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FIGHTER DEMONSTRATION MANUAL

Version 4.0

Issued under the Authority of Commander 1 Canadian Air Division

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Endorsed by:

Recoverable Signature

X A DComd FG Col Luc Girou...

BGen I.H. Huddleston
Deputy Commander Force Generation
Signed by: GIROUARD, LUC 607

Approved by:

Recoverable Signature

X 

MGen J.H.C Drouin
Commander 1 Canadian Air Division
Signed by: BOYLE, SEAN 627

Fighter Demonstration Manual Record of Amendments

Amend	DATE	DETAILS	DONE BY
0	XX Mar 19		Capt Thys R.G.T.

This document is issued on the authority of the OC Fighter Standards and Evaluation Team (FSET) and contains information specific to the employment and role of the Fighter Demonstration Team. Inquiries and suggestions for changes shall be forwarded through Special Events Coord and OC FSET for review and submission to SSO Fighters for the approval of the Commander 1 Canadian Air Division.

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Chapter 1: PREPARATION

The intent of the FDM (Fighter Demonstration Manual) is to provide a single point of reference for selection, training, preparation, and execution of the CF-18 Demonstration Mission. This document aims to avoid redundancy with superseding orders and manuals. All aircrew shall operate aircraft in accordance with the following orders as they apply to their particular aircraft types in the following order of precedence:

a. BGA-100 Flying Orders;

b. Flight Operations Manual;

c. 1 Cdn Air Div Orders;

d. AOIs;

e. FDM;

f. Wing Flying Orders; and

g. Squadron Flying Orders.

The FDM describes the considerations and details that surround the FDT (Fighter Demonstration Team). It forms a comprehensive training package intended to provide an experienced pilot, with the necessary background, to perform the CF-18 Demo profile safely and effectively through the airshow season. All manoeuvres are described in detail via fundamental procedures and mechanics. The intent is to standardize fighter aerobatics to the point that every manoeuvre is predictable, well understood, and above all, safe. Therefore, prior to deviation from the FDM, careful analysis, consideration and approval must be granted.

101. TEAM SELECTION

The incoming Fighter Demonstration Pilot (FDP) shall be, at minimum, a PTLL3 pilot with no less than 500 hrs on the CF-18. If possible, the incoming FDP should either be qualified as Maintenance Test Pilot (MTP), or acquire the qualification prior to starting the demo season. In order to embark on an ideal timeline, and to allow for continuity, the incoming FDP shall be appointed no later than 01 November by the Fighter Capability Advisory Group (FCAG). Ground crews should be identified before the end of December.

102. AIRSHOW ROUTINE

The FDP should work early to develop the required skills to perform the enclosed High and Limited/Flat Show routine. The incoming FDP should work with the outgoing pilot in order to review the routines and develop the required mechanics to execute a safe and effective air demonstration routine. The manoeuvres of the High and Limited/Flat Show should roughly follow the same sequence of events so that if the weather becomes a factor during the display, the pilot can easily switch to the Limited/Flat show. The enclosed routines have been reviewed by the chain-of-command. Each year an acceptance show shall be performed prior to departing for the airshow circuit.

103. FIGHTER DEMONSTRATION TRAINING

The Fighter Demonstration Training Syllabus at Annex A, outlines minimum requirements for Upgrade Pilot (UP) to reach standards as FDP. Additional sorties can be added to either Instructor Pilot (IP) proficiency flights (AD IP 1-3) or Student Upgrade flights (AD10-17). IP and/or Safety Pilot recommend, and local training supervisor (Squadron CO level or equivalent) approves additional sorties.

Pre-flight briefings shall discuss topics contained in this guide, as well as detailed manoeuvre mechanics. FDP should also review the CF188 Aircraft Operating Instructions (AOI), applicable TMVs, BGA-100 orders, 1 CAD Orders, RCAF FOM, and Wing Flying Orders.

Simulator training missions shall cover both the High and Limited/Flat Show, as well as present engine and flight control emergencies throughout the routine. As a result of inaccuracies in the simulator flight performance model, particular caution should be exercised, and FDP shall strive to maintain the aircraft within its designed limitations and restrictions at all times.

Dual sorties are identified in the syllabus. IP AD 3 will have UP in the backseat, with IP performing the routine. The rest has UP flying the routine with IP instructing/observing from the backseat.

A sample Performance Review Card is also included at Annex B and shall be included and tracked as part of the members Training File. IP shall continuously monitor and assess UP up to and including EAD4. Grading levels are in accordance with current Fighter Pilot Training Directive (FPTD).

104. ACCEPTANCE SHOW

The work-up program is concluded with the successful completion of the Acceptance Show. This will normally be scheduled in conjunction with the

Snowbirds Acceptance Show. The Acceptance Show consists of a detailed briefing followed by an air demonstration, and debriefing of the performance. Prior to the acceptance show, the Commander shall have already had an opportunity to review the manoeuvre package.

On successful completion of the Acceptance Show, Commander 1 Canadian Air Division or his delegate will formally clear FDP to perform the CF-18 Demo routine by signing the Transfer Of Authority (TOA) message to transfer Operational Control (OPCON) of the Demo Team from 3/4 Wing to 1 CAD A3 CAOC Dir who will be responsible to manage the CF-18 Demo Team for the airshow season.

Chapter 2: OPERATIONAL CONSIDERATIONS

201. CONFIGURATION

The required demo jet configuration is a clean CF188A/B (no pylons, except station 5) with dummy bullets or ballast in the nose. Internal fuel is sufficient to conduct the full routine with additional pyro passes. A CF188B is an acceptable airshow configuration. It generally performs well, with slightly less internal fuel available.

It usually takes 1000 lbs of fuel for start, taxi and runway delays, FDP should plan accordingly. For offsite shows, the routine must be amended to ensure sufficient transit fuel remains after the routine.

202. AIRCRAFT LIMITS

Aircraft limits are in accordance with the CF188 AOI. The current version of the AOI should be consulted and supersedes information in this section.

Points to highlight from the AOI which directly affect the airshow routine include: Angle Of Attack (AOA), G-limiter, tire speed, landing gear down/in transit G limits, and prohibited manoeuvres and aircraft tones.

a. If flying the demo in a CF188B, different AOA limits apply. For CF188B aircraft above Mach 0.8, the AOA limit is -6°/+15°, and between Mach 0.7 and 0.8, the AOA limit is -6°/+20°. The demo profile does not consistently operate in these regimes, but awareness is necessary as it is possible to exceed these limits.

b. The G-limiter is an effective tool until 3300 lbs of fuel, at which time G application must be manually monitored;

c. Tire limit speed is 190 Kts Ground Speed (GS) for the nose wheel tire, and 210 Kts GS for the main tires. The take-off manoeuvre for the air show sequence must ensure that these limits are not exceeded. Tailwind shall not exceed 10 Kts for the “take-off dirty roll” manoeuvre;

d. G-limits when the landing gear is in transit must be considered if the take-off roll manoeuvre is to be performed. Symmetrical limits of +0.5 to +2.0G and asymmetrical limits of +0.5 to +1.5G with gear in transit are in effect. The landing gear should not be retracted

until the roll is completed in order to minimize the chances of exceeding the asymmetrical limits or damaging the gear doors;

e. Prohibited manoeuvres which directly affect the air show sequence are:

i. Negative G flight greater than 10 seconds, less than one minute between negative G manoeuvres;

ii. Bank angles greater than 180° at negative G;

iii. Zero G, except transient;

iv. Dive angle greater than 45° with less than 1900lbs of fuel remaining (though the routine shall be complete at this fuel state);

v. Stick and/or rudder inputs over 360° of roll or yaw;

f. The aircraft is susceptible to certain tones when performing the air show routine. The AOA tone is activated at greater than 35° AOA and less than –7° AOA. These AOA tones are very possible during the square loop manoeuvre. Also, a tone is heard when <175 KCAS, <7500 ft altitude, landing gear up, and a descent rate greater than 250 ft/min. This gear tone is heard at the top of the initial looping manoeuvre and may be intermittently heard if performing the high alpha pass.

The points contained in this section are not all inclusive. A sound knowledge and understanding of the current AOI is mandatory for the FDP.

203. FLIGHT EQUIPMENT

The flight equipment used by the FDP is no different than that used by any other fighter pilot; however, the contents of the cockpit shall be limited as much as possible. The aircraft checklist and seat pins are generally carried in the g suit pocket with no helmet bag or other materials present and unsecured. The RCS mesh is insufficient to hold items in the “VTR bay” during flight demonstrations. It is essential that the demo pilot’s G-suit is properly fitted at all times. The oxygen mask is another item requiring a tight fit. Under high G manoeuvres, an unwanted downward movement of the mask is possible if the mask is not sufficiently tight.

204. AIRSHOW PRACTICE

Practicing of the High and Limited/Flat Show routines are essential in maintaining a safe and effective show standard.

Conduct:

a. Pre-flight items of an airshow practice include a review of NOTAMs, weather, and DA; as well as a detailed briefing with the tower (co-ordinating timings and airspace requirements). A review of the last practice/show is ideally conducted as part of the briefing process;

b. The flight portion of the practice involves flying the High / Limited Flat Show in accordance with the brief; and

c. The debrief involves a critique of the practice flown with a full tape review, normally with the Safety Pilot or previous year's FDP.

The type of practice flown is normally dependent on the type of show expected at the next show site.

a. A standard show (High or Limited/Flat) involves a start from take- off, flown within the airport environment. This is the style of performance found at most show locations;

b. An airborne start is the type of show found at off-site locations, or sites where the show-line is radically different than the take-off runway. This practice involves starting the show from an airborne posture;

c. Visual Pyro/Attack pop manoeuvres should be rehearsed as there are numerous sites that will integrate pyrotechnics at the show;

d. Heritage flights (dissimilar aircraft formation) - 1 CAD approval is required for all dissimilar flight. If a dissimilar fly-past is approved, it is recommended to practice with the heritage aircraft and pilot prior to the air demonstration.

e. Over water show: several show sites have a display area over water, such as Toronto and North Bay. Practicing in this environment is essential as the visual cues and site picture are substantially different.

The number of practices conducted each week varies with experience and proficiency.

a. Experience: On completion of the work-up program, but prior to the first show site, daily practices are recommend if feasible. Once the show season is underway, one practice per week is sufficient;

b. Proficiency: Exceptions to the above paragraph exist. If the air show schedule results in a week or two of leave, an increase in the number of practices is required on return from vacation. As well, the first show

site requiring a different type of show, such as overwater or offsite, suggest a dedicated practice; and

c. Ultimately, the amount of air show practices rests with the FDP. The above paragraphs act as a guide only.

205. 5000 ft RUNWAY OPERATIONS

Operating out of short runways may be required throughout the air show season. The 410 TF(OT)S SMM includes a section detailing proper landing technique and provides considerations for short field landings. Many 5000 ft airports are single runway configurations. Retaining large amounts of alternate fuel may be undesirable when factoring for stopping distance, especially at high density altitude.

Employment of a Mobile Aircraft Arresting System crew for short runways is highly recommended. If the runway is wet, there may be insufficient runway remaining to stop the aircraft.

