



2018  
*Snowbirds*  
Manoeuvres  
Package

Royal Canadian Air Force - 431 Air Demonstration Squadron

## **MESSAGE FROM THE COMMANDING OFFICER**

As Canadian ambassadors, the members of 431 Air Demonstration Squadron, the Canadian Forces Snowbirds are committed to inspiring the public by demonstrating the skill, professionalism, and teamwork of the men and women of the Canadian Armed Forces to audiences across North America. To accomplish this mission, all members of the Snowbirds are highly skilled and qualified aircraft technicians, accomplished pilots, or support personnel, who have undergone intensive training and evaluation prior to be authorized to deploy or perform with our team. The Snowbirds strive for only the highest standards of excellence throughout our organization. From the precision flying, our professional collaboration with air show organizers, air bosses, and air traffic controllers, to the exceptional quality of our aircraft servicing, these attributes allow us to ensure that our performances for the public are an example of the highest safety and professional standards within the air show industry.

The following document supplements the actual ribbon diagrams by outlining the numerous factors that together build and govern the precision aerobatic demonstration that inspires millions each year. With your assistance, we seek to complete our 48th successful Snowbirds season. We look forward to working with you and your representatives to continue a tradition of excellence throughout the upcoming year.

*The Hatiten Ronterios --- Warriors of the Air*



Michael French  
Lieutenant-Colonel  
Commanding Officer

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## **GLOSSARY**

### **1 CAD (1 Canadian Air Division)**

#### **1 CAD Air Display Organizer's Package (Annex H)**

The governing document that defines the requirements of the Royal Canadian Air Force for either static or flying aircraft displays.

### **2 CAD (2 Canadian Air Division)**

#### **AD (Air Demonstration)**

431 (AD) Sqn or fully 431 Air Demonstration Squadron

#### **AGL (Above Ground Level)**

Unit of measure to describe the aircraft altitude above the surface of the earth.

#### **ARFF/CFR (Aircraft/Airfield Rescue and Firefighting/Crash Fire Rescue)**

Used to describe the host airport's rescue capability.

#### **ASL (Above Sea Level)**

Unit of measure to describe the aircraft altitude above sea level.

#### **B-GA-100 -National Defence Flying Orders (Annex E)**

The governing document for Flight Rules and Air Standard for the Canadian Forces.

#### **Dead Side**

The area behind the Crowd Line when they are facing the event.

#### **DND (Department of National Defence)**

#### **FAA (Federal Aviation Administration)**

The governing body for all aeronautical activities within United States Airspace.

#### **FOM (Flight Operations Manual) (Annex F)**

The governing document of orders for all flight and aircrew operations in the RCAF.

#### **FSDO (Flight Standards District Office)**

The FAA regional office that looks after all temporary flight restrictions and waivers.

#### **Live Side**

Typically the area directly in front of crowd.

**NOTAM (Notice to Airmen)**

A notice issued by a governing authority to pilots about restrictions and abnormalities within airspace.

**PAO (Public Affairs Officer)**

Snowbird team member specially trained to manage media, conduct public outreach, and interact with the public.

**PSA (Primary Spectator Area)**

Location parallel the Show Line where the majority of the crowd gathers, and is under control of the organizer.

**RCAF (Royal Canadian Air Force)**

Canadian's branch of the armed forces which encompasses all flying units and assets in the Canadian military.

**SET (Standards, Evaluation, and Testing)**

**Sterile Air Display Area (SADA)**

Formerly known as the "Aerobatic Box", this is the area where no ground personnel other than essential personnel are allowed to enter while the Snowbirds perform.

**Show Line**

The line indicated by the air show organizer on which all performers will conduct their manoeuvres.

**Show Site**

The location where the aerial event is going to take place. This does not have to be the location the aircraft will arrive and depart from.

**Smoke Oil**

The diesel fuel utilized by the Snowbirds for the smoke in their demonstrations.

**Smoke-On**

The time from which the Snowbird Coordinators will take the microphone and begin the commentary and music for the performance. Despite its name, this may not coincide with the release of smoke from aircraft at this time.

**Team Coordinators / Advance & Safety Pilots**

Snowbirds 10 and 11. One will be assigned as the primary point of contact for each show. They also coordinate all aspects with Transport Canada and the FAA.

**TFR (Temporary Flight Restriction)**

A restriction put into place by the FAA for the purposes of conducting air shows. Only required in the USA. This is roughly the equivalent to a restricted airspace NOTAM in Canada.

## **SNOWBIRDS CONTACT INFORMATION**

### **Snowbird 1 - Team Lead**

Major Denis Bandet  
Cell: 306-630-2780  
Email: [denis.bandet@forces.gc.ca](mailto:denis.bandet@forces.gc.ca)

### **Snowbird 10 - Lead Coordinator**

Captain Blake McNaughton Cell: 306-684-1778  
Email: [snwbd10@gmail.com](mailto:snwbd10@gmail.com)

### **Snowbird 11 - Coordinator**

Captain Robbie Hindle  
Cell: 306-681-5303  
Email: [snwbd11@gmail.com](mailto:snwbd11@gmail.com)

### **Snowbird Public Affairs Officer**

Lieutenant (Navy) Michele Tremblay  
Cell: 306-681-3170  
Email: [snwbdpao@gmail.com](mailto:snwbdpao@gmail.com)

### **Commanding Officer**

Lieutenant-Colonel Michael French  
Cell: 306-631-3043  
Email: [michael.french2@forces.gc.ca](mailto:michael.french2@forces.gc.ca)

### **Mailing Address:**

The Canadian Forces Snowbirds  
15 Wing Moose Jaw  
PO Box 5000  
Moose Jaw, SK S6H 7Z8  
Canada  
Phone: 306-694-2431



## **BACKGROUND – THE CANADIAN FORCES SNOWBIRDS**

### **The Squadron**

The Snowbirds are a Canadian icon comprised of 431 Air Demonstration Squadron, Canadian Armed Forces (CAF) members. Pilots, technicians (aviation, avionics, aircraft structure, supply), mobile support operators, resource management support clerks, engineering officers, a logistics officer and a public affairs officer, representing all three elements (Army, Navy and Air Force), work as a team to bring thrilling performances to the Canadian public. Serving as ambassadors, the CF Snowbirds demonstrate the high level of skill, professionalism, teamwork, discipline and dedication inherent in the men and women of the CAF and they inspire the pursuit of excellence wherever they go in North America.

