



1 February 2023

FAA -

1. The 2023 Thunderbird team is ready for the show season and kindly request the FAA join us at NAF El Centro, CA on 2 March 2023.
2. The following is the list of 2023 Thunderbird pilots:
 - Thunderbird 1 – Lt Col Justin Elliott, Commander/Leader
 - Thunderbird 2 – Capt Zachary Taylor, Left Wing
 - Thunderbird 3 – Maj Jacob Impellizzeri, Right Wing
 - Thunderbird 4 – Maj Lauren Schlichting, Slot
 - Thunderbird 5 – Maj Daniel Katz, Left Solo/Lead Solo
 - Thunderbird 6 – Maj Eric Tise, Right Solo/Opposing Solo
 - Thunderbird 7 – Lt Col Ryan Yingling, Operations Officer/Pilot
 - Thunderbird 8 – Maj Jeffrey Downie, Advance Pilot/Narrator
3. The attached 2023 Certification Guide includes a memorandum from the Commander, maneuver sequences, and graphical depiction of the maneuvers. Please contact Lt Col Ryan Yingling with questions at ryan.yingling.1@us.af.mil, afthunderbird7@gmail.com, or 702-271-6627.

Sincerely,

ELLIOTT.JUSTIN.JAME S.1255525758
Digitally signed by
ELLIOTT.JUSTIN.JAMES.1255525758
Date: 2023.02.01 14:06:01 -08'00'

JUSTIN J. ELLIOTT, Lt Col, USAF
Thunderbird 1, Commander/Leader



DEPARTMENT OF THE AIR FORCE
USAFADS "THUNDERBIRDS" (ACC)
NELLIS AIR FORCE BASE NEVADA

10 January 2023

MEMORANDUM FOR FAA Representatives

FROM: USAFADS/CC

SUBJECT: 2023 Thunderbirds Maneuver Package

1. This United States Air Force Air Demonstration Squadron (Thunderbirds) Maneuver Package provides you with a pictorial display of demonstration maneuvers used by the Thunderbirds.

2. The Thunderbirds have three show types depending upon weather or terrain considerations. A high show, which includes formation rolls and loops, may be flown with a minimum ceiling of 6,500' and 5 nautical mile visibility. A low show, which has formation rolls only, may be flown with a minimum ceiling of 3,500' and 5 nautical mile visibility. A flat show, which includes no loops or rolls, may be flown with a minimum ceiling of 2,000' and 5 nautical mile visibility (USAFADS/CC may waive the flat show minimum ceiling to 1,500'). Transitions between show types and maneuvers occur on occasion if weather or other conditions prohibit safe execution of a given maneuver. Additionally, in the interest of pilot and public safety, show-site conditions, hazards within the TFR, and weather may drive resequencing of maneuvers or truncation of show sequence.

3. The Department of Defense accepts full responsibility for the operation of Thunderbird demonstration maneuvers as described herein. Lieutenant Colonel Justin Elliott, Commander/Leader, USAF Air Demonstration Squadron, is the designated representative for the Department of Defense for the execution of these maneuvers and prioritizes safety over visual appeal or presentation.

4. Thunderbird maneuvering airspace and minimum dimensions for an aerobatic box are depicted in section III. The team will review and approve modification or truncation to the aerobatic box on a case-by-case basis. FAA guidelines currently permit non-aerobatic passes flown no closer than 500' from the crowd. Aerobatic maneuvers shall occur at the 1500' show line; however, non-aerobatic maneuvers may take place on the 500' show line. Non-aerobatic passes over the crowd will be a minimum of 500' AGL. Thunderbird formations in the transition area may descend from 500' to be at their minimums at 1NM from show center, even over occupied buildings. All maneuvers can transition to a flat pass if conditions dictate.

5. The Thunderbirds may fly a demonstration with less than six aircraft. Fallout of the left and right solos is depicted in the maneuvers package as 5-ship shows; any other fallout scenarios will result in an incomplete diamond with or without solos as part of the formation. The Thunderbirds will occasionally fly a seventh aircraft during practice demonstrations and site surveys in a photo-chase profile. This aircraft will be flown by Thunderbirds 7 or 8 upon completion of syllabus-directed training. If the seventh aircraft is a 2-seat F-16, only a designated Thunderbird team member will occupy the rear cockpit. The photo-chase aircraft will maneuver as required to achieve the desired photographic position relative to the diamond, solos, or delta. The same rules and regulations governing the 6-ship within the TFR and aerobatic box also apply to the seventh aircraft. The photo chase aircraft will never fly during an official demonstration.

6. The Thunderbirds on occasion may fly non-Thunderbird individuals in the rear cockpit of a 2-seat F-16 during practices and rehearsals for purposes of training and outreach. Prior to flying individuals in the backseat at airshow locations, the Thunderbirds will notify the Airboss, FAA Inspector in Charge (IIC), and the Certificate of Waiver (CoW) holder for concurrence. Only Thunderbird demonstration pilots will fly during an official demonstration.

7. My point of contact to address any questions concerning these maneuvers is Lieutenant Colonel Ryan Yingling, Thunderbird Operations Officer, at (702) 271-6627 or DSN 682-9931.