--> Landing Weight: 27000 lbs
DA: 0.95 (25° Celsius at 500 feet MSL) Head Wind: 0 Kts

--> Runway required
Dry: 2800 ft
Wet: 4600 ft

--> Runway required with 50 ft obstacle clearance
Dry: **3617 ft**
Wet: **5417 ft**

206. MOBILE AIRCRAFT ARRESTING SYSTEM

The Mobile Aircraft Arresting System (MAAS) crew is located at 8 Wing Trenton, and normally completes their annual training requirements in conjunction with the expected show season requirements. Requesting MAAS early on for any site with runway length less than 6000 ft is advisable. Other criteria such as elevation and the proximity of suitable alternates (generally within 30nm and runway greater than 8000 ft and/or equipped with a cable) should be taken into consideration.

Erecting and dismantling of the arresting system normally takes about five minutes. The safest and most efficient method is to have the MAAS team set up the gear immediately before the routine (during taxi). The MAAS crew is part of the FDT and considered essential personnel. They will be equipped with a radio and on Air Boss frequency.

Once the MAAS has been erected on-site, certification is required. The parameters for certification are outlined in the 1 CAD Orders Vol 11, 11-002 ANNEX C – para 7.b(2).

An additional consideration when operating with a MAAS system is that the demo aircraft generally rotates about 2500 ft down the runway which can be right where the arresting system is located. The tail comes very close to the ground and there is risk of hitting or damaging the cable during the aggressive lift off. If this is the case, careful planning will be required and a standard take-off rotation may be preferred instead of the aggressive rotation prescribed in this SMM for the take-off dirty roll manoeuvre.

207. OFF-FIELD SHOWSITE CONSIDERATIONS

Off-field shows require some slight modifications to the demo sequence. Simulating the take-off dirty roll from an airborne start is not possible. An off-field show will normally start with a high-speed pass. Altimeter setting, fuel and synchronization of music requires special attention with off-field displays. The altimeter is normally set to read zero at the surface of the display area. Simple elevation errors have been made on a number of occasions. Elevation can be determined from PFPS (Google earth also has data) to determine the height difference between the ramp at start-up and the display location. An altimeter verification shall be performed on off-site shows by making the first pass straight and level while cross checking BARALT and RADALT in the HUD.

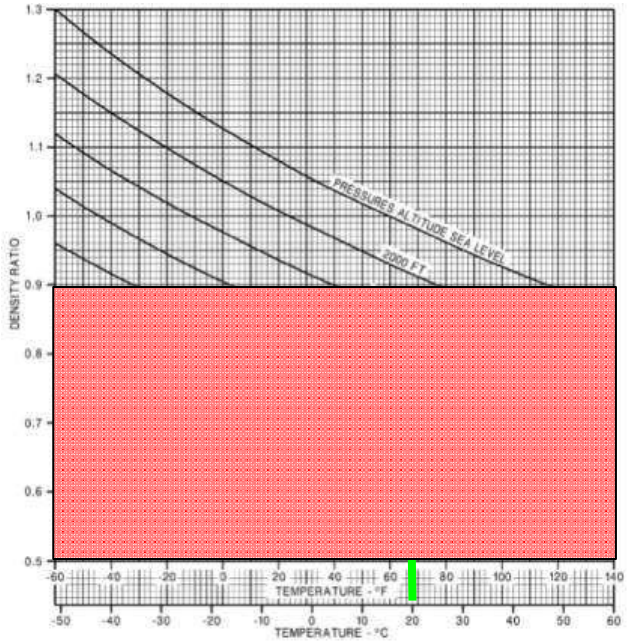
More in depth fuel computations are required with off-field sites. Delays in execution (and holding) are to be anticipated at off-field sites and should be considered when mission planning. Following transit, some manoeuvres will feel different and the risk of overstress may be increased due to lower fuel loads.

208. DENSITY ALTITUDE

Density Altitude (DA) is one of the factor which must be considered prior to each show performance. The current show is designed for DAs of up to 5,999 ft. For show sites having a DA of 6000 ft and higher, FDP must apply additional recovery factors to display altitudes numbers. The rule of thumb is that starting at 6000 ft; 100 ft is added to all minimum recovery altitudes. An additional 100 ft is added to standard recovery altitudes for every 1000 ft above 6000 ft. For example, for a DA of 7000 ft, the square loop recovery altitude of 2500 ft would increase to 2700 ft (7000 ft DA = +200 ft).

Furthermore, the minimum altitude for the hi-alpha pass must be adjusted for higher DA show sites. When the air density ratio is below 0.90 (red area), which equates to a 10% performance loss compared to a standard ICAO day, the minimum display height will be raised to compensate for the performance lost. FDP shall add 100 ft to the minimum display altitude of 500 ft AGL for each 0.05 below a density ratio of 0.90. This formula translates into a 20% increase in

altitude for a 10% loss in performance (2:1 ratio). For example, using the density ratio chart below (figure 4-4-2 of the CF-18 AOI), the density ratio for a show site with a temperature of 20° Celsius and a pressure altitude of 4000 ft is 0.86. In this case, the hi-alpha pass will be flown at 600 ft AGL, 100 ft higher than the standard altitude. Using table 4-4-2: 0.85 to 0.90 equals a minimum of a +100 ft adjustment; 0.80 to 0.84 equals to +200 ft, etc.



209. ARRIVAL RECCE

On arrival at a given show site, a recce is recommended to identify landmarks and get acquainted with the show environment. In some instances, the air show practice day may be weathered out and the arrival may be the only opportunity to survey the local features and determine if the show-lines are visible from the air. The arrival recce can be conducted on arrival at the airport provided sufficient safety measures are in place:

a. The traffic pattern shall be clear and the entry of other aircraft monitored by a controlling agency (ATC or Air Boss);

b. The air show performance area is clear;

c. Passes should be non-aerobatic unless the aerobatic box is active;

d. There should be no loose equipment in the “VTR bay” or cockpit if planning to perform aerobatic manoeuvres on arrival;

e. Minimum altitude is 500’ AGL unless the aerobatic box is active; and

f. Minimum weather should be IAW VFR limits including a well-defined horizon.

The intent of the arrival recce is to observe features. Non-aerobatic passes at a slightly higher than minimum display altitude and slower speeds are more desirable. Recommended arrival passes are as follows:

a. Level pass down the 1500 ft line verifying the altimeter setting;

b. Top side pass down the 500 foot line;

c. Level 360° turn at show centre; and

d. Closed pattern or circuit to observe area environment.

210. PRE-FLIGHT PREPARATION

Due to the physiological demands of the airshow circuit and the stresses that are placed on the body during the airshow routine, FDP should maintain a good level of physical fitness. FDP will likely experience more G forces in one display than a line pilot will for that entire month. Neck and back ailments are common so exercise should focus on core, neck and strength training and G tolerance exercises.

The sequence should be rehearsed and chair flown to the point that the pilot does not need to cross check a reference card. Most of the pilot task load will be devoted to completing the manoeuvres and monitoring outside references. Part of the pre-flight preparation should be “chair flying” the manoeuvres, reviewing key performance altitudes and numbers, just prior to the show. Some airshow performers will even walk through the sequence of manoeuvres prior to the display.

It is very important that the FDP shall have a 30 to 60 minute period, prior to display flying, for mental preparation. Some demo pilots would isolate themselves in the rental car or strap in early, so they can have a moment alone to review their sequence. Reviewing an aerial photograph of the show box and airfield when rehearsing the routine can be helpful. FDP should get assistance from the ground crew to isolate the aircraft and FDP during their preparation time prior to their performance.

Monitoring of show schedule can be difficult and it changes frequently. FDP should get a good hack from the air boss at the morning brief. Subsequently, FDP should use the initial schedule, but also watch for what act should be airborne when it is time for them to step. The team’s Narrator/Coordinator and/or Safety Pilot will be co-located with the Air Boss and can assist in keeping track of schedule changes.

211. AIR SHOW PRE TAKE-OFF CHECKLIST

In addition to the normal checklist procedures, the following checks shall be completed just prior to taking the runway for the display. Depending on which take-off manoeuvre the FDP chooses for the High Show will determine the flap and trim settings. These checks shall be reviewed specifically on the flight card prior to each flight and not trusted to memory:

PRE SHOW CHECKLIST	
STRAPS	TIGHT
G-SUIT	CHECK
EJECTION SEAT	ARM
ALTIMETER SET – DA/APEX	0-2000' /
FLAPS	AUTO (DIRTY ROLL)
	HALF (MAX CLIMB)
TRIM	SET 4 NOSE UP(Arrows Up)
FREQUENCIES	SET
HUD/DDI's	NORM/FCS or HUD/RDR
TAWS/ALT WARNINGS	OFF/WARNINGS 250'
WYPT 1	SHOW CENTRE w/ CRSE LINE
FUEL	MINIMUM/BINGO SET
IFF	ON/SET
TAPES	ON
TIME	NOTE (EET set if used)

REVIEW DISPLAY ROUTINE AND NUMBERS IF TIME PERMITTING

POST LANDING

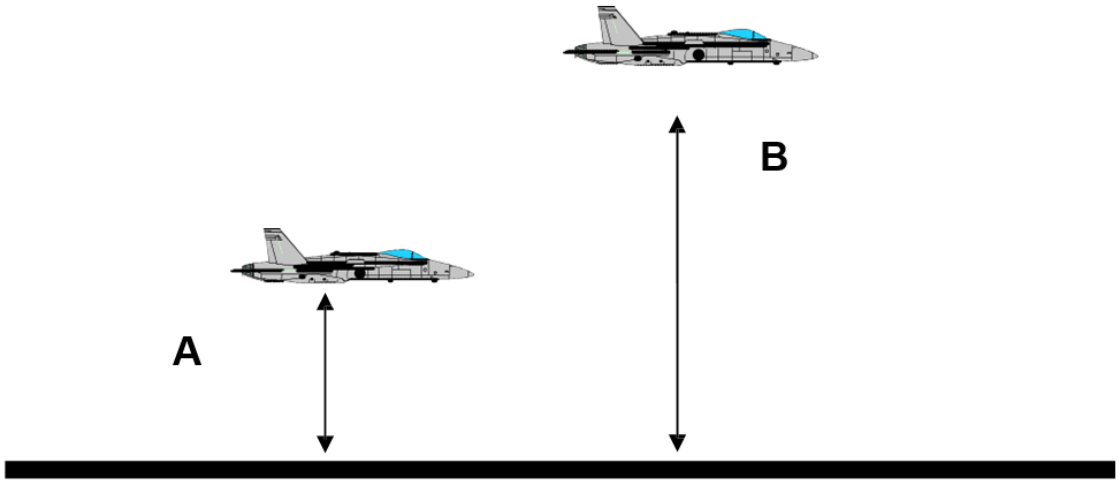
IFF……..OFF
TAPES …….LEAVE ON
TIME ……...NOTE

Note: Altimeter must be set above 29.95"hg to have altimeter in order to read 0 feet in the HUD at 2000 ft elevation.

212. ALTIMETER SETTING

In order to avoid confusion, two altimeter setting techniques are acceptable: either set the altimeter in the HUD to 0 or to 2000 ft on the ground at show site.

In example A, the show is practiced at 300ft AGL, therefore the altitude in the HUD when flying at 300ft would read 300ft or 2300ft. To accomplish this, on the ground FDP would set 0 or 2000 ft on the ground.



In example B, FDP wishes to practice a show sequence at 700 ft AGL. In order to do that, while still "flying the numbers" per his usual references, the altitude in the HUD on the ground should read -400 ft or 1600 ft. When the HUD shows 300 ft or 2300 ft in flight, the aircraft will be at 700 ft AGL.