### **Air Demonstration Flight**

With nine Show Pilots, two Team Coordinator Pilots, one Public Affairs Officer, 12 Technicians, one Supply Technician, and one Mobile Support Vehicle operator, the “Air Demonstration Flight” travels across North America each year. They perform approximately 60 shows in about 40 locations between May and October. The Air Demonstration Flight is comprised of 11 jets, the Snowbirds’ Mobile Support Vehicle (MSV) tractor trailer and a Light Support Vehicle (LSV) pickup truck, bringing their show to both large and small communities alike.

While the Air Demonstration Flight is deployed, the Squadron, led by the Snowbirds Commanding Officer, provides support to the deployed elements, begins to train the following year’s team, and ensures that the other home based aircraft are excellently maintained and available should the need arise.

### **The History**

With its roots beginning with the Golden Centennaires, an air demonstration team that performed in honour of Canada’s Centennial in 1967, the Snowbirds have a proud and inspiring history of professional service to Canada.

The Snowbirds received their name as a result of a contest held at the Canadian Forces Base Moose Jaw Elementary School in 1971. They then flew for the first time on 11 July of that year at the Saskatchewan Homecoming Air Show.

As a tribute to their home province of Saskatchewan, the Snowbirds’ crest displays four “Speed Birds” in formation resembling a sheaf of wheat. The Speed Bird is also shown on the bottom of each Snowbird aircraft.

The Snowbirds are the only jet team in North America to perform with nine jets flying in close formation. This requires the highest degree of piloting skill and show pilots have on average 15 years of military experience and thousands of hours flying various aircraft in the Canadian Forces. Similarly, Snowbird technicians are not only highly skilled and well trained, but they also demonstrate remarkable dedication and teamwork.

### **The Tryouts and Training Season**

Before the show is performed in front of the North American audience, the team undergoes extremely selective tryouts and an intense training season. Every year, the Snowbirds aim to accept four new show pilots to the team. During the three-week tryout the pilots are evaluated on their formation flying proficiency, but also on their suitability to act as Canadian ambassadors. The thorough selection is usually completed in the month of February a year prior to joining the team.

The new Snowbirds pilot’s typically commence their training the following July, when they begin aircraft conversions. Once the previous year’s Team has finished



Golden Centennaires 1967

the show season, a new training season begins spanning October until May. With two or three practices per day, this extremely demanding training program is not only strenuous for the pilots, but also for the technicians who work diligently to ensure the Squadron's aircraft and maintenance personnel are prepared for such a demanding summer flight schedule.

In April of each year, the team deploys to 19 Wing in Comox, British Columbia, for a final three week training session to hone their skills flying over water and mountains. During this time, the Coordinating team puts the finishing touches on the show music, narration and production. In May, the Commander of 1 Canadian Air Division inspects the team's show ensuring that it meets safety requirements and that it represents the best of the Canadian Forces.

The Snowbirds deploy from their home base of Moose Jaw, Saskatchewan in May for about six months and travel across Canada and the United States performing in air shows and civic events. While deployed, the Snowbirds not only perform in air shows but they also participate in a variety of community activities, often including school, hospital and cadet visits. One of the best parts of their job is this privilege of meeting such a wide variety of North Americans day in and day out.

### **The CT-114 Tutor**

The Snowbirds fly the CT-114 Tutor, a trainer jet built by Canadair in the mid-1960s, which was used for pilot training until 2000. A very maneuverable aircraft, the CT-114 Tutor jet is ideally suited to formation and aerobatic flying. Its relatively slow speed for a jet (maximum speed 412 knots), coupled with its maneuverability allows the Snowbirds to keep their formations continually flying in front of the spectators. Similarly, with regard to maintenance, the Tutor is a robust, well-built jet that is relatively easy to maintain. This assists Snowbirds technicians to ensure that all jets are ready to fly multiple missions on a daily basis.

The 7,170 pound Tutor jet is only slightly modified for Snowbird employment through a smoke generating system and an unmistakable red and white paint scheme. The smoke generating system highlights many aspects of the Snowbirds' dynamic show. It also provides distinct smoke trails, allowing the pilots to better identify each other and predict one another's flight paths. The Snowbirds' unique paint scheme provides a sharp contrast to most skylines, and coupled with the Tutor's performance, makes for a beautiful and exhilarating show.

### **The Show**

During each show, the pilots fly at speeds ranging from 100 to 320 knots and fly in formations with distances as close as four feet of wing overlap. The formations include exciting loops, rolls and solo passes in addition to graceful nine-jet arrangements. To complement this aerobatic excellence, a selection of music is chosen and compiled by squadron members to accompany each show. With more than 50 different formations and maneuvers in their 30-minute show, the Snowbirds' performance leaves audiences with memories which are both inspiring and enduring in nature.

As ambassadors for the Canadian Armed Forces and of Canada, the Snowbirds consider it an honour and a privilege to perform in communities all across North America. They proudly represent all men and women in Canada's military, serving both at home and on deployed missions overseas.

## **APPROVALS**

### **In Canada**

In accordance with 1 CAD APPROVAL OF AIR DISPLAY (B-GA-100, Book 1 of 2, Ch 11 & the RCAF Flight Operations Manual, FOM), a manoeuvres package and draft operations order for the show season will be sent, prior to the Show Team's deployment to Comox, to the 15 Wing Commander for staffing through the Tutor Standard, Evaluation and Testing (SET) cell, Special Events Coordinator, to the Commanders (Comds) 1 and 2 CAD for review. The manoeuvres package must conform to North America standards IAW B-GA-100 Chapter 11 and FAA Chapter 6. At the Acceptance Show, the Comds 1 and 2 CAD or a delegated officer will sign the manoeuvres package/operations order granting approval for the show season.

