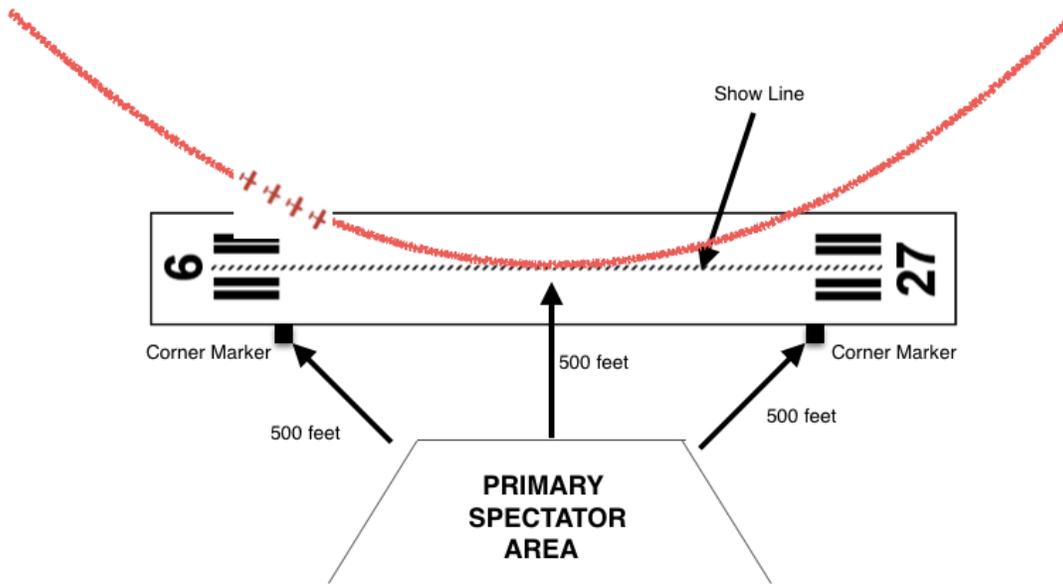
- The formation changes must be complete and the formation must be stable prior to the energy vector passing through the spectator area.

### TYPICAL AIRSHOW MANEUVERS DEFINED:

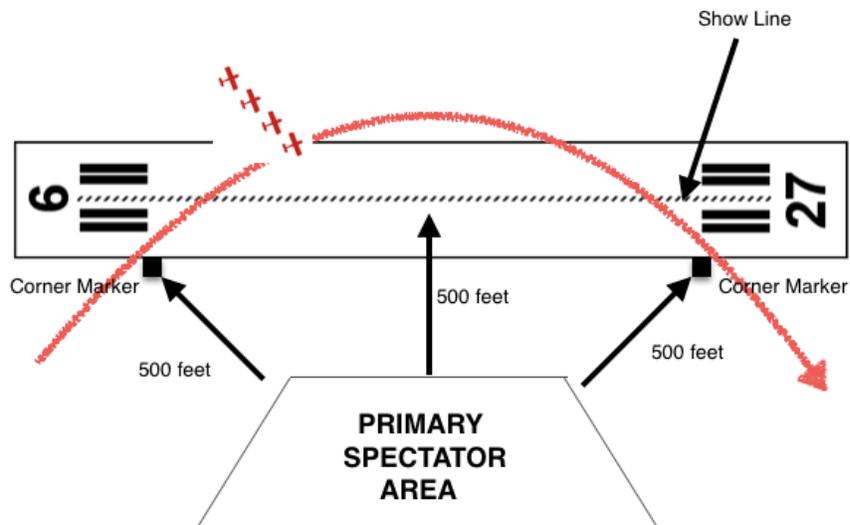
- **Flat Pass** - A straight and level flight path that parallels the showline.



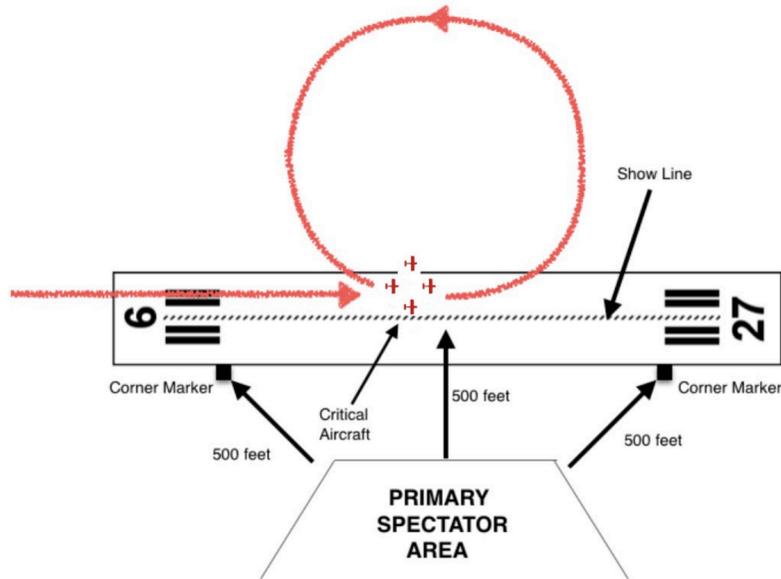
- **Reverse Banana Pass** - An arcing flight path that begins away from the showline and primary spectator area, approaches the show line at show center, then arcs away again, while maintaining a near constant radius turn.