300 ft:	0 or 2000
500 ft:	-200 or 1800
700 ft:	-400 or 1600
1000 ft:	-700 or 1300

Another method used when practicing at a location separate from that of departure is to fly over the field at desired altitude in RAD ALT, then set BARO ALT to 300 ft or 2300 ft. Pilots must be mindful to use the actual altimeter setting once in the pattern for landing. Also, the tower or air boss may call out traffic during the display. FDP must appreciate the altimeter adjustment when trying to de-conflict or get tally.

When working at locations with extremely high DA such as in Reno Nevada or Denver Colorado, another method must be employed. It will not be feasible to use 0 ft as an altitude base. Instead an altitude of 4000 ft or 6000 ft

can be used and all other altitude numbers added are added to that. As these numbers are new, they must be learned prior to the flight. Some manoeuvres will create an area of low pressure around the pitot tubes making the aircraft display an altitude that is slightly higher than reality. It is possible to have the altimeter read up to 150 feet high during high AOA manoeuvres, the horizontal 360, or with atmospheric anomalies during the high-speed pass.

213. SAFETY PILOT

If available human resources permit, risk mitigation measures can be augmented by adding a dedicated Safety Pilot to the team. Flying the demo routine without a Safety Pilot is not inherently unsafe. Adhering to the current MALA, approved demonstration profile, and flight parameters, the inherent risk of the flight profile is mitigated to an acceptable level of safety.

The value the Safety Pilot brings to the CF-18 Demonstration is based on the experience of the individual filling the position; specifically, Hornet operational experience, and air demonstration experience. CF-18 Hornet experience is considered a valuable asset, enabling the Safety Pilot to assist with emergency situations and check-list backup, similar to an Ops Desk pilot for Hornet operations at a main operating base. The second valuable asset would be experience within the air demonstration industry. This would be manifested in sight-picture awareness from the ground, show line attentiveness, altitudes confirmation, and SADA management.

214. SAFETY PILOT RESPONSIBILITIES

Safety Pilot responsibilities include the following contracts:

a. The Demonstration Pilot would call the altitude while inverted, prior to every vertical nose-down transition. If the minimum gate was not achieved, the aircraft would be recovered by rolling wings level and slicing into the follow-on manoeuvre. The Safety Pilot would prompt a “check gate” call if the gate was not called. The Safety Pilot would call an “abort” if the gate was not met and the pilot did not already acknowledge an abort;

b. The Safety Pilot would prompt “check show line” if the demonstration aircraft appeared to be inside the minimum show line spacing for the specific pass, requiring a response from the Demonstration Pilot;

c. The Safety Pilot would prompt “check altitude” if at any time the demonstration aircraft appeared to be below the minimum altitude for any manoeuvre, requiring a response from the Demonstration Pilot;

d. The Safety Pilot would conduct all necessary liaising with the Air Boss and relaying that coordination on the discrete radio frequency; and

e. The Safety Pilot would coordinate with the announcer so that specific transmissions on the discreet radio would be live from the cockpit, allowing the Demonstration Pilot to talk to the crowd. This is accomplished with standard RT calls:

I. Demonstration Pilot: “Stand-by simulcast.”
II. Safety Pilot: “Ready simulcast.”
III. Demonstration Pilot: transmit intended message.

The Safety Pilot and Demonstration Pilot would equally share the “recover,” “abort,” and “knock it off” contracts, permitting either pilot to make such a call if required.

These contracts are as follows:

Recover: The recover call would be initiated during any manoeuvre that transitioned below a required altitude, inside a show line restriction, or at an energy state that was below the minimum requirements outlined in the FDM.

1) The Air Demonstration Pilot would immediately roll, in the shortest direction, to wings-level climbing attitude, and once under control, transition to a flight path away from the crowd line;
2) Once recovered to stable, level flight, the Demonstration Pilot would discuss with the Safety Pilot the cause of the deviation and decide if the demonstration could be safely continued or not; and
3) This coordination would be on the discreet radio.

Abort: This call would be made during a reposition or prior to commencing a pass if the altitude, show line spacing, or energy state was evaluated to be below the minimum requirements for the next manoeuvre.

1) In the event of an “abort” call, the Demonstration Pilot would flow through the show box above 300’ AGL wings level, rather than conducting the intended manoeuvre.
2) The Demonstration Pilot would discuss with the Safety Pilot the cause of the deviation and decide if the demonstration could be safely continued or not.
3) This coordination would be on the discreet radio.

Knock It Off: This call would be made following a “recover” or “abort” call if either the Safety Pilot of Demonstration Pilot determined that the incident was significant enough, or circumstances dictated that the routine could not be continued safely.

1) Following a “knock it off” call, the Demonstration Pilot would maintain non-aerobatic flight and transition to a full-stop landing; and
2) The Safety Pilot would inform both the Air Boss and the Air Display Director that the demonstration would not be continuing, and the aircraft would be landing.

Any “recover,” “abort,” and “knock it off” calls would be debriefed in detail with all available media (HUD footage and team video from the ground.) No further flights would be conducted until the cause of the deviation was determined and the necessary rectification was established.

During air demonstrations, the onboard radio configuration should place the Safety Pilot on a discreet radio frequency on the right radio, with the Air Boss common frequency being monitored on the left radio.

215. SAFETY PILOT TRAINING

To act as a designated Safety Pilot for the CF-18 Hornet Demonstration routine, a minimum of the following training should be required:

a. A detailed brief of the Hornet Demonstration Profile, specifically outlining the altitude gates and show line restrictions;
b. A detailed brief of the Safety Pilot responsibilities;
c. A detailed flight brief of the Hornet Demonstration flight in question, specifically including density altitude and airfield considerations; and
d. Act as the dedicated Safety Pilot for at least one practice performance prior to performing the duties at a public air demonstration.

The instruction for this training would be conducted by FDP.

Chapter 3: FIGHTER DEMONSTRATION ROUTINE

301. PREFACE

This Manual is intended to be the primary reference for the FDP and to assist with the handover of duties from year to year. The manoeuvres shall be flown in accordance with the minimum and maximum limitations outlined in this standardized package. If at any time, these limitations have been exceeded, pilots will recover the aircraft by the most effective means possible. The routine may continue if an accurate airborne assessment can be carried out and only when the aircraft is safely re-established at the entry parameters of the follow-on manoeuvre. Primary responsibility and considerations of FDP during an Air Display will be (in order of priority): spectator safety, aircrew safety and aircraft/equipment preservation.

302. REPOSITIONS

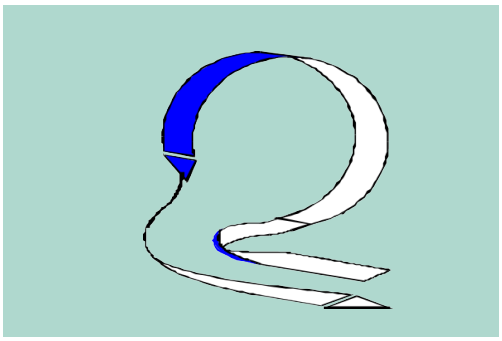
The following repositions can be flown at any time by the FDP based on weather, terrain and built-up areas around the SADA.

1. 90° / 270° REPOSITION

The aircraft will perform a 90^{o} turn away from the show line and pull up into a loop. The apex of the loop will be a minimum of 4000 feet AGL and have a maximum speed of 250 KCAS. The aircraft will be ¼ rolled (90^{o}) at 90^{o} nose down in the vertical, so as to align the aircraft with the show line. The roll shall be completed by a minimum of 3000 feet AGL and dive recovery initiated at 300 KCAS or 2500 feet AGL, whichever occurs first.

Entry parameters:

i. Altitude: 300 feet AGL;
ii. Airspeed: 325 KCAS; and
iii. Show line: Reposition for the 1500’ show line

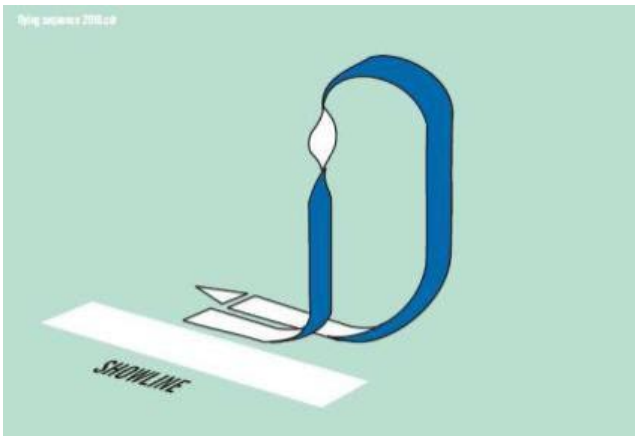


2. SPLIT “S” REPOSITION

The aircraft will commence a vertical climb with a minimum entry speed of 325 KCAS followed by a 180° roll in the vertical. The minimum apex altitude of the reversal will be 3500 feet AGL with a maximum speed of 250 KCAS. Recovery will be initiated no later than 2500 feet AGL or 300 KCAS, whichever occurs first. Recovery shall be no lower than 300 feet AGL.

Entry parameters:

i. Altitude: 3500 feet AGL;
ii. Airspeed: 120-250 KCAS (for pull down); and
iii. Show line: 1500 feet.



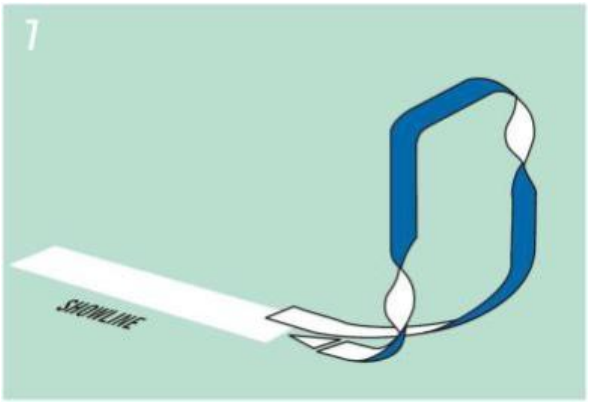
3. SQUARE LOOP REPOSITION

Turning 45° away from the show line, the aircraft will begin a pull up with a min entry speed of 325 KCAS. Through the vertical, the aircraft will be rolled 45° so that it is perpendicular to the show line. At 3500 feet AGL, the aircraft will be pulled to inverted and flow back toward the show line with a minimum apex of 4000 feet AGL. Inverted flight will be maintained for no more than 10 seconds with an airspeed of 135-200 KCAS. Once the aircraft is lined up with the show line, a 25° AOA pull will be made to position the aircraft 90° nose

down. The aircraft will be ¼ (90°) rolled to parallel the show line by 3000 feet AGL. At a minimum altitude of 2500 feet AGL or 300 KCAS (whichever occurs first) a 25° AOA pull will be maintained to bring the aircraft back to level flight no lower than 300 feet AGL.

Entry parameters:

i. Altitude: 300 feet AGL;
ii. Airspeed: 325 KCAS; and
iii. Show line: Reposition for the 1500' show line.



4. LIVE SIDE 270° REVERSAL

The aircraft will be reversed through 270° on the live side for the next

Entry parameters:

i. Altitude: 500 feet AGL;
ii. Airspeed: 230-250 KCAS; and
iii. Show line: Reposition for the 1500' show line.

5. 40-220° LIVE SIDE REPOSITION

The aircraft will climb, turn away 40° and reverse back 220° with a 270° tuck under roll (when altitude permits) towards the 1500' show line for the next pass.