### **In the United States of America (USA)**

The manoeuvres package will be provided to the FAA prior to the Show Team's deployment to Comox for review, feedback, and approval. FAA NAES, or designate, will be invited to attend the acceptance show, or first practice in the USA to review the flying demonstration for Letter of Authority (LOA) approval.

## **TRAINING**

### **Aircraft Technicians**

Maintenance personnel are all qualified Aircraft Technicians graduated from the Canadian Forces School of Aerospace Technology and Engineering (CFSATE). The school conducts apprentice level training in accordance with approved doctrine and standards for various trades, including Avionics (AVS), Aviation (AVN), and Aircraft Structures (ACS) technicians. These courses precede the 431 (AD) Sqn graduates going directly to the flying squadron where they complete on-job-training and on-type courses for the CT-114 Tutor Aircraft.

### **Pilots**

All Snowbird pilots, 1 through 11, are qualified Canadian Forces pilots and have successfully completed the Snowbird Conversion Course on the CT-114 Tutor aircraft and meet the current Aircraft Captaincy requirements outlined in the B-GA-100 and RCAF FOM. When flying, they are operating as per the squadron Standard Manoeuvres Manuals (SMM) Vol 1 & Vol 2 (Annex H and Annex I) under the authority of the Comd 1 CAD. In accordance with the RCAF FOM, prior to the advanced training for Snowbirds 1 through 9, the Comd 1 CAD will approve a stated intent for the upcoming show season; a list of proposed show season manoeuvres not already approved in the squadron SMM; and a request to train and a training plan covering the requested manoeuvres. Team Lead, Snowbird 1, is selected from a past Snowbird wingmen pool and receives training from the previous Lead before commencing winter training season.

### **Training Plan**

Each year the Snowbirds create a new sequence of approved manoeuvres for each of their four shows. As such, in addition to training the new pilots on the team, manoeuvres not flown in the previous year must be trained and solidified prior to the acceptance show approval. This is accomplished by a detailed Training Plan developed by the Snowbirds Training Officer and approved by Comd 1 CAD. It follows a building block approach to progression with specific attention to specialty manoeuvres, skill consolidation, and emergency considerations. See Annex G.

## **SHOW PERSONNEL**

The following pilots are authorized to perform in the 2018 Snowbirds show:

Team Lead	Snowbird 1	Major Denis Bandet
Inner Right Wing	Snowbird 2	Captain Sarah Dallaire
Inner Left Wing	Snowbird 3	Major Jason Tuckett
First Line Astern	Snowbird 4	Major Stephen Melanson
Second Line Astern	Snowbird 5	Captain Kevin Domon-Grenier
Outer Right Wing	Snowbird 6	Major Bassam Mnaymneh
Outer Left Wing	Snowbird 7	Captain Pierre-Marc Deschenes
Lead Solo	Snowbird 8	Captain Greg Hume-Powell
Opposing Solo	Snowbird 9	Captain Taylor Evans

The (ground) Safety Pilots are:

Snowbird 10	Captain Blake McNaughton
Snowbird 11	Captain Robbie Hindle

Aircraft airworthiness maintenance shall be completed by 431 (AD) Sqn aircraft technicians under the supervision of:

Crew Chief	Snowbird 1A	Sergeant John Enright
Deputy Crew Chief	Snowbird 5A	Master Corporal Shawn Falzarano

## **PARTICIPANT'S SAFETY BRIEFING ATTENDANCE**

At each air show, a Snowbird representative shall attend the Participants Safety Brief, or "Air Boss Brief". Normally, this will be a designated "Show Pilot" pre-selected from Snowbirds 2 through 9; however, on occasion Snowbird 1, 10 or 11 may also serve as the Snowbird representative. All pertinent show information shall be conveyed back to the Snowbirds via a team brief.

## **SHOW AIRCRAFT**

The aircraft used in the Snowbirds' performances are nine CT-114 Tutors. There are two CT-114 Tutors that sit as spare aircraft on the ground for use in case of issues with any of the primary aircraft. All eleven CT-114 Tutors are assigned to 431 (AD) Sqn as part of RCAF CT-114 fleet inventory and are owned and operated as property of Canada's Department of National Defence (DND).

### **Liability Insurance**

The Snowbirds, as representatives of the Government of Canada and the Crown, do not carry any form of liability insurance. The Crown is self-insured and thus covers all its liabilities from Crown assets. It is the Organizer's responsibility to contact Transport Canada or the FAA to determine the degree of insurance required for each event.

## **USA DIPLOMATIC OVEFLIGHT AND LANDING CLEARANCE**

The Snowbirds operate in the USA under the guidelines of the annually renewed Diplomatic Overflight and Landing Clearance Procedures. Each year in accordance with the "Canada-United States Permanent Joint Board on Defence, letter from United States Section Chairman to Canadian Section Chairman 18 April 2000", the Department of State completes a review and pre-approval of all Canadian military aircraft conducting routine flights (to include but not limited to transits, maintenance flights, exercises, transport, air displays, etc.) and operational units in transit, that they may file directly to their U.S. destination without specific approval of the Department of State or Military Services. For 2018, this approval was granted 29 Nov 2017 by Department of State to the Canadian Defence Liaison Staff (Washington) Air Attaché. See Annex I.