ELLIOTT.JUSTIN.JAMES.1
255525758
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ELLIOTT.JUSTIN.JAMES.1255525758
Date: 2023.01.10 16:48:29 -0800

JUSTIN J. ELLIOTT, Lt Col, USAF
Commander/Leader

Recruit – Retain – Inspire

1st Ind, USAFADS/CC, 10 January 2022, 2023 Thunderbirds Maneuver Package, 57 WG/CC

MEMORANDUM FOR USAFWC/CC

Recommend: Concur/~~Nonconcur~~

GOODMAN.RICHARD.A.11158748
17

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GOODMAN.RICHARD.A.1115
874817
Date: 2023.01.19 04:35:07
-08'00'

RICHARD A. GOODMAN
Brigadier General, USAF
Commander

2d Ind, USAFWC/CC

MEMORANDUM FOR ACC/A3

Recommend: Concur/~~Nonconcur~~

CUNNINGHAM.CASE.A.112865111
SE.A.1128655111

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5111
Date: 2023.01.25 14:21:16
-08'00'

CASE A. CUNNINGHAM
Major General, USAF
Commander

3d Ind, ACC/A3

MEMORANDUM FOR ACC/CC

Recommend: Concur/~~Nonconcur~~

LYONS.DAVID.BRADLEY.1062026460
0

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LYONS.DAVID.BRADLEY.1062
026460
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-05'00'

DAVID B. LYONS
Major General, USAF
Director of Operations

4th Ind, ACC/CC

MEMORANDUM FOR USAFADS/CC

Concur/~~Nonconcur~~

KELLY.MARK.D.1134000828
1134000828

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KELLY.MARK.D.11340008
28
Date: 2023.02.13
09:13:06 -05'00'

MARK D. KELLY
General, USAF
Commander



DEPARTMENT OF THE AIR FORCE
USAFADS "THUNDERBIRDS" (ACC)
NELLIS AIR FORCE BASE NEVADA

1 February 2023

MEMORANDUM FOR RECORD

FROM: USAFADS/CC

SUBJECT: 2023 USAFADS "Thunderbirds" Demonstration Pilots

1. I appoint the following USAF Air Demonstration Pilots for the 2023 season:

- #1 Commander/Leader – Lt. Col. Justin Elliott
- #2 Left Wing – Capt. Zachary Taylor
- #3 Right Wing – Maj. Jacob Impellizzeri
- #4 Slot – Maj. Lauren Schlichting
- #5 Lead Solo – Maj. Daniel Katz
- #6 Opposing Solo – Maj. Eric Tise
- #7 Operations Officer – Lt. Col. Ryan Yingling
- #8 Advance Pilot/Narrator – Maj. Jeffrey Downie

2. For questions or concerns, please contact Capt. Randi Winther at DSN 682-9584, commercial (702) 652-9584.

ELLIOTT.JUSTIN.JAM
ES.1255525758
JUSTIN J. ELLIOTT, Lt Col, USAF
Commander/Leader

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ELLIOTT.JUSTIN.JAMES.1255525758
Date: 2023.02.01 14:07:17 -08'00'

Recruit – Retain – Inspire



USAF Air Demonstration Squadron (Thunderbirds)

2023 FAA Maneuver Package



Section I

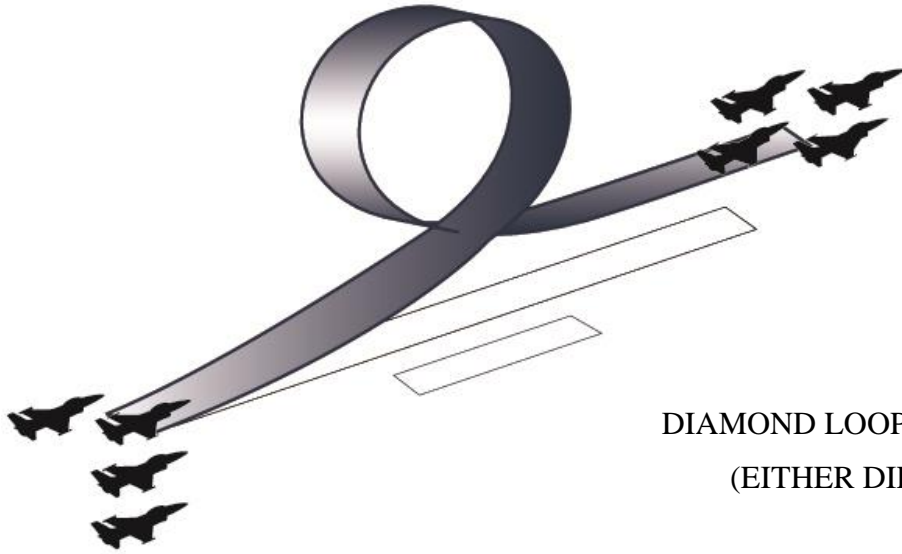
2023 6-SHIP SHOW (18 JAN 23)