6. 40-220° COLD SIDE REPOSITION

The aircraft will climb, turn away 40° towards the hot side and reverse back 220° with a 290° tuck under roll (when altitude permits) towards the 500 foot show line for the next pass.

7. RUDDER ROLL OBLIQUE REPOSITION

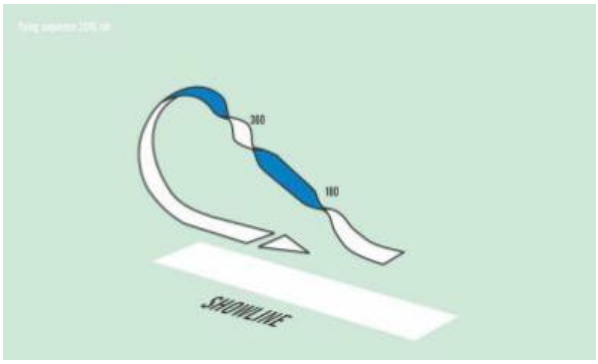
The aircraft will be turned 40° away from the crowd. The nose of the aircraft will then be pulled up to minimum 45° nose up and increase the alpha to 25° AOA. A 360° Rudder Roll will be commenced away from the show line. The aircraft will maintain a minimum airspeed of 180 KCAS. The aircraft will continue to fly away from the crowd on the live side and then be reversed 220° to line up with the 1500' show line.

8. REVERSE HALF CUBAN REPOSITION

The aircraft will be pulled to 45°-60° nose up and rolled through 180° to the inverted. At 2500 feet AGL the, the aircraft will be rolled 360°. With a minimum apex of 3500 feet AGL and a maximum airspeed of 250 KCAS, a 25 AOA pull with full afterburner will be executed in order to achieve a level flight recovery by 300 feet AGL.

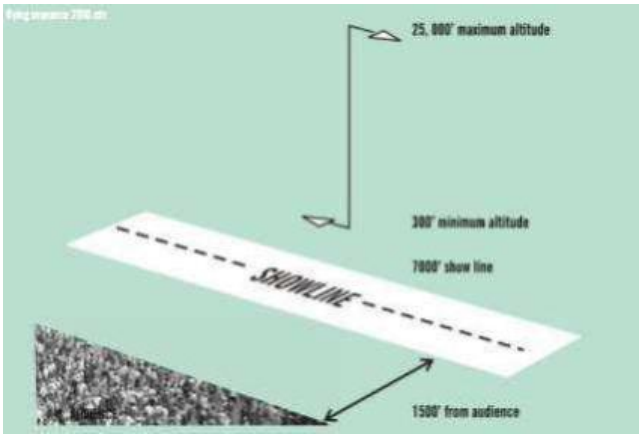
Entry parameters:

i. Altitude: 3500 feet AGL;
ii. Airspeed: 120 - 250 KCAS; and
iii. Show line: Reposition for the 500' show line.



303. HIGH SHOW PROFILE

In accordance with B-GA-100-001 regulations, the CF188 High Show will be flown when the minimum ceiling is 5000 feet AGL with a visibility of three statute miles or greater. Each manoeuvre that can be flown during the high show is described in detail below. There are 2 options for the take-off manoeuvre during the high show profile. The FDP will select the manoeuvre that he/she wishes to perform for the season.



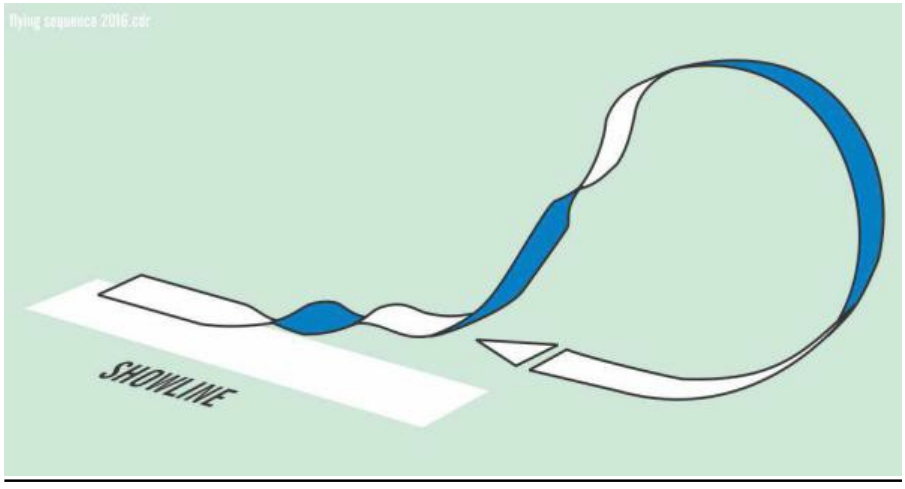
1. <u>TAKE-OFF DIRTY ROLL AND CUBAN 8</u>

The show will begin with a maximum performance take-off with flaps set to AUTO and trim set to 4^{o} nose up. The take-off will occur at 170 KCAS with the nose of the aircraft being pulled up to 25-30^{o} followed by a 360^{o} roll. Upon completion of the roll, the aircraft will be at ~210 KCAS and commence a 10^{o}-15^{o} AOA climb. The landing gear will be selected up once the aircraft is in a stabilized climb at less than 2G.

Show sites where the runway is inside of the 1500 foot show line will require the aircraft to be turned away from the spectator area and cross the 1500 foot show line before conducting the Dirty Roll. Off field show sites shall begin with a pass from behind and overhead the crowd at 500 feet and up to 0.95 Mach followed by a climbing 270^{o} arc in order to reposition for the Cuban 8 along the 1500' show line at 300 feet AGL and 325 KCAS.

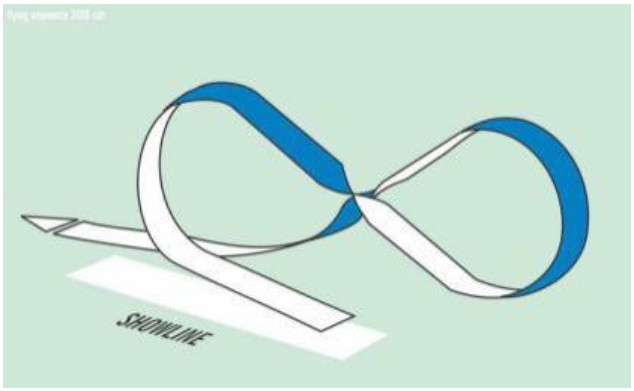
Entry parameters:

i. Altitude: 200 feet AGL, AOB not to exceed 75^{o} below 300 feet AGL;
ii. Airspeed: 170 KCAS; and
iii. Show line: 1500 feet.



The minimum apex altitude for the first half of the Cuban will be 3500 feet AGL, with an airspeed of 120 KCAS or greater (maximum speed of 250 KCAS). The aircraft will hold a 45° inverted dive before initiating a roll upright by 2500 feet AGL in order to commence a wings level dive recovery no later than 1500 feet AGL. The minimum altitude during the recovery shall be no lower than 300 feet AGL. The second half of the Cuban will be flown identical to the first.

Recovery and pull up will commence no lower than 1500 feet AGL with a maximum speed of 350 KCAS.

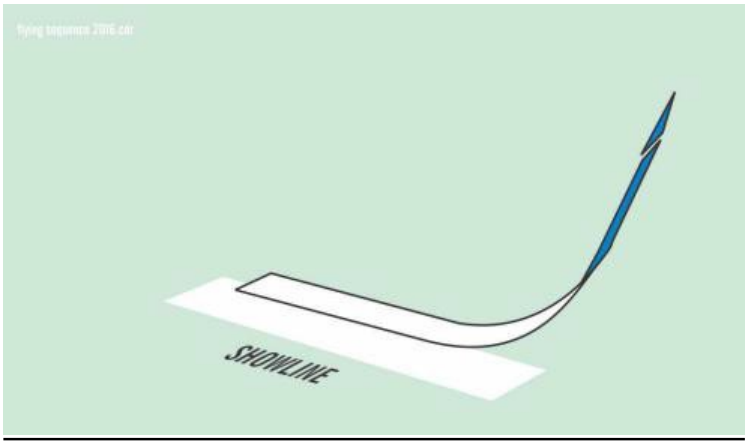


2. <u>MAXIMUM PERFORMANCE CLIMB AND CUBAN 8</u>

The show will begin with a normal take-off with flaps set to HALF, trim set to 12° nose up and RADALT selected as the altitude source. Landing gear and flaps will be cycled up as soon as possible once a positive climb is confirmed. The aircraft will be held at 50ft AGL until an airspeed of 290 – 310kts is achieved at which point a maximum performance pull to 60° nose up is executed. Once stabilized in the climb, BAROALT will be selected in the HUD. If flightpath will be extended beyond the airport environment or if obstacles are present, a climb to 200ft AGL will be commenced.

Entry parameters:

i. Altitude: 50ft AGL
ii. Airspeed: 290-310kts
iii. Show line: 500ft



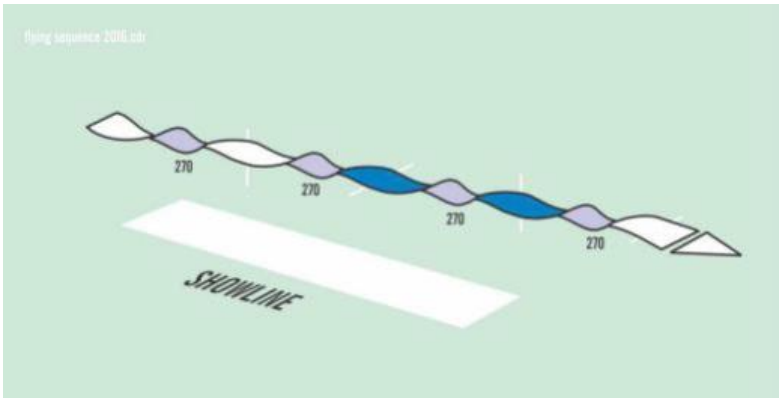
The minimum apex altitude for the first half of the Cuban will be 3500 feet AGL, with an airspeed of 120 KCAS or greater (maximum speed of 250 KCAS). The aircraft will hold a 45° inverted dive before initiating a roll upright by 2500 feet AGL in order to commence a wings level dive recovery no later than 1500 feet AGL. The minimum altitude during the recovery shall be no lower than 300 feet AGL. The second half of the Cuban will be flown identical to the first. Recovery and pull up will commence no lower than 1500 feet AGL with a maximum speed of 350 KCAS.

3. QUAD 270° ROLL

At 3000 feet prior to show center, with a minimum speed of 375 KCAS, the aircraft's nose will be raised to 15° nose up and will commence four (4) consecutive 270° rolls. The aircraft will momentarily pause after each 270° roll. After the last 270° roll, the nose of the aircraft shall be no lower than 5° nose down. The aircraft will then be recovered to level flight. If the nose drops below the horizon prior to the last 270° roll, the aircraft shall be recovered.

Entry parameters:

i. Altitude: 300 feet AGL;
ii. Airspeed: 375 KCAS; and
iii. Show line: 1500 feet.