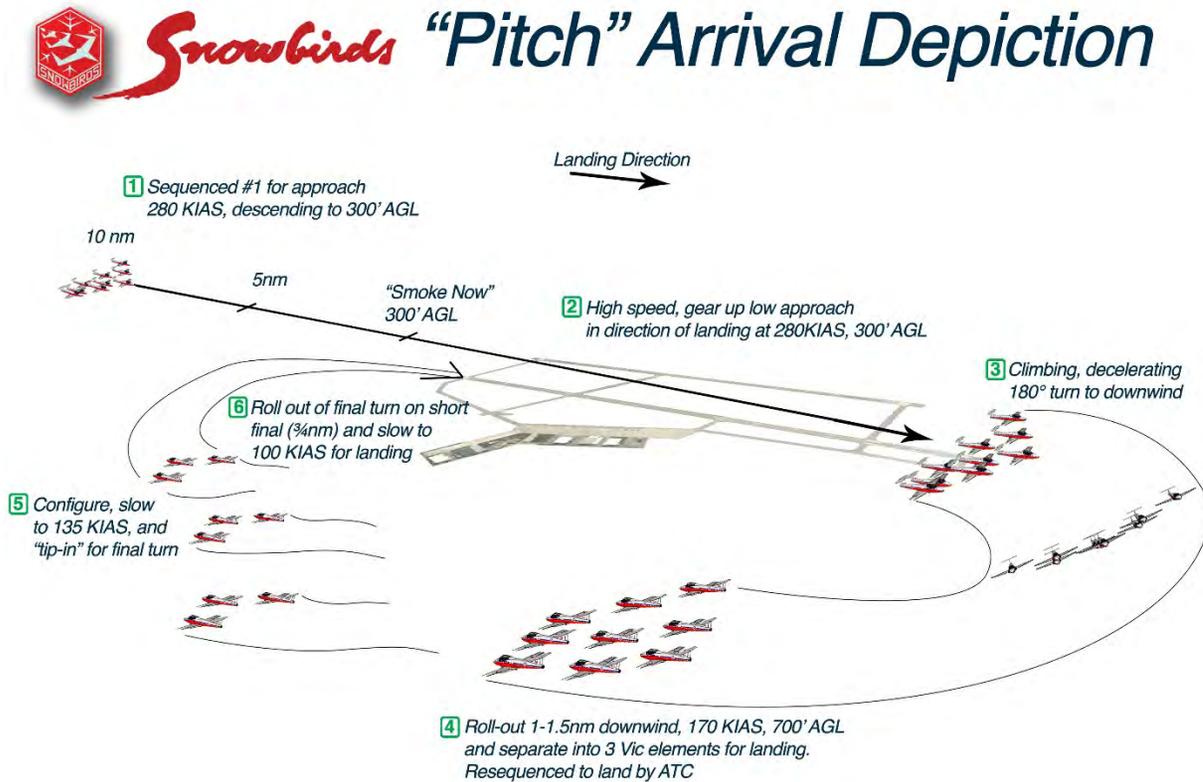
## **ARRIVAL RECCE**

For Snowbirds arrivals (typically Tuesdays and Thursdays,), fuel permitting, the Team Lead will want to overfly the SADA to visually verify Show Line markers and identify ground features. This "reconnaissance" or "recce" is a safety item that takes 5-10min. The 9 aircraft separate into "trail" with each aircraft 500ft behind one another creating a long train. This train then overflies the show-site North-South, West-East, South-North, East-West in a clover shape before setting up to land. The compass directions will vary depending on the orientation of the SADA. At controlled airports it will be coordinated with ATC. In Canada this may be flown as low as 300ft AGL and at 300kts. USA show sites, however, will require additional FAA waivers for this arrival recce if the Snowbirds plan to be low level or above 250kts. Additional waivers will be arranged in advance with show organizers and FAA. If waivers are in place, a briefing will be completed prior to arrival.

## SNOWBIRD PITCH

This is the preferred method to recover at show airports following a performance. The Snowbird Standard Manoeuvres Manual (SSM) outlines the following reasons:

1. Provides a safe method to recover large formations by keeping the formation together as long as possible;
2. Maintains energy for all formation members such that an emergency forced landing is possible from most points in the manoeuvre;
3. Minimizes traffic and RT congestion at the recovery airport;
4. An efficient method of losing energy without excessive throttle reductions;
5. Provides predictability for the congested airport environment; and
6. Provides a degree of showmanship during arrival to ground observers.



## **AIRFIELD RESCUE AND FIRE FIGHTING (ARFF)**

The Snowbirds require firefighting services be in place at all times when the Team flies, including arrival, practice, media flight (if applicable), and show. ARFF **must** maintain an immediate response capability during each of these timeframes. The Snowbirds will provide air show organizers with a Snowbird extraction package and corresponding video for amplification to be given to all ARFF crews prior to Technical Coordinator arrival briefing.

During flying operations, the Coordinators/Safety-Pilots must either be immediately adjacent to the Air Boss with direct contact to ARFF by secure radio, OR adjacent to an ARFF representative with secure radio contact to ARFF crews.

### **Arrival Briefing**

The crews from the show ARFF Team must be available for the arrival of the advance party. After the aircraft have been secured (~30min), the Technical Coordinator will provide a briefing to the ARFF crew on the safety considerations of the jets. If ARFF crews switch due to shift changes, the ARFF commander must ensure that any replacement ARFF crews are briefed by outgoing crews on these safety considerations. For overwater shows, the crash boat operator and rescue divers must attend this briefing as well.

### **On-Site ARFF Facilities**

ARFF crews **must** be on standby or in position on the airfield for the Snowbirds' arrival, practice, media flight, shows and departure. ARFF personnel are deemed essential personnel and can therefore be positioned inside the Sterile Air Display Area. In all cases however, they must remain a minimum of 200 feet back from any active runway.

### **Off-Site ARFF Facilities**

If the airport is not equipped with an ARFF crew, organizer must ensure the local community supplies at least one fire truck capable of dispensing water to a crash scene and one ambulance for arrival, practice, media flight, and shows.

### **Overwater Shows**

If the show is over water, in addition to the information above, organizer must provide at least one crash boat to be in proximity when the Team flies, including practice, media flight, and shows. This requirement also applies if the show box is not over water but there is a large body of water in close proximity to the show site. Rescue divers for overwater shows must hold, as a minimum, a civilian diver's certification as well as a Basic First Aid certification.