HIGH SHOW	LOW SHOW	FLAT SHOW
Diamond Takeoff / Loop on Takeoff	Low Transition Formation Takeoff	Low Transition Formation Takeoff
(LS) Roll on Takeoff	(LS) Roll on Takeoff	(LS) Roll on Takeoff
(RS) Max Climb / Split S	(RS) Max Climb / Split S	(RS) Low Trans Takeoff
Diamond Cloverloop Opener ⬆←	Low Opener ⬆←	Flat Opener ⬆←
Crossover Break ←⬆→	Crossover Break ←⬆→	Crossover Break ←⬆→
Diamond PIR ←	Diamond PIR ←	Diamond PIR ←
(RS) Knife Edge →	(RS) Knife Edge →	(RS) Knife Edge →
Diamond Roll ⇒	Diamond Roll ⇒	Diamond Flat Pass ⇒
Calypso Pass ←	Calypso Pass ←	Calypso Pass ←
Echelon Pass in Review ⇒	Echelon Pass in Review ⇒	Echelon Pass in Review ⇒
(LS) Sneak Pass →	(LS) Sneak Pass →	(LS) Sneak Pass →
(RS) Slow Roll →	(RS) Slow Roll →	(RS) Slow Roll →
(LS) Aileron Rolls ←	(LS) Aileron Rolls ←	(LS) Aileron Rolls ←
Bon Ton Roule ⇐	Bon Ton Roule ⇐	Bon Ton Roule ⇐
Opposing Knife Edge →⇐	Opposing Knife Edge →⇐	Opposing Knife Edge →⇐
Trail to Diamond BUP ⇒	Trail to Diamond BUP ⇒	Trail to Diamond BUP ⇒
Opposing Inverted →⇐	Opposing Inverted →⇐	Opposing Inverted →⇐
Trail to Diamond Cloverloop ⬇←	High Low Hit ←	High Low Hit ←
(RS) Rejoin to Stinger (via Chaos) ←	(RS) Rejoin to Stinger ←	(RS) Rejoin to Stinger ←
Low Bomb Burst ⬇	Low Bomb Burst ⬇	Low Bomb Burst ⬇
(RS) Rejoin to Stinger (via LBB hit) ↑	(RS) Rejoin to Stinger (via LBB hit) ↑	(RS) Rejoin to Stinger (via LBB hit) ↑
(LS) High Alpha / Muscle Climb ←	(LS) High Alpha / Muscle Climb ←	(LS) High Alpha / Muscle Climb ←
5-Card Loop ⇐	5-Card Flat Pass ⇐	5-Card Flat Pass ⇐
(LS) Vertical Rolls →	(LS) 8-Point Roll →	(LS) 8-Point Roll →
Line Break Loop ⇒	Stinger Break Cross ⇒	Stinger Break Cross ⇒
(LS) Max Turn, 1/2 Cuban →	(LS) Max Turn, 1/2 Cuban →	(LS) Max Turn →
Burner 360 ⬆	Burner 360 ⬆	Burner 360 ⬆
Solo Rejoin to Delta ⬆	Solo Rejoin to Delta ⬆	Solo Rejoin to Delta ⬆
Delta BUP ⇐	Delta BUP ⇐	Delta BUP ⇐
Delta Roll ⇒	Delta Roll ⇒	Delta Flat Pass ⇒
Delta Loop ⇐	Delta 360 ⇐	Delta 360 ⇐
Delta Burst ⬇	Delta Burst ⬇	Delta Burst ⬇
Opposing Split S →⇐	Opposing Split S / 4-Point →⇐	Opposing 4 Point →⇐
High Bomb Burst ⇒	Rapid Recovery ⬆	Rapid Recovery ⬆
Thunderbird Pitch ⇐	Thunderbird St-In	Thunderbird St-In
Reflection Pitch (Reflection Pass) ←	Solo St-In	Solo St-In

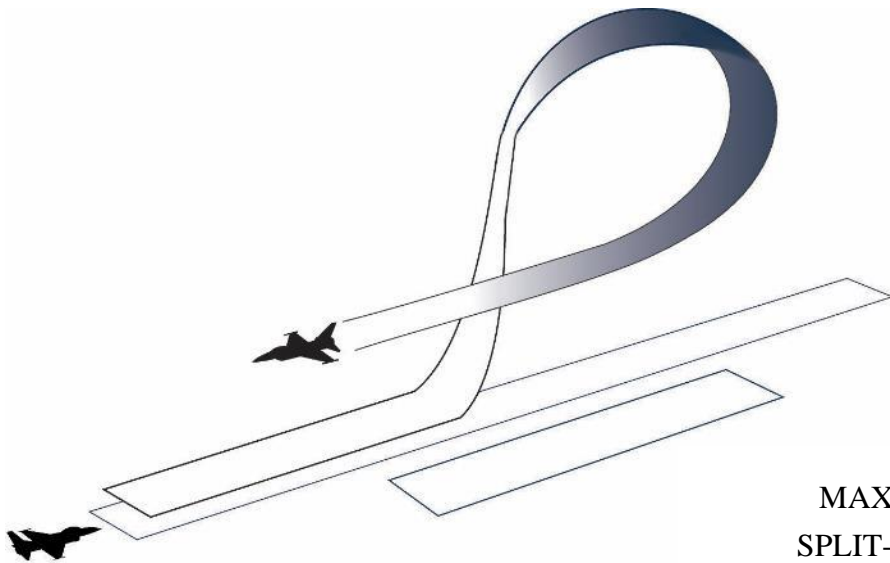
2023 5-SHIP SHOW (18 JAN 23)