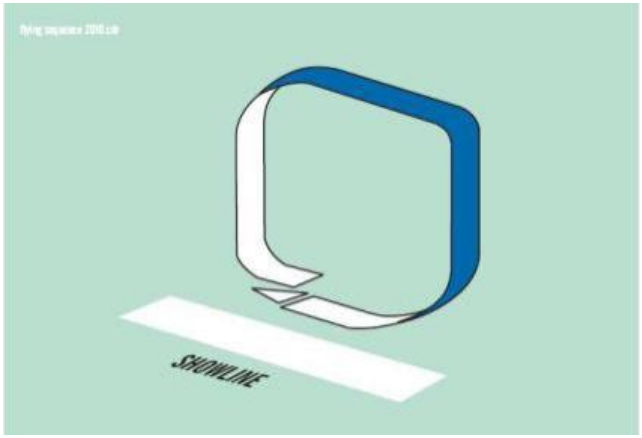


3. SQUARE LOOP AND RUDDER ROLL

At 325 KCAS, with both afterburners lit, a maximum G pull to the vertical will be executed. The aircraft will unload for a vertical extension to 2500 feet AGL. The aircraft will then be pulled at 25^{o} AOA in order to establish inverted flight (maximum of 10 seconds) at a minimum altitude of 3500 feet AGL. With an airspeed of 135-200 KCAS, a 25-30^{o} AOA pull will position the aircraft 90^{o} nose down along the 1500' show line. At a minimum altitude of 2500 feet AGL or 300 KCAS (whichever occurs first) a 25° AOA pull will be maintained to bring the aircraft back to level flight no lower than 300 feet AGL;

Entry parameters:

i. Altitude: 300 feet AGL;
ii. Airspeed: 325 KCAS; and
iii. Show line: 1500 feet.

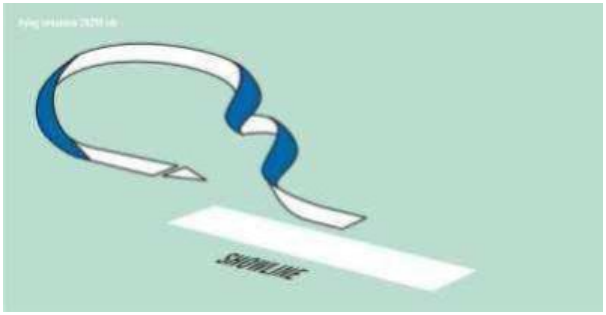


Upon completion of the Square Loop, the aircraft will be turned 40^{o} away from the crowd. The nose will then be pulled to 45^{o} nose up and increase the alpha to 25^{o} AOA. A 360^{o} Rudder Roll will be commenced away from the show line while maintaining a minimum airspeed of 180 KCAS. The aircraft will

continue to fly away from the crowd on the live side and then be reversed 220^{o} to line up with the 1500' show line.

Entry parameters:

i. Altitude: 300 feet AGL;
ii. Airspeed: 300 KCAS; and
iii. Show line: Reposition for the 1500' show line.

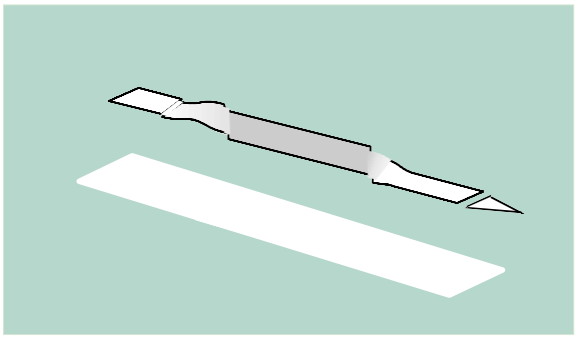


5. <u>TOP SIDE PASS</u>

The Top Side Pass will be flown along the 1500' show line at 400 KCAS and 300 feet AGL. At 3000 feet prior to the show center, the aircraft will be pulled to 5^{o} nose up and rolled 100^{o} angle of bank. Power, top side rudder and forward stick will be applied to maintain the manoeuvre. As the aircraft's nose reaches the horizon, the aircraft will be recovered to level flight, no lower than 300 feet AGL.

Entry parameters:

i. Altitude: 300 feet AGL;
ii. Airspeed: 400 KCAS; and
iii. Show line: 1500 feet.

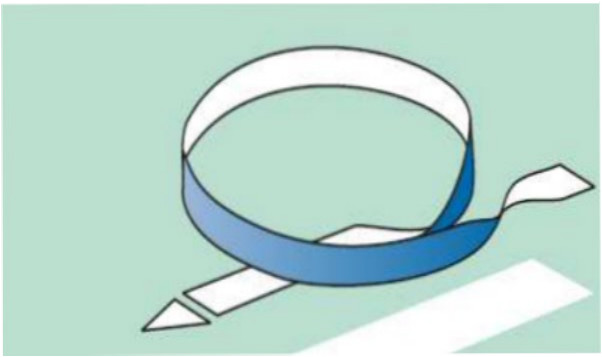


6. LEVEL HIGH G 360° TURN HIGH ALPHA LOOP AND RUDDER ROLL

The aircraft will fly along the 1500' show line in order to set up for the Level High G 360° Turn. At 325 KCAS and 300 feet AGL (maximum altitude of 400 feet AGL), the nose of the aircraft will be raised 2° nose up prior to a 290° tuck under roll. With afterburner selected, the aircraft will perform a maximum rate 360° turn until parallel with the 1500' show line. A 70° roll to level flight will be executed to recover the aircraft back to level flight.

Entry parameters:

i. Altitude: 300 feet AGL;
ii. Airspeed: 325 KCAS; and
iii. Show line: 1500 feet.

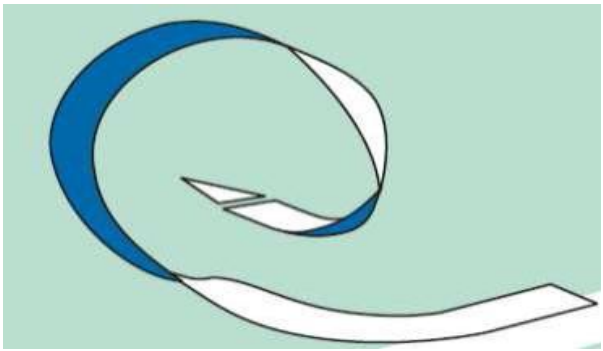


Upon completion of the Level High G 360° Turn, the aircraft will commence a High Alpha Loop with a minimum airspeed of 325 KCAS in full afterburner. A maximum G pull up to the vertical will be executed and the aircraft will unload for a vertical extension to 1500 feet AGL. The aircraft will then be pulled to maintain 25°-30° AOA and pass through inverted flight at a minimum of 3500 feet AGL. With 90° of the loop remaining, a rudder turn will be completed to place the aircraft flying away from the crowd. The aircraft will recover from the High Alpha Loop by 1,000 feet AGL. Upon completion of the High Alpha Loop, the nose will then be pulled up to minimum 45° nose up and increase the alpha to 25° AOA. A 360° Rudder Roll will be commenced away from the show line.

The aircraft will maintain a minimum airspeed of 180 KCAS or greater.

Entry parameters:

i. Altitude: 300 feet AGL;
ii. Airspeed: 325 KCAS; and
iii. Show line: 1500 feet.

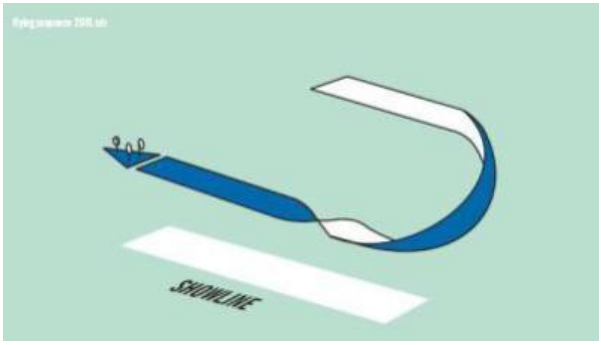


7. DIRTY INVERTED PASS

The aircraft will reposition from the live side to line up with the 1500' show line. At less than 300 KCAS, the arresting hook and refuelling probe will be extended. At 240 KCAS and less than 2G, the landing gear will be extended. 3000 feet prior to show center and 500 feet AGL, the aircraft nose will be raised to 5^{o}-7^{o} and rolled 180^{o} to the inverted position for a maximum of 10 seconds followed by a 180^{o} roll, returning the aircraft to the upright position. The landing gear, hook and probe will then be retracted from a stabilized aircraft at less than 250 KCAS and 2G.

Entry parameters:

i. Altitude: 500 feet AGL;
ii. Airspeed: 230-250 KCAS; and,
iii. Show line: 1500 feet



After extending out from the Dirty Inverted Pass, the aircraft will retract the landing gear, arresting hook and refuelling probe while turning to the cold side for the next manoeuvre.

8. HIGH ALPHA PASS

Entry at no lower than 500 feet AGL and 25 AOA. Approaching the show line, the aircraft will be turned to line up and parallel the 1000' show line. Just beyond show centre, the standard recovery procedure will be flown.

a) Entry parameters:

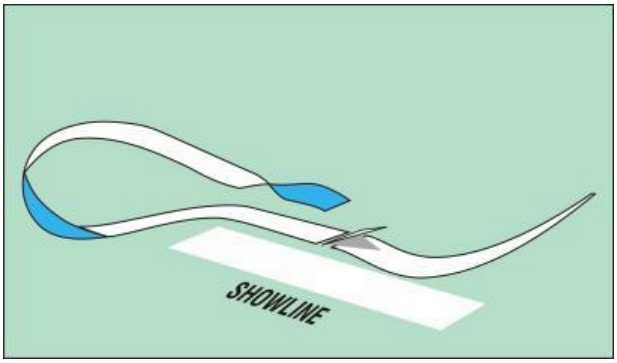
i. Altitude: 500 feet AGL;
ii. Airspeed: 180-220 KCAS; and
iii. Show line: 1000 feet.

b) Given the fact that standard aircraft cautions and warnings will not provide adequate indication of a loss of thrust in a timely manner, a recovery will immediately be initiated if any of the following occur:

i. AOA reaches 27º without indications of positive correction (minor transients up to 27˚ is allowed provided immediate corrections are applied and aircraft responds);
ii. Altitude reaches 450 feet AGL with corrections applied and aircraft not responding;
iii. Un-commanded heading change of -/+15º; and
iv. Landing Gear Warning tone remains on after positive corrections have been applied.

c) Standard recovery procedures:

i. Simultaneously select MIL power on both engines, opposite rudder to keep sideslip at zero, and aggressively lower the nose to seek a maximum of 15 AOA;
ii. Select maximum AB, if desired, once the AOA is less than or equal to 15° AOA; and
iii. For both MIL and MAX power recoveries, climb with a maximum AOA of 15°.



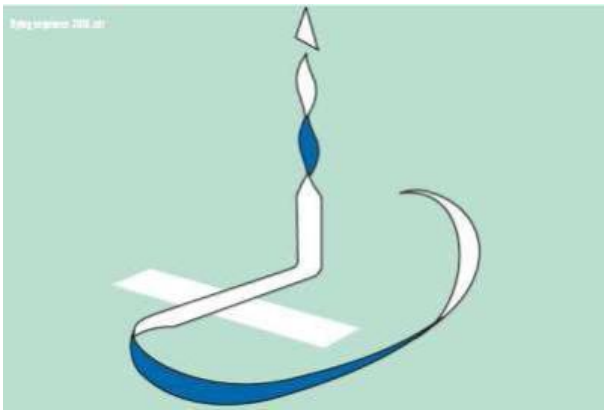
Upon completion of the high alpha pass, at a minimum airspeed of 250 KCAS and a minimum altitude of 500 feet AGL, the aircraft will be rolled 270^{o} to tuck back to the cold side and set-up for the next pass.