## **SECURITY**

### **General Security**

The Tutor aircraft is equipped with ejection seats and a jettison capable canopy. All systems are secured while on the ground but the potential for a ground accident still exists. 1 CAD Air Display Organizers Package dictates the degree of security required for Snowbird aircraft. Unauthorized personnel and spectators must not be allowed to roam around the Team's aircraft.

### **Surveillance**

The Snowbirds require 24/7 surveillance of their aircraft from the moment of arrival until the last aircraft leaves the aerodrome.

### **Armed Response**

The Snowbirds require an armed response capable of responding to an incident within 5 minutes of the request by on-site security personnel. Furthermore, Snowbird aircraft must be located in a secure area at all times when the Team Members are not present.

## **CROWD SAFETY REQUIREMENTS**

### **Public Address (PA) System**

The PA system must be able to reach the majority of the crowd and thus extend most of the crowd line. Not only is a PA system important for the show, but also for Team and crowd safety. The PA system shall be set-up and fully functional for both Practice and all Show Days. As per the 1 CAD Air Display Organizer's Package, the Snowbirds are unable to perform without a suitable PA system in place.

### **Team Coordinator Location**

The Team Coordinators provide narration, music, and perform Safety Pilot duties during the Snowbirds Show. The Organizer must ensure they are located within the following guidelines:

1. In front of the crowd, preferably directly in front of Show Centre and separated from the crowd by a suitable fence; and
2. In close proximity to the Air Boss. It is ideal that the Air Boss and the Snowbird Coordinators be co-located on the show-stand. If you are planning to have a displaced Air Boss (i.e. located in the ATC tower) special coordination will be required for any emergency response. If there is no Air Boss, then the ARFF commander should be situated next to the Coordinators.

## **EMERGENCY RESPONSE PLAN (ERP)**

The Snowbirds ERP begins with the Snowbirds Safety Pilot acting as our On-Scene Commander completing the following:

### Immediate actions

1. Direct immediate response for fire, rescue, and security;
2. Coordination with Air Boss/ATC for recovery of any airborne assets; and
3. Provide assistance to Air Show announcer and Air Show organizers for crowd safety and control.

### Secondary actions

1. Notify Canadian Forces Directorate of Flight Safety, Chain of Command, (in USA, DND will notify FAA & DoD)
2. Ensure the safeguarding of evidence for investigation;
3. Provide support to Air Show operations ERP; and
4. Provide critical data to Snowbird PAO and Air Show organizers for media requirements. (PAO contact info, page 7)

### Tertiary actions

1. Assist detachment Unit Flight Safety Officer to initiate Flight Safety response;
2. Gather Snowbirds team members for further direction; and
3. Hand over control, when relieved by DND Flight Safety organization or subsequent Snowbirds On-Scene Commander.

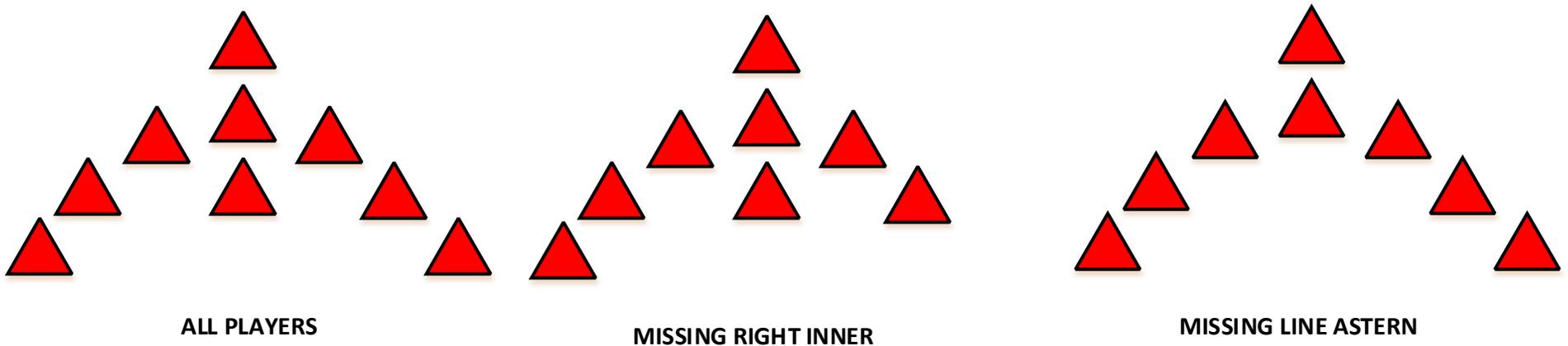
Additionally, the Snowbirds ground personnel will provide a Secure Emergency Team able to assist in recovery/quarantine/ preservation of evidence under direction of the DND Flight Safety Organization.

The Snowbirds ERP is primarily short-term guidance for directing the appropriate response for preservation of life, protecting assets, and facilitating follow-on investigation success as it relates to Snowbird air and ground operations. As such, the Snowbirds ERP is a small part of the more expansive and robust Air Show ERP, and the operational procedures required and governed by Transport Canada or the FAA. Air Show organizers and Air Bosses will be coordinated with to ensure the Snowbirds ERP is incorporated into the overall emergency response plan.

## **MISSING PLAYER PLAN**

If, for a non-critical emergency reason, the Snowbirds are performing with less than the normal nine aircraft, they follow a detailed contingency strategy for the loss of each position. This is a pre-planned design created by the Snowbirds Training Officer each year and briefed to all team members as a part of Spring Training. During each pre-show brief, a simulated emergency is conducted leading to a missing player scenario. The missing player plan is re-briefed to solve that scenario. In the actual event that an aircraft should have to land before the end of the show, the specific missing player plan encountered is verbally briefed on the team common radio frequency.