HIGH SHOW		LOW SHOW		FLAT SHOW	
Diamond Takeoff / Loop on Takeoff		Low Transition Formation Takeoff		Low Transition Formation Takeoff	
(LS) Roll on Takeoff	(RS) Max Climb / Split S	(LS) Roll on Takeoff	(RS) Max Climb / Split S	(LS) Roll on Takeoff	(RS) Low Trans Takeoff
Diamond Cloverloop Opener	↑←	Low Opener	↑←	Flat Opener	↑←
Max Climb	↑	Immelmann	↑	Left Pitchback	↑
Diamond PIR	←	Diamond PIR	←	Diamond PIR	←
Knife Edge	→	Knife Edge	→	Knife Edge	→
Diamond Roll	⇒	Diamond Roll	⇒	Diamond Flat Pass	⇒
4-Point Roll	←	4-Point Roll	←	4-Point Roll	←
Echelon Pass in Review	⇒	Echelon Pass in Review	⇒	Echelon Pass in Review	⇒
Sneak Pass	→	Sneak Pass	→	Sneak Pass	→
Aileron Rolls	←	Aileron Rolls	←	Aileron Rolls	←
Bon Ton Roule	←	Bon Ton Roule	←	Bon Ton Roule	←
Inverted	→	Inverted to Inverted	→	Inverted to Inverted	→
Trail to Diamond BUP	⇒	Trail to Diamond BUP	⇒	Trail to Diamond BUP	⇒
Inverted to Inverted	←	Repo for High Low Hit		Repo for High Low Hit	
Trail to Diamond Cloverloop	↓←	High Low Pass	←	High Low Pass	←
Rejoin to Stinger	↑	Rejoin to Stinger	↑	Rejoin to Stinger	↑
Low Bomb Burst	↓	Low Bomb Burst	↓	Low Bomb Burst	↓
(LS) High Alpha / Muscle ←	(RS) Slow Roll ←	(LS) High Alpha / Muscle ←	(RS) Slow Roll ←	(LS) High Alpha / Muscle ←	(RS) Slow Roll ←
Diamond Loop	←	Diamond Flat Pass	←	Diamond Flat Pass	←
Vertical Rolls	→	8-Point Roll	→	8-Point Roll	→
Slot Break Cross	⇒	Slot Break Cross	⇒	Slot Break Cross	⇒
Max Turn, 1/2 Cuban	→	Max Turn, 1/2 Cuban	→	Max Turn	→
Burner 360	↑↑	Burner 360	↑↑	Burner 360	↑↑
Solo Rejoin to Wedge	↑↑	Solo Rejoin to Wedge	↑↑	Solo Rejoin to Wedge	↑↑
Wedge BUP	←	Wedge BUP	←	Wedge BUP	←
Wedge Roll	⇒	Wedge Roll	⇒	Wedge Flat Pass	⇒
Wedge Loop	←	Wedge 360	←	Wedge 360	←
Wedge Burst	↓	Wedge Burst	↓	Wedge Burst	↓
High Bomb Burst	⇒	Split S	→ or ←	4-Point Roll	→ or ←
High Bomb Burst RJ	←	Rapid Recovery	↑↑	Rapid Recovery	↑↑
Thunderbird Pitch	←	Thunderbird St-In		Thunderbird St-In	
ARPU	←	Solo St-In		Solo St-In	

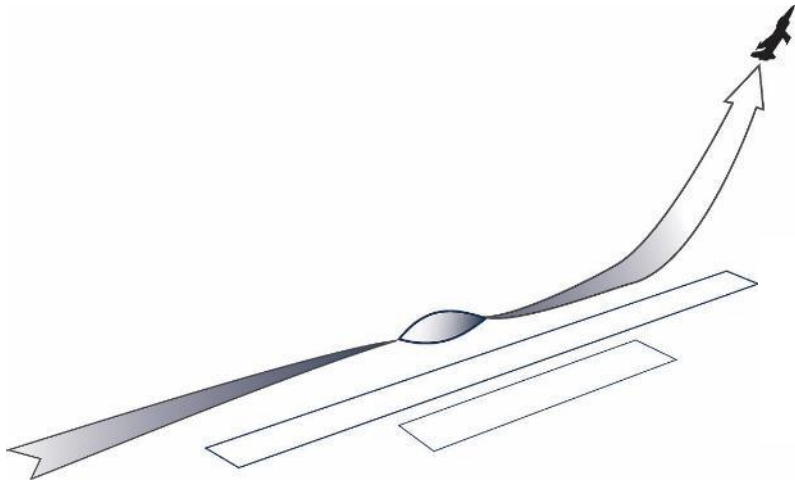
Section II



DIAMOND LOOP ON TAKEOFF
(EITHER DIRECTION)