9. VERTICAL ROLLS AND SPIRAL DESCENT

The aircraft will be accelerated up to a maximum of 0.95 Mach and achieve wings level at 500 feet AGL prior to passing overhead the crowd. 1000 feet prior to show centre, a gradual 6G pull to the vertical will be executed followed by a four-point hesitation roll, or multiple 360 o rolls in opposite directions (with momentary pauses after each roll.) Depending on the weather, the climb will be conducted up to a maximum of 25,000 feet MSL. A modified 45-60^{o} nose up pull at 400 KCAS will be conducted in order to accommodate lower ceilings.

Entry parameters:

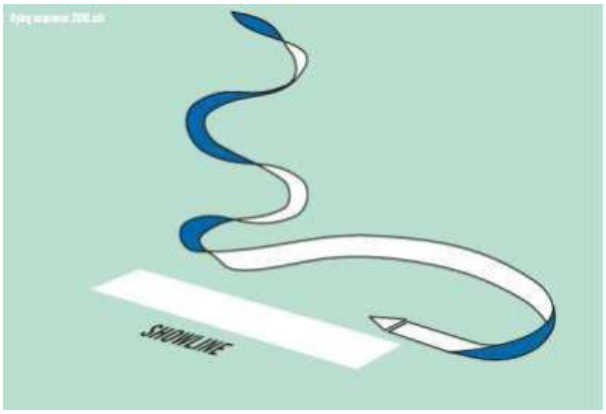
i. Altitude: 500 feet AGL;
ii. Airspeed: 400 KCAS - 0.95 Mach; and
iii. Show line: 500 feet.



The aircraft will be recovered via an idle descending turn at 20º-25^{o} AOA on the live side. A blend of rudder and back stick will be required for this manoeuvre. Rudder inputs must be managed to ensure no yaw greater than 360o is performed. The aircraft recovery from the Spiral Reposition will be initiated at 5000 feet AGL in order to set up for the High-Speed Pass.

Entry parameters:

i. Altitude: Recovery initiated by min 5000 feet AGL;
ii. Airspeed: 200 KCAS or greater; and
iii. Show line: Reposition for the 500’ show line.



10. HIGH-SPEED PASS

The High-Speed Pass will be conducted at 300 feet AGL, up to 0.95 Mach along the 500' show line.

Entry parameters:

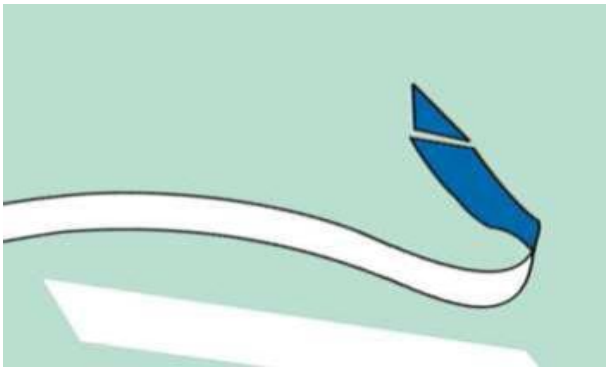
i. Altitude: 300 feet AGL;
ii. Airspeed: Up to 0.95 Mach; and
iii. Show line: 500 feet.

11. CANOPY PASS AND HALF BARREL ROLL

The Canopy Pass will be positioned on the 500' show line at 300 feet AGL and 325 KCAS. Passing show centre, the aircraft will be pulled up into a Half Barrel Roll and flown away from the crowd inverted with the nose of the aircraft on or above the horizon. Prior to a maximum of 10 seconds of inverted flight, the aircraft will be rolled 180^{o} upright. If sufficient fuel allows, the CF-18 will reposition for the Heritage Flypast or the Attack and Pyrotechnic Display. If there is insufficient fuel, or if one of these profiles is not scheduled at the event, the aircraft shall be repositioned to land or engage the Mobile Aircraft Arresting System (MAAS) when available.

Entry parameters:

i. Altitude: 300 feet AGL;
ii. Airspeed: 325 KCAS; and
iii. Show line: 500 feet.



304. LIMITED / FLAT SHOW PROFILE

In accordance with B-GA-100-001 regulations, the CF188 Limited Show will be flown when weather conditions are below those required for the High Show, but not less than a minimum ceiling of 2500 feet AGL and three statute miles visibility. The CF188 Flat Show will be flown when weather conditions are below those required for the Limited Show, but not less than a minimum ceiling of 1500 feet AGL and three statute miles visibility.

NOTE

With the exception of the Inverted Pass, all aerobatic entry parameters are outlined under the High Show Profile.

1. TAKE-OFF DIRTY ROLL

The show will begin with a maximum performance take-off with flaps set to AUTO and trim set to 4^{o} nose up. The take-off will occur at 170 KCAS with the nose of the aircraft being pulled up to 25-30^{o} followed by a 360^{o} roll. Upon completion of the roll, the aircraft will be at ~210 KCAS and commence a 10^{o}-15^{o} AOA climb. The landing gear will be selected up once the aircraft is in a stabilized climb at less than 2G;

Show sites where the runway is inside of the 1500' show line will require the CF188 to be turned away from the spectator area and cross the 1500' show line before conducting the Dirty Roll. Off field show sites shall begin with a pass from the cold side (behind and overhead the crowd) at 500 feet and up to 0.95 Mach followed by a climbing 270^{o} arc in order to reposition for the Inverted Pass.

2. INVERTED PASS

From 300 feet AGL and 400 KCAS the aircraft will be pulled to 5^{o} nose up, rolled to the inverted position and flown along the 1500' show line. The aircraft will be rolled upright prior to attaining a maximum inverted flight time of 10 seconds. Recovery will be initiated if the aircraft nose falls through the horizon.

Entry parameters:

i. Altitude: Min 300 feet AGL;
ii. Airspeed: 400 KCAS; and
iii. Show line: 1500 feet.

3. QUAD 270° ROLL

At 3000 feet prior to show center, with a minimum speed of 375 KCAS, the aircraft's nose will be raised to 15° nose up, and will commence four (4) consecutive 270° rolls. The aircraft will momentarily pause after each 270° roll. After the last 270 ° roll, the nose of the aircraft shall be no lower than 5° nose down. The aircraft will then be recovered to level flight. If the nose drops below the horizon at any point prior to the final roll, the aircraft will be recovered.

4. TOP SIDE PASS

The Top Side Pass will be flown along the 1500' show line at 400 KCAS and 300 feet AGL. 3000 feet prior to the show center the aircraft will be pulled to 5° nose up and rolled 100º angle of bank. Power, top side rudder and forward stick will be applied to maintain the manoeuvre. As the aircraft's nose reaches the horizon, the aircraft will be recovered to level flight, no lower than 300 feet AGL.

5. LEVEL HIGH G 360° TURN

The aircraft will fly along the 1500' show line in order to set up for the Level High G 360° Turn. At 325 KCAS and 300 feet AGL (maximum altitude of 400 feet AGL), the aircraft's nose will be raised 2° nose up prior to a 290° tuck under roll. With afterburner selected, the aircraft will perform a maximum rate 360° turn until parallel with the 1500' show line. A 70° roll to level flight will be executed to recover the aircraft back to level flight.

6. DIRTY INVERTED PASS

At less than 300 KCAS, the arresting hook and refuelling probe will be extended. At 240 KCAS and less than 2G, the landing gear will be extended. 3000 feet prior to show center and 500 feet AGL, the aircraft nose will be raised to 5-7 degrees and rolled 180 degrees to the inverted position for a maximum of 10 seconds, followed by a 180 roll, returning the aircraft to the upright position. After extending out from the Dirty Inverted Pass, the aircraft will retract the landing gear, arresting hook and refuelling probe (at less than 250 KCAS and 2G) while turning to the cold side for the next manoeuvre.

7. HIGH ALPHA PASS

Entry no lower than 500 feet AGL and 25 AOA. Approaching the show line, the aircraft will be turned to line up and parallel the 1000 ft show line. Just beyond show centre, the standard recovery procedure will be flown. At a minimum airspeed of 250 KCAS and minimum of 300 feet AGL, the aircraft will be rolled 270^{o} to tuck back to the cold side and set up for the next pass.

8. OVERHEAD PASS

The aircraft will be accelerated up to a maximum of 0.95 Mach and achieve wings level at 500 feet AGL prior to passing overhead the crowd. After passing over the crowd, set up either left or right for the next pass.

9. HIGH-SPEED PASS

The High-Speed Pass will be conducted at 300 feet AGL, 0.95 Mach along the 500' show line;

10. CANOPY PASS AND HALF BARREL ROLL

The Canopy Pass will be positioned on the 500' show line at 300 feet AGL and 325 KCAS. Passing show centre, with cloud ceiling permitting, the aircraft will be pulled up into a Half Barrel Roll and flown away from the crowd inverted with the nose of the aircraft on or above the horizon. Prior to a maximum of 10 seconds of inverted flight, the aircraft will be rolled 180º upright. If sufficient fuel allows, the CF-18 will reposition for the Heritage Flypast or the Attack and Pyrotechnic Display. If there is insufficient fuel, or if one of these profiles is not scheduled at the event, the aircraft shall be repositioned to land or engage the Mobile Aircraft Arresting System (MAAS) when available.

11. DIRTY PASS

The Dirty Pass is a backup manoeuvre that can be substituted for any other manoeuvre, in the high or limited/flat show profile, if required for unpredicted circumstances. At less than 300 KCAS, the arresting hook and refuelling probe will be extended. At 240 KCAS and less than 2G, the landing gear will be extended. The Dirty Pass is flown on the 500' show line. After passing the end of the primary spectator area, the landing gear, hook and probe will be retracted at less than 250 KCAS and 2G.

Entry parameters:

i. Altitude: 300 feet AGL;
ii. Airspeed: 230-250 KCAS; and
iii. Show line: 500 feet.

305. TWILIGHT SHOW DISPLAY

To avoid disorientation and to manage circumstances such as a HUD failure or a system degrade, all aerobatic manoeuvring must be completed no later than the end of Evening Civil Twilight. This time is independent of sunset, contingent on the latitude of location and time of year.

The B-GA-100-001/AA-000 defines nights as commencing at the end of ECT:

> *Period of time when the center of the sun's disc is more than 6 degrees below the horizon, which commences at the end of Evening Civil Twilight (ECT) and ends at the start of Morning Civil Twilight (MCT). See AIP Canada - Gen1.6.2 for ECT/MCT times. Note: In Southern Canada and the mid-latitudes, ECT and MCT occur approximately one-half hour after sunset, and one-half hour before sunrise, respectively.*

Specific Evening Civil Twilight for a date and location can be derived from a variety of verified sources; one such example is: https://www.timeanddate.com.