In all cases, Snowbirds missing player philosophy is that the inside missing player's position will be filled for aesthetics, but for the more demanding manoeuvres, i.e. splits or bursts, players will remain in their natural position with a "ghost" aircraft in between them and lead. A single solo show will encompass show line maneuvering without crosses.



## **WEATHER**

### **Weather Requirements**

The Snowbirds abide by very strict safety regulations. These include requirements for minimum visibility and cloud ceiling. In order to provide the greatest likelihood of being able to perform, the Snowbirds performance has been designed with four different possible show sequences:

**High Show:** *4500ft\* ceilings and 3 statute (SM) visibility.* This show intended for ideal weather conditions with little to no restrictions due to clouds or visibility.

**Low Show:** *1500ft ceilings and 3 SM visibility.* This show is flown when the weather is not ideal with respect to cloud cover and/or visibility but still allows some flexibility to the team while they perform.

**Flat Show:** *1000ft ceilings and 3 SM visibility \*\*.* This show is flown when cloud ceilings or visibility would prevent some of the more dynamic aspects of either the High or Low Shows.

**Non-Aerobatic Show (NAD):** The weather requirements are the same as the Low Show. This show is flown when it is impossible for the organizer to provide a Sterile Air Display Area (SADA). It is a series of level, topside, or bottom-side non-aerobatic passes. The nine aircraft remain together in one formation throughout, until ending with a non-aerobatic split and then into non-aerobatic trail manoeuvring. In the USA, this profile is considered simply VFR flying. It shall abide by normal VFR limitations at all times, remaining above 1,000 ft AGL above the highest obstacle within 2,000ft horizontally, and below the regulated airspeed. As such, no waivers are requested or given, and it is not an FAA approved manoeuvres package.

Should weather dictate, it is at the discretion of Snowbird 1 to switch between High Show, Low Show, and Flat Show. Despite weather conditions in excess of VFR requirements, any combination of factors (such as high surrounding terrain with low visibility) may preclude the Snowbirds from performing. In all cases the Team Lead makes the final decision based on all variables of the day for each show site.

Asterisks above indicate requests to 1 Canadian Air Division for deviations to retain operational flexibility as follows:

\*Less than the B-GA 100 CH11 ceilings of 5000ft; and

\*\*Less than the B-GA 100 CH11 visibility of 5 SM

## **AIRSPACE REQUIREMENTS**

In Canada, the Snowbirds request a 10 nautical mile (NM) radius centered on Show Centre with a height of 7,500 ft above ground level (AGL). While a 10 NM radius is preferred, reduced airspace dimensions may be accepted at the discretion of Snowbird 1, the Team Lead. If reduced restricted airspace dimensions are required, organizers are to contact the team for approval and carbon copy 1 Canadian Air Division.

In the United States, the Snowbirds request a 7 NM radius centered on Show Centre, and can accept a reduction to 5 NM if required.

## **STERILE AIR DISPLAY AREA (SADA)**

The Snowbirds require a sterile area (no persons other than essential personnel are allowed into this area, know as the Sterile Air Display Area, SADA) as detailed in the diagram below. Security personnel must block access roads that may enter or cross this area. Any buildings that lie within this area must be vacant. These measures must be in place prior to the Snowbirds performing. This includes all practice days as well as performances. This SADA is often referred to as the "Show Box". The standard SADA dimensions are depicted below with Show Line placement at 1,500ft front and back, which can be waived to 1,200ft with 1 CAD (and FAA in the USA) approval for a total of 2,700ft. The markers used to display the Show Line must be discernible at least 3nm from Show Centre at an altitude of 200' AGL. The Show Line and Crowd Left and Crowd Right markers must be clearly visible from the highest altitude required by the applicable team or 15,000ft over show center.

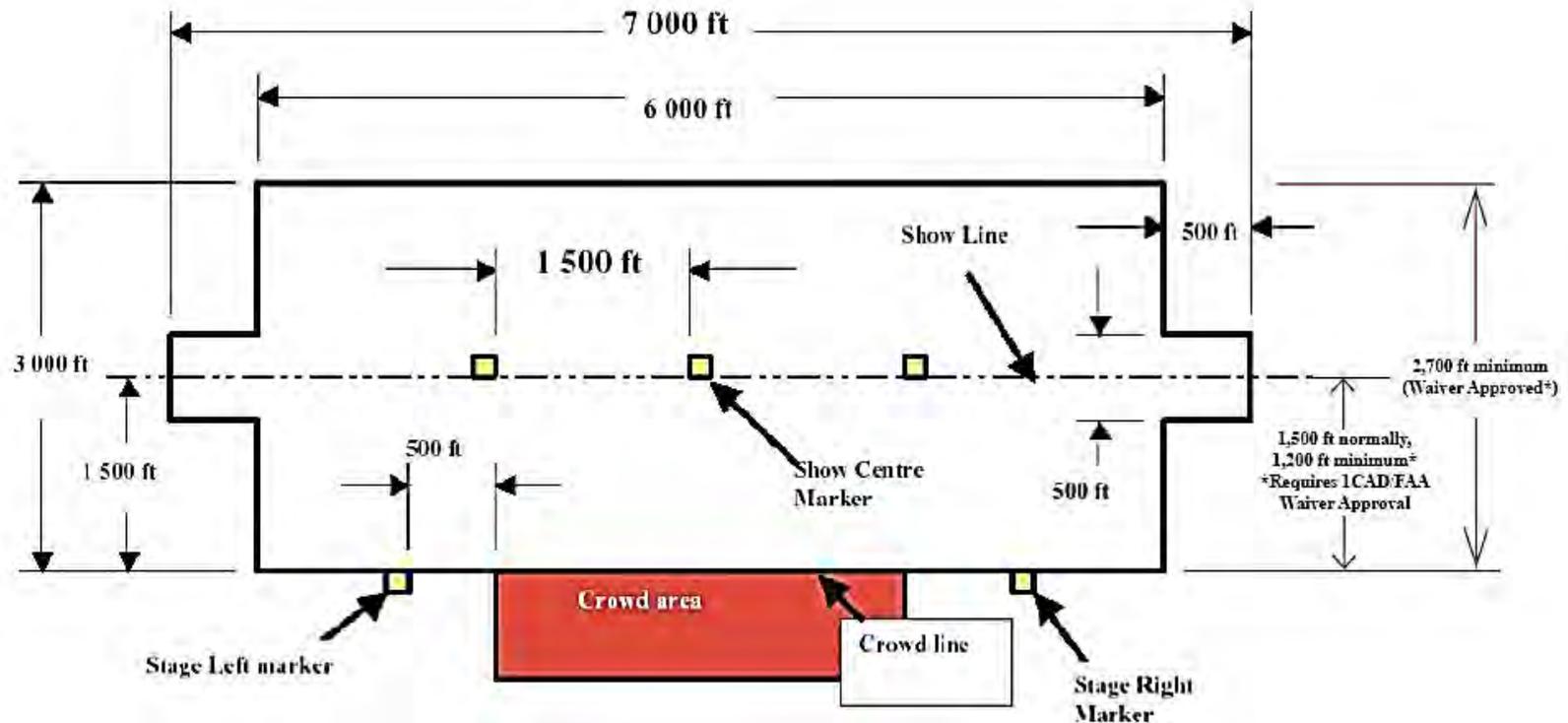
Organizers must advise well in advance if they are applying for a 1200ft show line waiver. 1 CAD, not the Snowbirds, are the approving authority on the waiver. FAA approval for 1200ft show line does not constitute 1 CAD approval, and both must be sought separately.