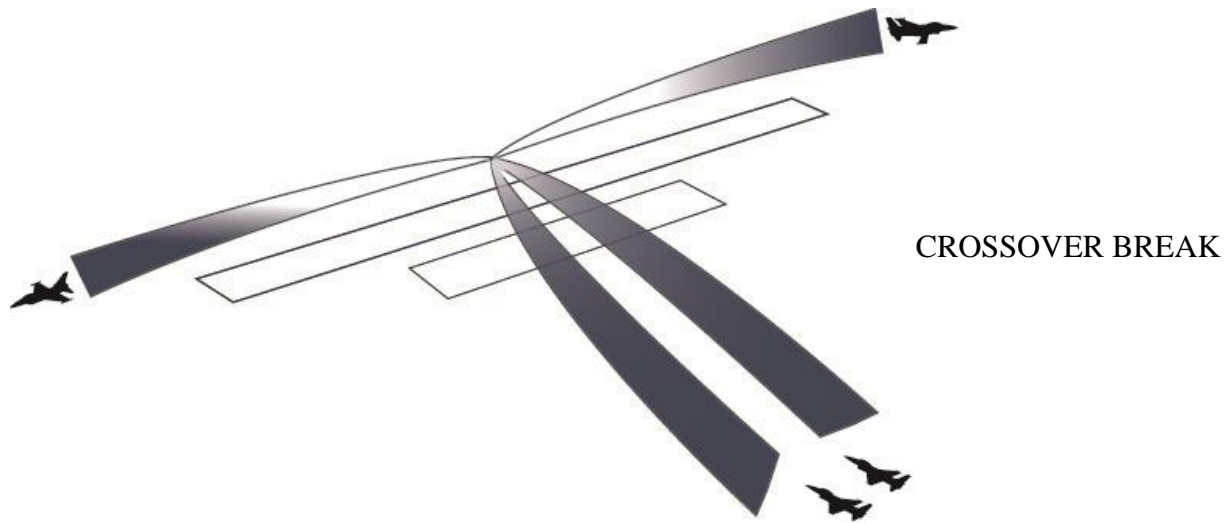
MAX CLIMB WITH
SPLIT-S ON TAKEOFF
(EITHER DIRECTION)



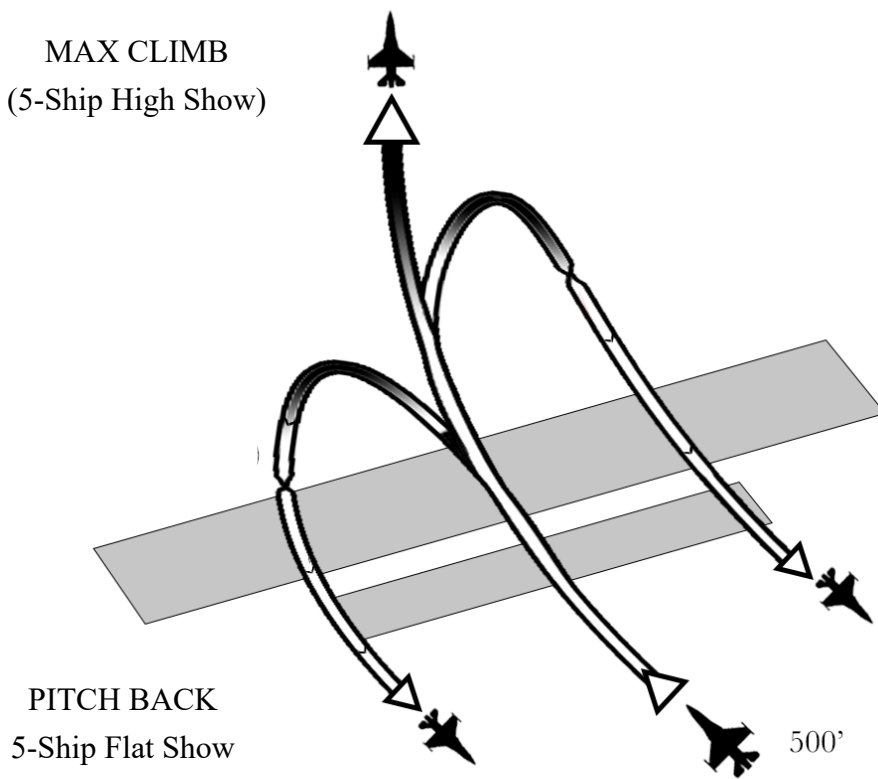
SOLO ROLL ON TAKEOFF
(EITHER DIRECTION)



CLOVERLOOP OPENER

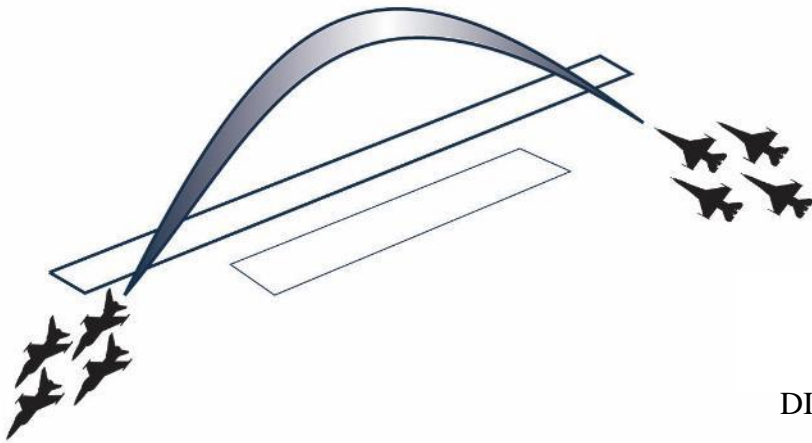


MAX CLIMB
(5-Ship High Show)