Prior to flying a Twilight Show air demonstration, it is necessary to brief the following items:

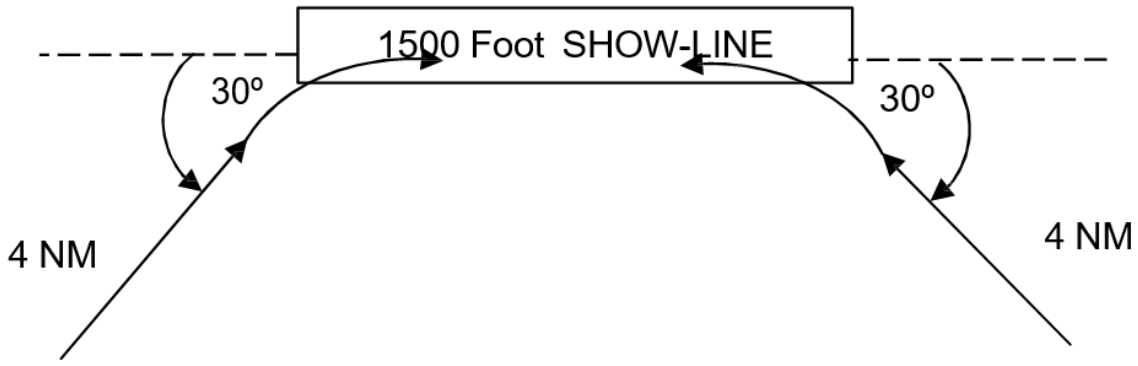
- Cultural lighting,
- Topography of horizon (mountainous vs flat),
- Effects of overcast cloud cover,
- Profile of horizon (city vs black hole of water), and
- HUD brightness, clear visor, and cockpit light settings.

306. ATTACK AND PYROTECHNIC DISPLAY

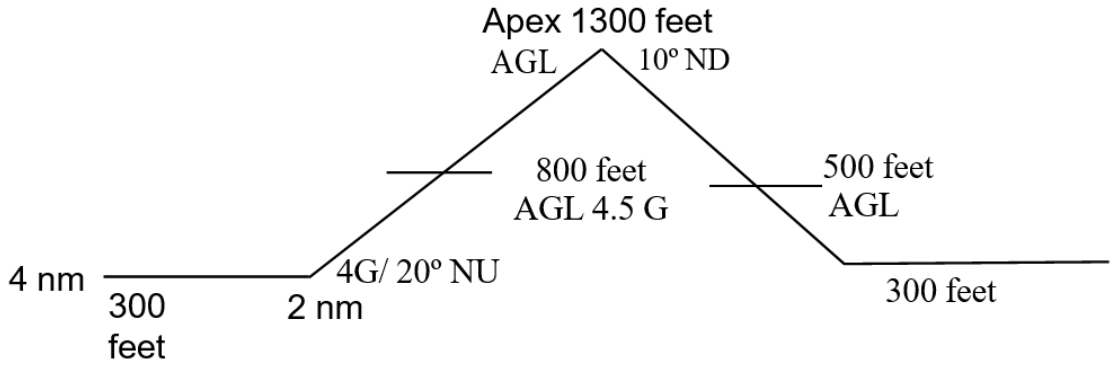
The Attack and Pyrotechnic (Pyro) Show can be flown when the minimum weather is 1500 feet AGL and visibility of three statute miles or greater. A face-to-face brief between the pilot and the pyrotechnics team will be conducted at least one day prior as well as the day of the show. There will be two types of manoeuvres; Strafe/Bomb and a Wall-Of-Fire Pass:

1. <u>STRAFE/BOMB PASS</u>

This will commence at a distance of 4 nm from show centre at a heading 30º off of the show line from either the live side or the cold side. Bomb attacks will recover to straight and level flight and strafe attacks will recover to a 30º nose up attitude. The ingress will be flown at 300 feet AGL (if not over built up areas) at a maximum speed of 400 KCAS.



At a distance of 2 nm from the show centre the pilot will commence a 4 G pull to 20º nose up. At 800 feet AGL the pilot will commence a 135º roll towards show centre and commence a 4.5-5 G pull to 10º nose down attitude, parallel to the show line. The CF-18 shall apex at an altitude of 1300 feet AGL and line up on the 1500' show line. The pilot will start a wings level, 5 G recovery at 500 feet AGL to recover no lower than 300 feet AGL. The pyrotechnics team will commence the "Strafe" pass after the aircraft nose is 10º down. The "Bomb" pass will commence just as the aircraft is starting the 5G recovery.



2. WALL-OF-FIRE PASS

The pilot will line up on the 1500' show line, wings level at an altitude of 500 feet AGL and up to Mach 0.95. As the aircraft flies over show centre the pyrotechnics team will commence the Wall-of-Fire.

307. HERITAGE FLIGHT MANOEUVRES

The RCAF Heritage Flight is approved by the Comd 1 CAD. During previous show training seasons, the FDP was able to deploy to a location for dedicated Heritage Flight training. This allowed the FDP to train flying the approved routines with heritage flight pilots. Comd 1 CAD can authorize dissimilar non-aerobatic fly-pasts for specific events and show sites in cases when no pre-season Heritage Flight training is conducted.

Annex D provides pictorial descriptions of examples for standardized two and three plane Heritage Flight profiles.

Minimum weather required to conduct these profiles is a ceiling of 1500 ft and a visibility of 3 statute miles. No aircraft in the formation will be flown lower than 300 feet AGL. The demonstration profile will be planned using a maximum of 60° of bank and 2 G for all passes. It is recommended that the Demo Hornet fly as the outside wingman, with the contract that the Hornet will perform “lost wingman” procedures if necessary. Explicit direction for the formation line-up (lead vs wingman) will be included in the authorization from Comd 1 CAD.

When flying in formation with non-military air show performers it is essential to have a solid brief prior to going flying. Important points to cover should include altimeter setting, de-confliction plan during rejoins, rejoin parameters, miss contracts, pilot experience, last time pilot flew in formation, whether pilot has ever flown in formation with fast-jet aircraft, and minimum safe speeds. It is important to remember that in many cases the non-military air show performer is just as excited about the upcoming formation flight with you as the spectators coming to the air show, and he/she needs to be reminded the flight is no different than any other they would conduct in front of a crowd.

Chapter 4: EMERGENCIES

401. GENERAL

FDP must practice the recovery from potential airborne problems at all altitudes. The ADCTS provides a safe environment to simulate these scenarios. This list of emergencies is by no means exhaustive, but a select few that warrant extra consideration. The primary reaction is to recover the aircraft away from the spectators. Note that there should be limited risk to the spectators if the demonstration is flown at or outside the minimum safety distances. Normal emergency responses should occur only after safe recovery away from the ground and spectators is complete.

402. PROBLEMS ON TAKE-OFF

FDP shall brief the take-off plan before flying. Considerations should include but not be limited to abort speed for the conditions of the day, runway length, and cable status/location. An aggressive rotation over the cable may cause the tail of the aircraft to come very close to the ground and there is risk that the cable or aircraft could be damaged.

There are unique considerations associated with the delayed rotation for the dirty roll on take-off. The aircraft will be held on the ground past normal rotation speed and could immediately go airborne if required. Engine failures during the take-off should be treated normally for the take-off roll. If an engine failure occurs beyond the computed abort speed but prior to the aggressive rotation then a normal lift off should occur. If the engine fails after the aggressive pull up, then the best way to recover is to laterally roll the aircraft, towards the bad engine, allowing the nose to drop normally through the roll. Attempting to sustain the nose up attitude longer than normal will cause the aircraft to quickly run out of energy. As the nose barrels around it will slowly gain energy and rudder authority. It will gradually settle out as the roll is completed and the aircraft should be able to climb away with full afterburner set on both engines. Diagnosing the engine problem and adjusting the throttles should be delayed until the aircraft is recovered and climbing away from the ground and spectators. Once recovered, appropriate engine failure response should be completed.

403. ENGINE PROBLEMS

If inverted, FDP should roll upright and recover. Getting away from the ground and spectators is paramount. The worst point for an engine failure is during the high alpha pass. In the high AOA configuration there is not enough

airflow over the rudders for them to counter the thrust differential between a failed engine and an engine in afterburner. The most notable aspect of the recovery is that the initial actions are somewhat counter-intuitive. Upon recognition of an engine failure or handling problem, the pilot should immediately and aggressively bunt to reduce the AOA on the aircraft. At the same time, power will be increased to MIL on both engines. Maximum afterburner should be selected only below 15º AOA as it will aggravate directional control problems and delay the recovery. If there is a slight wing drop with the failure then the pilot should bunt the stick forward, opposite quadrant of the wing drop.

Once the aircraft is under less than 15° of AOA, full afterburner should be selected on both engines. The reason for this is that there is little time to properly diagnose the engine problem and the pilot should still be focused on recovering the aircraft not diagnosing. Half flaps may be selected to reduce the nose up attitude and provide extra lift. The aircraft should lose approximately 250 ft during the manoeuvre and should bottom out above 100 ft AGL if the manoeuvre was initiated at 500 ft AGL (250 ft for recovery and potential of up to 150 ft in altitude errors from pitot system). Once the aircraft begins to climb away from the ground and the spectator area, the pilot should diagnose the engine problem as per normal checklist procedures.

In order to further mitigate risk and build appropriate habit patterns, the normal recovery from the high alpha pass shall be the same as the emergency procedure. This way, FDP will continually practice the recovery and it will be a more intuitive response in the event of an actual failure. The aircraft should be recovered from the high alpha pass by aggressively unloading to max 15° AOA. Once the AOA is less than or equal to 15°, full afterburner shall be applied on both engines and the aircraft should accelerate away on a level to slightly climbing flight path. The pilot should verify that the nozzles open on both engines with the afterburner light.

404. EJECTION

FDP should study the AOI ejection charts and determine where one can safely get out of the jet, paying close attention to the nose down attitude during a square loop.

405. OVERSTRESS

If an overstress has occurred, the FDP shall 'Knock It Off' (KIO) and land. Overstresses are most likely to occur at low fuel weights near 3300 lbs and transonic regions during vertical climbs.

406. GEAR PROBLEM

This problem should be handled as per the AOIs. FDP should terminate display, as there could be some other related problems.

407. FLIGHT CONTROL

FDP should first recover the jet, then handle the emergency. FDP shall not try to reset a failure during a manoeuvre. Demands on the flight control system are the highest during an air show. If a problem has occurred, then it will most likely occur again. If there is an FCS degrade or Master Caution, FDP shall terminate the display and recover the aircraft.

One of the main areas of concern is a leading-edge flap lock-up during the back of the square loop. This can be rehearsed in the simulator. Of note, the recovery from this failure, and the normal recovery are very similar. There is already altitude padding in the recovery numbers such that the aircraft usually levels out around 600 ft AGL. The aircraft will likely dish lower during the recovery with a flap lock-up and there may be some wing waggle. As long as the pull is initiated by 2500 ft AGL or 300 KCAS (whichever occurs first) the aircraft will be able to recover. If the flight control failure occurs just before the benchmark then the aircraft should be recovered immediately.

Pilots must remember to add altitude to the recovery of the square loop for higher density altitude shows. The aircraft will not turn as tight and will settle lower during the recovery. The additional altitude for higher density altitude shows will account for this.

408. BIRD STRIKE

This emergency shall be immediately followed by a KIO and handled as per the AOIs, followed by an immediate landing.