There are five markers as designated in the image below:

One marker at Show Centre, situated on the Show Line at the center of the Show Box;

Two markers on the Show Line, each approximately 1,500ft either side of the Show Centre marker. (If it is not geographically possible to locate each on 1,500ft from the Show Centre marker, they need to be at least equidistant); Stage left and Stage Right markers a minimum of 500ft from the left and right edges of the Crowd Line;

The barrier defining the Crowd Line must not be closer than 500ft from the closest active runway. As our aircraft occasionally manoeuvre to the rear of the crowd, the Crowd Line shall be no longer than 5,000ft.



## **PRIMARY SPECTATOR AREA (PSA)**

All Snowbirds aerobatic manoeuvring shall take place a minimum of the 1,500ft Show Line laterally from the Crowd Line, unless a reduction by 1 CAD and the FAA has been approved. Airspace in front of the crowd is referred to as “live side” while airspace behind the Crowd Line (i.e. behind the crowd when they are looking towards the Show Line) is referred to as “dead side”. All aircraft exiting towards the crowd dead side shall maintain a minimum lateral spacing of 500ft (Stage Markers) from the left/right physical boundaries of the PSA.

On occasion, Snowbirds aircraft require flight directly overhead the PSA when entering/exiting the SADA. Pending Comd 1 CAD approval of these permitted manoeuvres (per B-GA-100 CH11), all aircraft shall fly no lower than 500ft AGL overhead the crowd in a wings level or level to climbing orientation.

The PSA, Show Line, Show Centre, and Stage Left/Right Markers will be depicted as follows throughout the ribbon diagrams.



## **INGRESSING / EGRESSING THE SADA**

When ingressing towards the SADA, all Snowbird ingress altitudes shall be a minimum of 500ft AGL above the highest obstacle along the aircraft's track. Similarly, when egressing the SADA, all Snowbird egress altitudes shall be a minimum of 500ft AGL to climbing. When there is a need to ensure safe separation between formation elements egressing the SADA and those awaiting ingress, altitude blocks new pre-briefed accordingly.

## **AIRSPEEDS**

During the performance, the minimum entry and exit airspeed are 100 KIAS and the maximum planned airspeed is 320 KIAS. Pressure and Density Altitude calculations may require padding both airspeeds for added safety.

## **AEROBATIC MANOEUVRING**

The majority of Snowbird aerobatic manoeuvring takes place within the Sterile Air Display Area (SADA) commencing no lower than 300ft AGL and apexing no higher than 1,500ft AGL (Low Show) and 4,500ft AGL (High Show) respectively. Aerobatic manoeuvring which takes place outside the SADA (such as the Heart) commence no lower than 500ft AGL and become aerobatic passing 1,500ft AGL. Apex altitudes for both the Low and High Shows remain the same. Additionally, some show sites have built-up areas near the SADA that underlie flight paths depicted herein. To maintain safe and scripted flows as described below, on occasion aerobatic manoeuvring above 1,500ft AGL and over built-up areas would be required, as permitted in B-GA-100 with CAD approval. In three instances aerobatic manoeuvring will take place outside the SADA between 500ft AGL and 1,500ft AGL and is permitted in Canada with Comd approval. These manoeuvres are:

- “Twizzle” (#18 Low Show) – Snowbirds 8 and 9 execute single point rolls prior to crossing and turning onto Show Line;
- “Lagback Cross” (#28 High Show, #28 Low Show) – Snowbird 6 executes two barrel rolls prior to calling the split; and
- “Battle-of-Britain” (#40 High Show, #40 Low Show) – All Snowbirds approach the SADA in trail formation (300 – 2,000 ft.), individually manoeuvring towards the Show Line. Aircraft may be manoeuvring acrobatically prior to paralleling the Show Line in preparation for landing.

## **PERFORMANCE DIFFERENCES IN THE USA**

While in the United States, the “Battle-of-Britain” manoeuvre, if flown, will need to be flown in such a way as to remain non- aerobatic due to manoeuvring outside the SADA. Aircraft will not barrel roll but will instead maneuver fluidly remaining non- aerobatic. Additionally in the United States, the Canadian approved SADA will need to be modified in order to accommodate the “Twizzle Roll” and “Lagback Cross”. A live side sterile corridor/extension, 1,500ft wide and 9,000 ft long (as depicted next page) will need to be added to the Canadian SADA. If the sterile corridor can only be 1,500ft by 1,500ft than the “Twizzle Roll” can still be flown. If a live side sterile corridor cannot be created, the “Lagback Cross” and “Twizzle Roll” will be modified and flown in a non-aerobatic manner. Non-aerobatic versions of the maneuvers are depicted immediately following their respective aerobatic counterparts. Coordination between air display organizers, local FAA Flight Standards District Offices (FSDO) and the Snowbirds will occur to determine which sterile air display area will be used and which maneuvers will be flown accordingly.