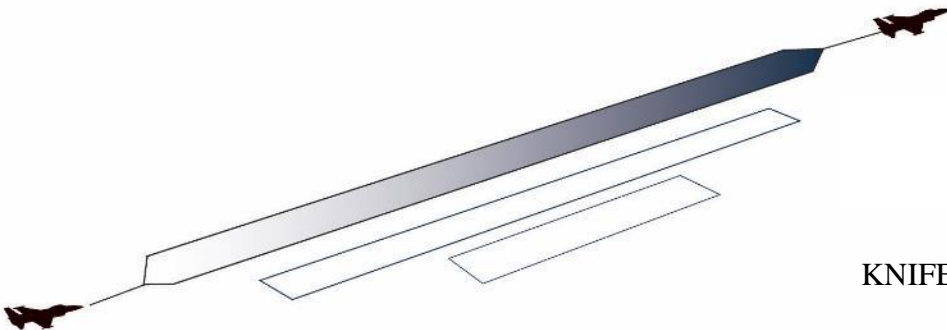


IMMELMAN
(5-Ship Low Show)

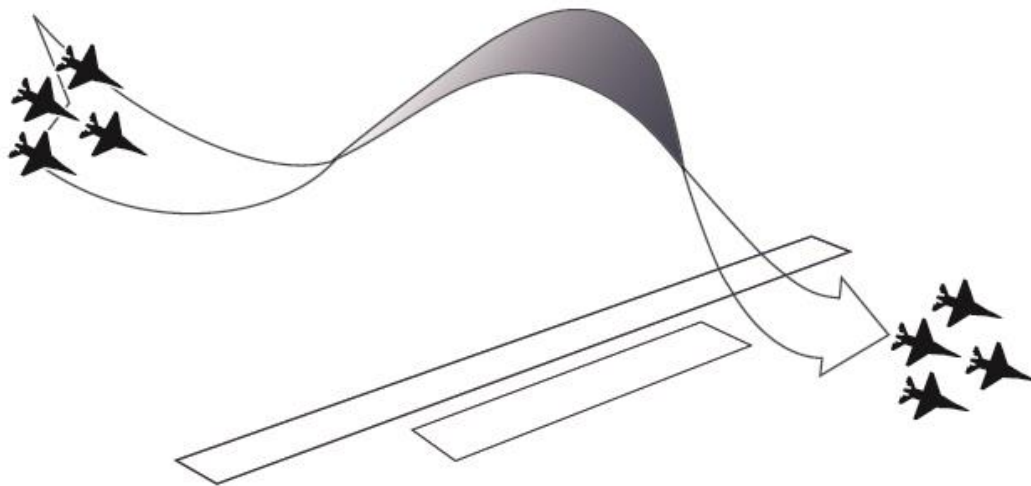
500'