ANNEX A - Fighter Demonstration Training Syllabus

Fighter Demonstration Training Syllabus

	Instructor Proficiency						Student Upgrade										
Location																	
Date																	
	ADCTS			1000'	700'	500'	ADCTS			2000	1000				700		500
Msn #	EAD1	EAD2	EAD3	IP AD1	IP AD2	IP AD3	EAD1	EAD2	EAD3	AD1	AD2	AD3	AD4	AD5	AD6	AD7	AD8	AD9
	DUAL	DUAL	DUAL	SOLO	SOLO	DUAL	DUAL	DUAL	DUAL	DUAL	DUAL	DUAL	SOLO	SOLO	SOLO	SOLO	SOLO	DUAL
	1.0	1.0	1.0	0.6	0.6	1.0	1.0	1.0	1.0	0.6	0.6	0.6	0.6	1.0	0.6	0.6	0.6	0.6
A/C	ADCTS						ADCTS											
Actual																		

	Student Upgrade									
Location										
Date										
	ADCTS	500'		300'						
Msn #	EAD4	AD10	AD11	AD12	AD13	AD14	AD15	AD16	AD17	ACPT
	DUAL	SOLO	SOLO	SOLO	SOLO	SOLO	SOLO	SOLO	SOLO	SOLO
	1.0	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.4	0.4
								TWILIGHT		
A/C	ADCTS									
Actual										

Legend	
	IP Front Seat
	UP Front Seat
	ADCTS

ANNEX B - Training Performance Review Card

	PILOT:		DATE:							
	MONITOR:		MISSION							
T										
A										
S	TAIL #:									
K	SORTIE TIME:									
#				LEVELS:	1	2	3	4	5	
1	BRIEFING									
2	SEQUENCE									
3	STAGING									
4	WEATHER / WIND ASSESSMENT									
5	ENERGY MANAGEMENT									
6	MAX PERFORMANCE CLIMB and CUBAN 8									
7	DIRTY ROLL + CUBAN 8									
8	90 / 270 REPOSIT									
9	QUAD 270									
10	SLPIT S REPOSIT									
11	SQUARE LOOP									
12	RUDDER OBLIQUE REPOSIT									
13	TOP SIDE									
14	SQUARE LOOP REPOSIT									
15	HIGH G 360									
16	HIGH ALPHA LOOP									
17	RUDDER OBLIQUE REPOSIT									
18	DIRTY INVERTED									
19	COLD SIDE 270 REPOSIT									
20	VERTICAL ROLL									
21	SPIRAL DESCENT REPOSIT									
22	HIGH SPEED PASS									
23	REVERSE 1/2 CUBAN									
24	CANOPY PASS									
25	1/2 BARREL AWAY									
26										
27	RECOVERY									
28	DE-BRIEFING									
29	EMERGENCIES									
30	AIRMANSHIP									
31	OTHERS									
32										
33										
34										
35										

COMMENTS

PILOT: _____ MONITOR: _____

PAGE 2

COMMENTS

STUDENT: _____ INSTRUCTOR: _____

ANNEX C - Demonstration Mission Data Card

DATE:	
C/S:	HORNET 1
MODE 3	
SHOWSITE:	
PRECEDING ACT	

ATIS / CLEARANCE:

TOLD / ENVIROS

SHOW AXIS	WIND	DA	RWY LGTH	ROT	T/O	WABT	DABT	LDG/W	LDG/D

FUEL PLAN OFFSITE SHOW	JOKER	BINGO	TAKEOFF	LAND

TIMES / FREQS

TIMINGS		AGENCY		LEFT	RIGHT
DRESS:		ATIS			
WALK:		GND			
START:		TWR			
TAXI:		SHOW			
T/O:		SAFETY			

WYPT	NAME	LAT	LONG	FLIGHT PRO CODES	
0	Ramp			DemoFE	AB207E
		Mvar	Elev	Demo TransFE	AB209E
1				MRS CODES	
2				Demo - Practice	AA C206 E00
3				Demo- Domestic	AA C207 E00
4				Demo - International	AA C208 E00
5				Demo - Transit	AA C209 E00
6				Ceremonial Flypast	AA C211 E00

AIRFIELD AND SHOWBOX:

	HIGH SHOW	LIMITED / FLAT SHOW
1	T/O Dirty Roll & Cuban 8	Take-off
	90° / 270° Repo	90° / 270° Repo
2	Quad x 270° Roll	Inverted Pass
	Slit "S" Repo	Hot 40° - Tuck - 220°
3	Square Loop	Quad x 270° Roll
	Hot Rudder Roll Oblique Repo	Hot 40° - Tuck - 220°
4	Top Side Pass	Top Side Pass
	Hot Square Loop Repo	Rudder Roll Oblique Repo or Tuck
5	High G 360° - High Alpha Loop	High G 360°
	Rudder Roll Away / 270°back	Rudder Roll Oblique reposit or Tuck
6	Dirty Inverted Pass	Dirty Inverted Pass
	Cold 270° reversal	Cold 270° reversal
7	High Alpha Pass	High Alpha Pass
	270° Behind the Crowd	270° Behind the Crowd
8	Overhead Pass - Vertical Rolls	Overhead Pass - Horizontal Rolls
	Hot Spiral Descent	Live Side 270° Reversal
9	High-Speed Pass	High-Speed Pass
	Reverse Half Cuban Repo	Hot 40° - Tuck - 220°
10	Canopy Pass & Half Barrel Roll	Canopy Pass & Half Barrel Roll
	Hot 270° reversal	Hot 270° reversal
11	On Crowd - Overhead Pass	On Crowd - Overhead Pass
	Cold 270° Reversal	Cold 270° reversal
12	Wave Pass	Wave Pass
	Downwind Transition	Downwind Transition
13	Land	Land

CHECKLISTS

PRE TAKEOFF	
STRAPS	TIGHT
G-SUIT	CHECK
EJECT	ARM
ALT / DA / APEX	0 - 2000 / ____ / ____
FLAPS	AUTO
TRIM	SET 4° NOSE UP
FREQS	SET
HUD / DDIs	NORM / FCS / RDR
TAWS / ALT	OFF / 275 / 250 / 250
WPT	SHOW CENTRE / SET CSEL
FUEL	MIN / BINGO
IFF	ON / SET
TAPES	ON
TIME	NOTE

EMERGENCY REVIEW
Abort Speed
Normal Rotate
Pre Takeoff Brief
"Recover" Initial Actions
"Abort" Airborne Procedures
"Knock It Off" Contract
Ejection + Vector

DIVERTS

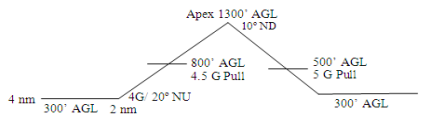
#	NAME	FUEL	DIST	TIME

BASE ALTITUDES		
300'	0'	2000'
500'	-200	1800
700'	-400	1600
1000'	-700	1300

POP-ATTACKS / PYRO OPTION

RECOVERIES	
1	Pop to 10 Bomb - Level Recovery
2	Pop to 15 Gun - Nose Up Recov
3	High Speed Level - Wall of Fire

ATTACK DIAGRAM:



ANNEX D – Heritage Flight Profiles

1. TWO PLANE HERITAGE FLIGHT


HERITAGE FLIGHT 2011
Second Pass – Top side along the 500
foot line "banana pass" with the CF18 in


HERITAGE FLIGHT 2011
Reposition for the last pass

Comd Approval Required: Over flight of the crowd at 500 feet AGL.

2. <u>TWO PLANE HERITAGE FLIGHT (HARVARD)</u>


HERITAGE FLIGHT 2011
Second Pass – Enter from 45 degrees
dead side stage left for a bottom side pass on the 1500 foot line. The CF18 starts from behind the Harvard and sets up to rejoin in a stepped up Echelon Left position as they pass crowd centre. The Harvard pilot sets and flies a profile, The CF18 Demo


HERITAGE FLIGHT 2011
Reposition for the last pass. The CF18
sets up so that it will overtake the Harvard

Comd Approval Required: Over flight of the crowd at 500 feet AGL.

3. THREE PLANE HERITAGE FLIGHT


HERITAGE FLIGHT 2011
Second Pass Vic Top Side – Top side
along the 500 foot line "banana pass" with


HERITAGE FLIGHT 2011
Reposition for the last pass

<u>Comd Approval Required</u>: Over flight of the crowd at 500 feet AGL

ANNEX E - MALA Demonstration Team

Fighter Force MISSION ACCEPTANCE (MA) Demonstration Team	
CONDITION *(If this condition is present…)*	**APPROVAL AUTHORITY** *(Then the approval authority is…)* **Demo Tasks** (does not include trg)
Air Demonstration tasking is on the approved season schedule in accordance with the signed CF188 Demonstration Season Op Order. **OR** The mission is a transit in direct support of a tasking on the approved season schedule in accordance with the signed CF188 Demonstration Season Op Order.	**Det Comd** **(National Demonstration Pilot)**
The tasking is a fly-by which is not on the approved season schedule in accordance with the signed CF-18 Demonstration Season Op Order.	**CAOC Dir**
The tasking is a full Air Demonstration performance which is not on the approved season schedule in accordance with the signed CF-18 Demonstration Season Op Order.	**Comd 1 CAD**

Fighter Force LAUNCH AUTHORITY (LA)
Demonstration Team

Conditions					
Crew					
1. 3FAR	12 or more	6-11			
2. Crew rest	< 8 hrs	8-12hrs			
3. Hours flown previous day (last 24 hrs)	≥ 8 hrs	6-8 hrs			
4. Planned Crew Day	≥ 16 hrs	12-16 hrs			
Environment					
5. Wind	> AOI limits	Crosswind exceeding 20kts			
6. Overwater operation – Wind/Sea State limits	Sfc wind >35 kts Wave height >4m	N/A			

Authorization Level – Launch Authority			
Steady-State	Comd 1 CAD	CAOC Dir	Det Comd (National Demonstration Pilot)
	3 FAR RED and/or ≥ 6 Amber or 1 Red	3FAR YLO and/or 4-5 Amber and no Red	3FAR GRN and ≤3 Amber and no Red
Signature			
Approved by			
	Rank, Initials, Name	*Rank, Initials, Name*	*Rank, Initials, Name*

Fighter Force LAUNCH AUTHORITY (LA) Amplifying Instructions
Demonstration Team

Conditions		References
Crew		
1. 3FAR	See 3FAR report. FAR result will determine overall MA/LA lowest level of authorization. FAR YLO = OpsO/AFC; FAR RED = CO/ATF CO/CCO. Does not count for overall MA/LA Red, Amber, Green count.	3FAR FOM Ann 2.1.3.A
2. Crew rest	Min 12 hrs. 14hrs following crew day that exceeds 14hrs or when flight commences and terminates 3 or more time zones apart. Less than 8 hrs must be approved by HHQ.	FOM 2.3.3.2
3. Hours flown previous day	Max daily accumulated flying time will not exceed 8 hrs (10 hrs for long range ferry flights).	FOM 2.3.3.2.A
4. Planned Crew Day	Continuous on-duty time should not exceed 16 hrs.	FOM 2.3.3.2.A
Environment		
5. Winds	The wing-down top-rudder technique is ineffective in crosswinds greater than 20 knots, creates excessive pilot work load, and should not be used. Note: this does not represent a restriction to operations but rather highlights an area of potentially elevated risk.	CF188 AOIs, Normal Operating Procedures para 28
6. Overwater operation – Wind/Sea State limits	FF ejection seat equipped aircraft will not conduct overwater flying operations, beyond gliding distance of land when: (1) maximum surface wind in the operating area is 35 knots or greater, steady state; and (2) the wave height in the operating area exceeds four meters (Sea State Six).	FOM 2.2.3.2

Authorization Level – Launch Authority			
	Comd 1 Cdn Air Div	CAOC Dir	Det Comd (National Demonstration Pilot)
Steady-State	3 FAR RED and/or ≥ 6 Amber or 1 Red	3FAR YLO and/or 4-5 Amber and no Red	3FAR GRN and ≤3 Amber and no Red

ANNEX F - Show Box Template