- **Corner to Corner (Photo or Banana) Pass** - An arcing flight path that begins at one corner marker, arcs away from show center, and ends at the opposite corner marker, while maintaining a near constant radius turn.



- **Inclined 360° Turn** - A 360° circle that starts at show center, on or beyond the show line. The formation begins a 360° turn with a climbing arc going away from the show line. The turn apexes in altitude at the point farthest from the crowd, at show center. The formation then descends while continuing the 360° turn back toward show center, completing the maneuver on or beyond the show line at the original starting altitude.

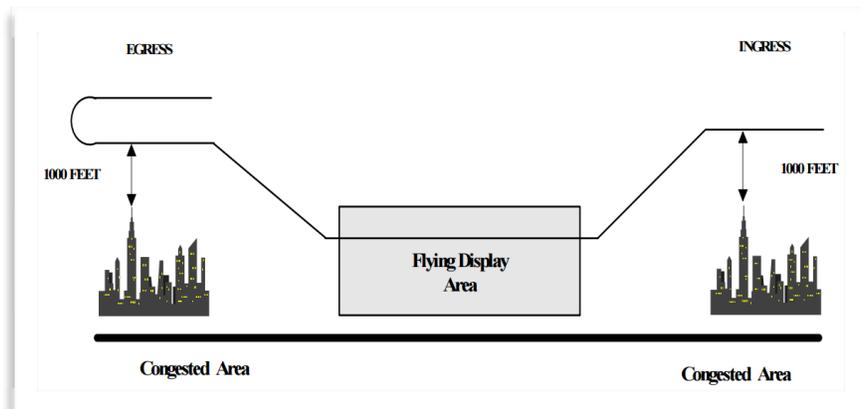


## LOW ALTITUDE MANEUVERING

For FFI formation flights, fly-bys may be conducted as low as 250 feet AGL, using a bank angle of no more than 60 degrees, and a pitch angle of no more than 45 degrees.

Special consideration must be made when flying near ground terrain and obstacles. Low level decision making by all members of the formation is critical. Pilots may experience a ground rush illusion where the surface features rapidly spread out to fill the entire field of view and the ground appears to rapidly rise. It is imperative that all members of the formation remain situationally aware, maintain their direct reference to the other aircraft in the flight, and not allow themselves to become distracted.

Special consideration must be made when densely populated or congested areas exist adjacent to the Flying Display Area. When this is the case, ingress and egress routes will likely be defined in the Certificate of Waiver. Typically, the Air Boss or IIC will brief a requirement that aircraft must be climbing to 1000' or above when egressing over these areas.



## FLYBY REQUIREMENTS AND LIMITATIONS

The following two tables are excerpts from the 8900.1, Chapter 6, Section 1, and define pitch, bank, altitude, and airspeed limitations (where applicable) for Standard, Dynamic, and Aerobatic Maneuvering (Solo and Formation).