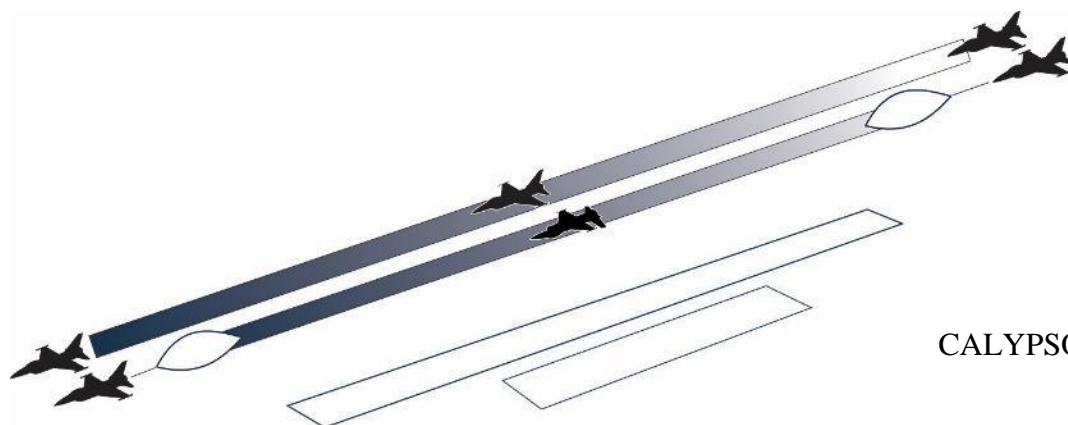
DIAMOND PASS-IN-REVIEW



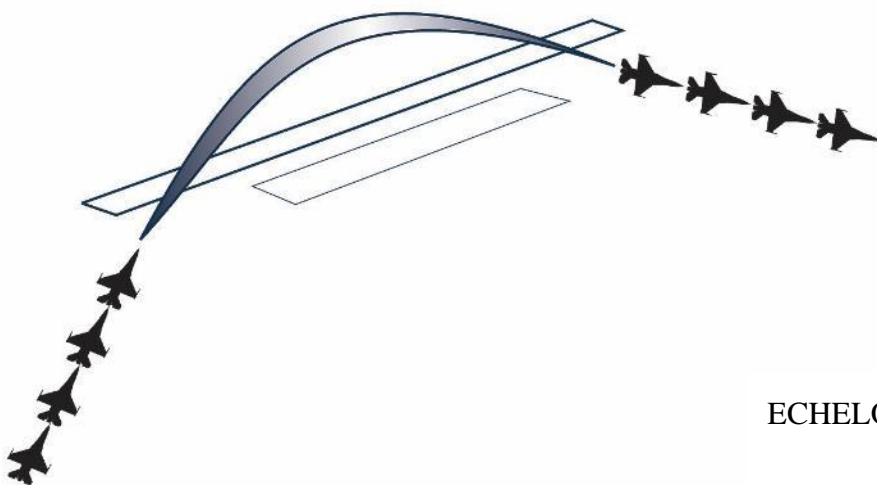
KNIFE-EDGE



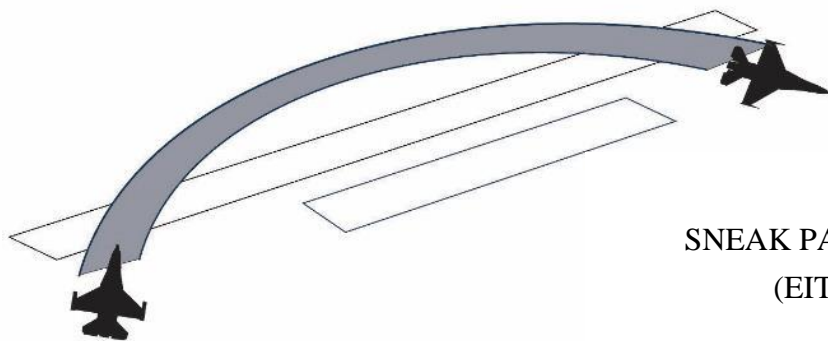
DIAMOND ROLL



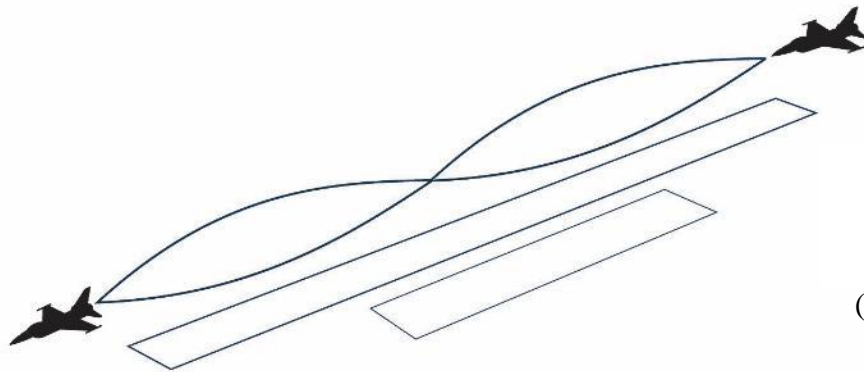
CALYPSO PASS



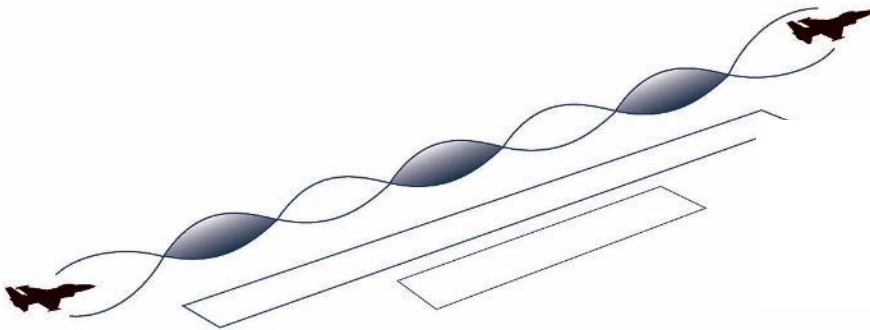
ECHELON PASS-IN-REVIEW



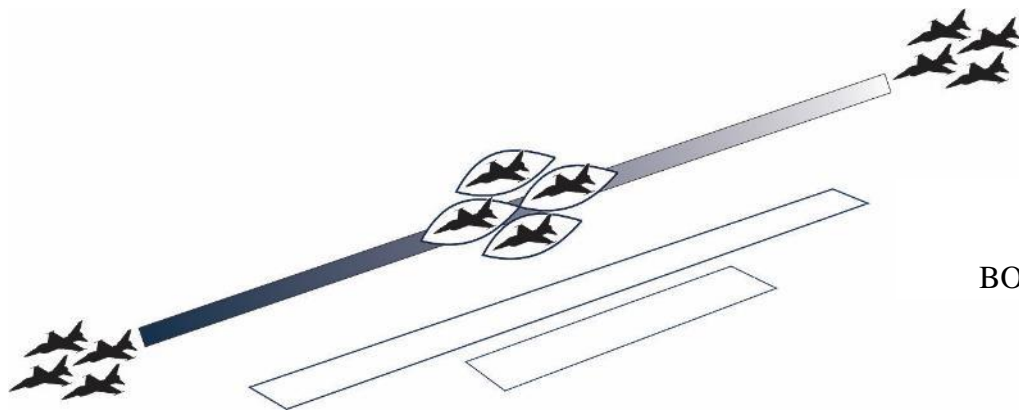
SNEAK PASS/AFTER BURNER ON
(EITHER DIRECTION)