## **GROUND TRACKS**

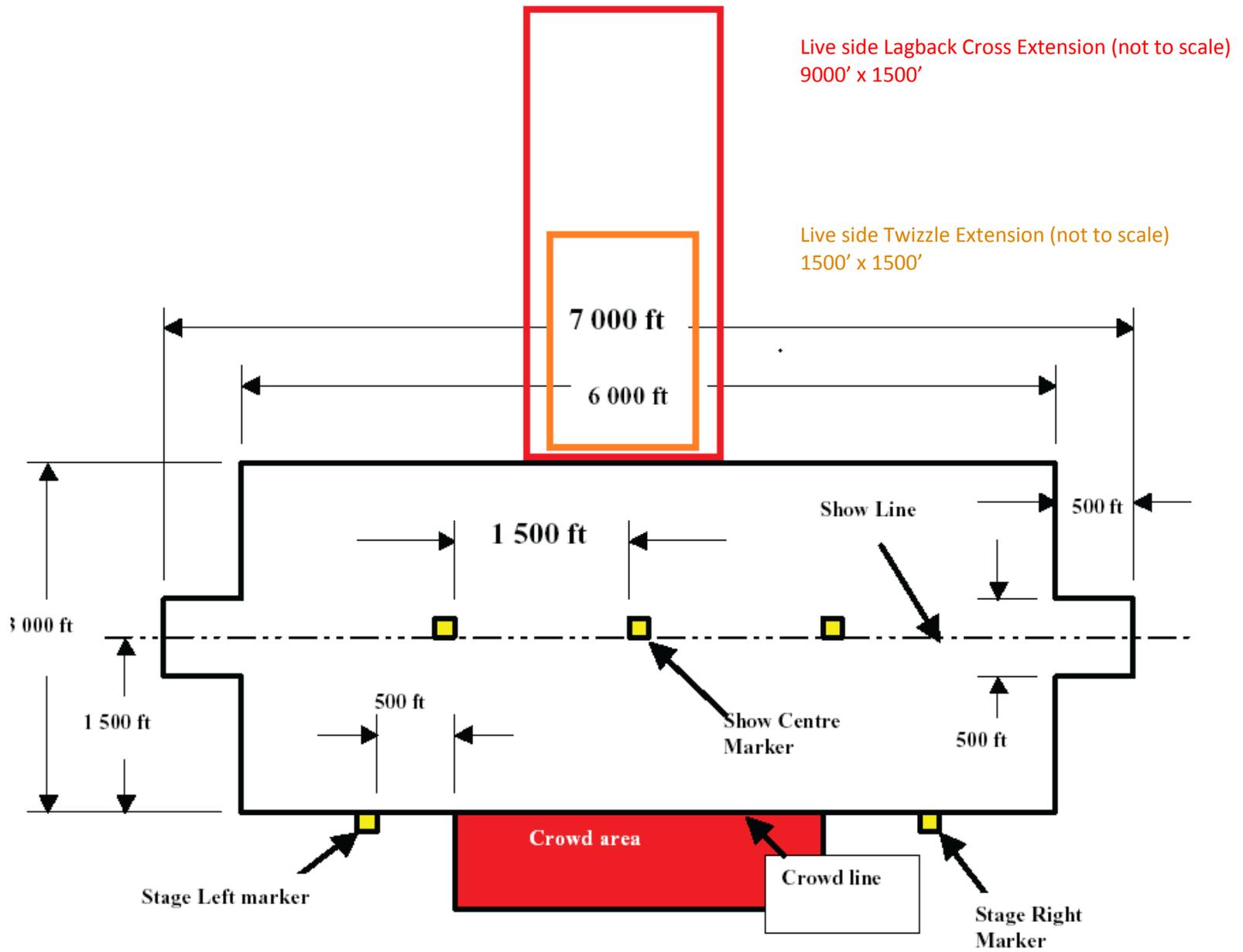
The ground tracks depicted in the ribbon diagrams represent the general flow of the main formation, solos, and specialty formations as applicable. Modifications of these ground tracks remains at the discretion of Snowbird 1, while retaining the intended flow. Additionally, Snowbird 1 maintains the ability to omit any sequences laid out in this maneuvers package in order to meet the desired conclusion for any show.

## **PERMITTED MANOEUVRES LEGEND**

All four ribbon diagrams in the annexes, conform to the same colour legend. Each manoeuvre has a classification colour box next to it to provide fidelity on the approval level required for each manoeuvre. Additional details are provide in text on each slide.

Manoeuvres have been classified as follows:

-  - Permitted Manoeuvres as per B-GA-100 Ch 11
-  - Permitted Manoeuvres requiring Comd approval as per B-GA-100 Ch 11
-  - Prohibited Manoeuvres as per B-GA-100 Ch 11; waiver required



## **LIST OF ANNEXES**

### **Ribbon Diagrams**

- Annex A - HIGH Show
- Annex B - LOW Show
- Annex C - FLAT show
- Annex D - Non-Aerobatic Show (Canada)

### **Supporting Documents**

- Annex E - B-GA-100 - Book 1 of 2, Chapter 11
- Annex F - RCAF Flight Operations Manual - Section 7
- Annex G - 2017/2018 Show-Team Training Plan
- Annex H - 2018 Snowbirds Support Manual
- Annex I - 1 CAD Air Show Organizer's Package 2018
- Annex J - 2018 Dept of State Overflight Letter
- Annex K - 431 (AD) SQN SMM Vol1
- Annex L - 431 (AD) SQN SMM Vol2