<b>FLYBY REQUIREMENTS AND LIMITATIONS</b>		
<p><b>FLYBY.</b> A pass or a series of passes, performed by one or more aircraft while in the flying display area before an invited open air assembly of persons at an aviation event while a CoW for an aviation event is in effect. A flyby is not considered part of a performer's maneuvering sequence and therefore must be performed in accordance with requirements listed below.</p>		
<p><b>SAC – Statement of Aerobatic Competency, FAA Form 8710-7</b></p> <ul style="list-style-type: none"> <li>• DMF – Dynamic Maneuvering–Formation</li> <li>• DMS – Dynamic Maneuvering–Solo</li> <li>• AF – Aerobatics–Formation</li> <li>• AS – Aerobatics–Solo</li> </ul>	<p><b>Formation Credential – FAST/FFI:</b></p> <ul style="list-style-type: none"> <li>• FAST – Formation and Safety Training</li> <li>• FFI – Formation Flying, Inc.</li> </ul>	
<p><b>Category Aircraft</b></p> <p>CAT I</p> <p>CAT II</p> <p>CAT III</p>	<p><b>Minimum Aircraft Category Show Line</b></p> <p>CAT III – 500 feet</p>	<p><b>Limitations</b></p>
<p><b>CAT I/II/III Aircraft – Solo</b></p> <ul style="list-style-type: none"> <li>➤ Standard Maneuvering–Solo</li> <li>➤ Dynamic Maneuvering–Solo</li> <li>➤ Aerobatic Maneuvering–Solo</li> </ul>	<p><b>CAT III</b></p>	<ul style="list-style-type: none"> <li>➤ <b>Standard Maneuvering–Solo</b> No Credential Required:</li> <hr/> <p style="text-align: center;">Pitch ≤ 60° and/or Bank ≤ 75°</p> <hr/> <p style="text-align: center;">Altitude ≥ 100 feet AGL</p> <hr/> <p style="text-align: center;">Airspeed ≤ 300 kts IAS</p> <hr/> <li>➤ <b>Dynamic Maneuvering–Solo</b> SAC with DMS endorsement:</li> <hr/> <p style="text-align: center;">Pitch ≤ 60° and/or Bank ≤ 90°</p> <hr/> <p style="text-align: center;">Altitude: SAC-DMS Level II or higher ≥ 100 feet AGL</p> <hr/> <p style="text-align: center;">Airspeed: SAC-DMS Level II or higher – No limitation (supersonic not authorized)</p> <hr/> <li>➤ <b>Aerobatic Maneuvering–Solo</b> SAC with AS endorsement:</li> <hr/> <p style="text-align: center;">Pitch &gt; 60° and/or Bank &gt; 75°</p> <hr/> <p style="text-align: center;">Altitude: SAC-AS Level I or higher – No limitation</p> <hr/> <p style="text-align: center;">Airspeed: SAC-AS Level I or higher – No limitation (supersonic not authorized)</p> </ul>

<p><b>CAT I/II/III Aircraft – Formation</b></p> <ul style="list-style-type: none"> <li>➤ Standard Maneuvering–Formation</li> <li>➤ Dynamic Maneuvering–Formation</li> <li>➤ Aerobatic Maneuvering–Formation</li> </ul>	<p><b>CAT III</b></p>	<ul style="list-style-type: none"> <li>➤ <b>Standard Maneuvering–Formation</b> FAST or FFI Formation Credential:</li> <hr/> <p style="text-align: center;">Pitch <math>\leq 45^\circ</math> and/or Bank <math>\leq 60^\circ</math></p> <hr/> <p style="text-align: center;">Altitude <math>\geq 250</math> feet AGL</p> <hr/> <p style="text-align: center;">Airspeed <math>\leq 250</math> kts IAS</p> <hr/> <p style="text-align: center;">Formation separation is not authorized in the flying display area (see subparagraph 3-145D1))</p> <hr/> <li>➤ <b>Dynamic Maneuvering–Formation</b> SAC with DMF endorsement:</li> <hr/> <p style="text-align: center;">Pitch <math>\leq 60^\circ</math> and/or Bank <math>\leq 75^\circ</math></p> <hr/> <p style="text-align: center;">Altitude: SAC DMF Level II or higher <math>\geq 250</math> feet AGL</p> <hr/> <p style="text-align: center;">Airspeed: SAC DMF Level II or higher – No limitation (supersonic not authorized)</p> <hr/> <li>➤ <b>Aerobatic Maneuvering–Formation</b> SAC with AF endorsement:</li> <hr/> <p style="text-align: center;">Pitch <math>&gt; 60^\circ</math> and/or Bank <math>&gt; 75^\circ</math></p> <hr/> <p style="text-align: center;">Altitude: SAC-AF Level I or higher <math>\geq 250</math> feet AGL</p> <hr/> <p style="text-align: center;">Airspeed: SAC-AF Level I or higher – No limitation (supersonic not authorized)</p> </ul>
<p><b>All Aircraft:</b></p> <ul style="list-style-type: none"> <li>➤ Maneuvering sequence may not be interrupted to perform a flyby.</li> <li>➤ Flyby may only be performed before or after the sequence is completed.</li> <li>➤ No abrupt maneuvers between the corner markers may be performed along the Category III show line.</li> <li>➤ Flyby must be conducted in accordance with subparagraph 3-147L.</li> <li>➤ Supersonic flight not authorized.</li> </ul>	<p><b>Military Aircraft:</b></p> <ul style="list-style-type: none"> <li>➤ Sanctioned military demonstration teams with an FAA-approved maneuvers package must comply with the limits approved.</li> <li>➤ All other military pilots must comply with the flyby requirements and limitations.</li> </ul>	