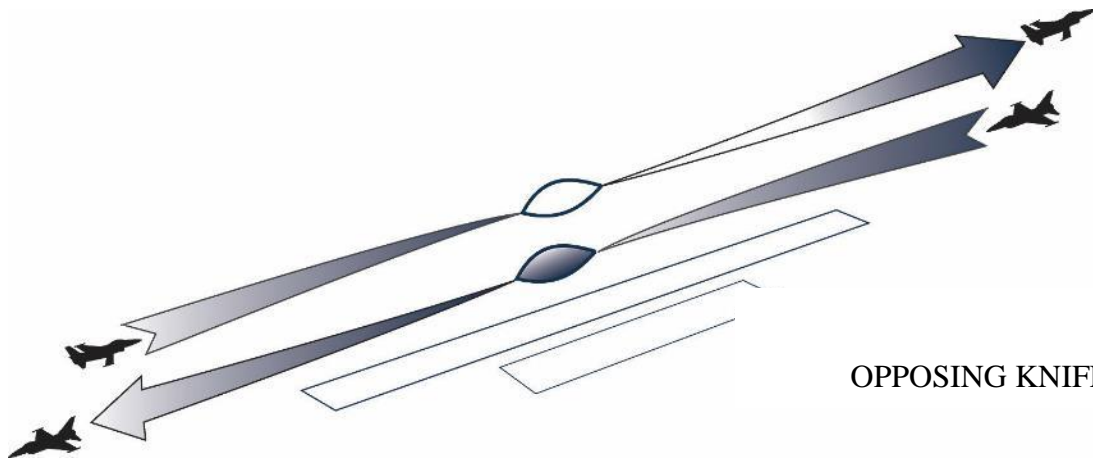
SLOW ROLL
(EITHER DIRECTION)



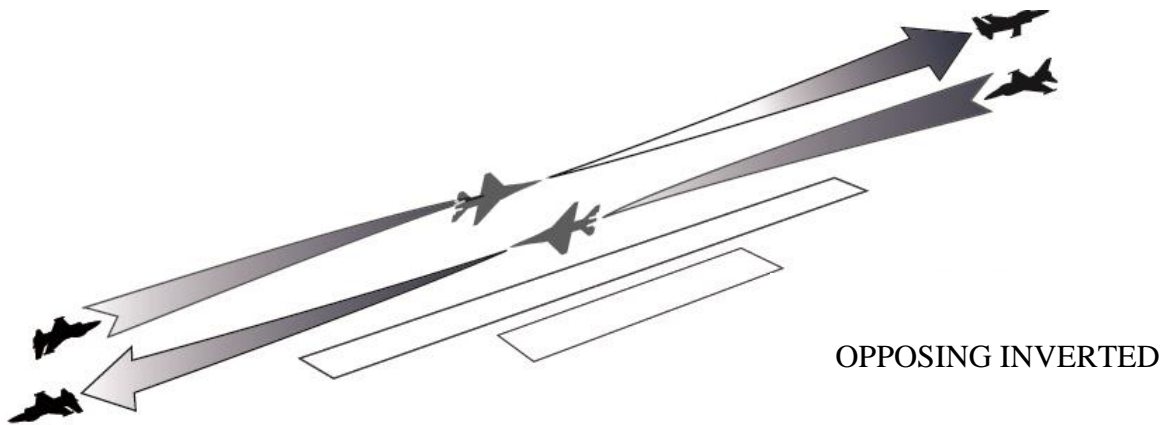
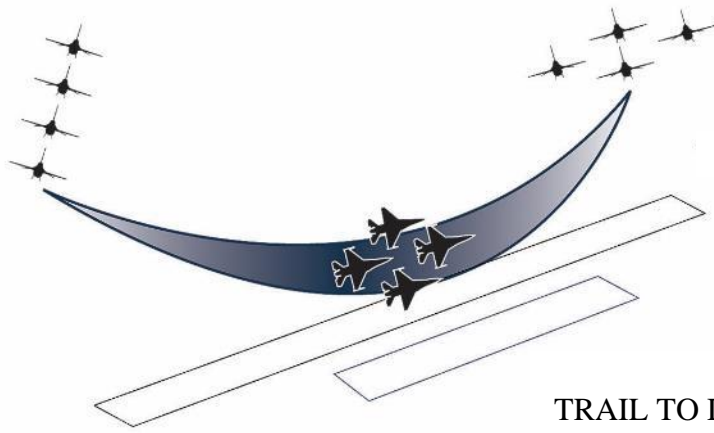
AILERON ROLLS
(EITHER DIRECTION)



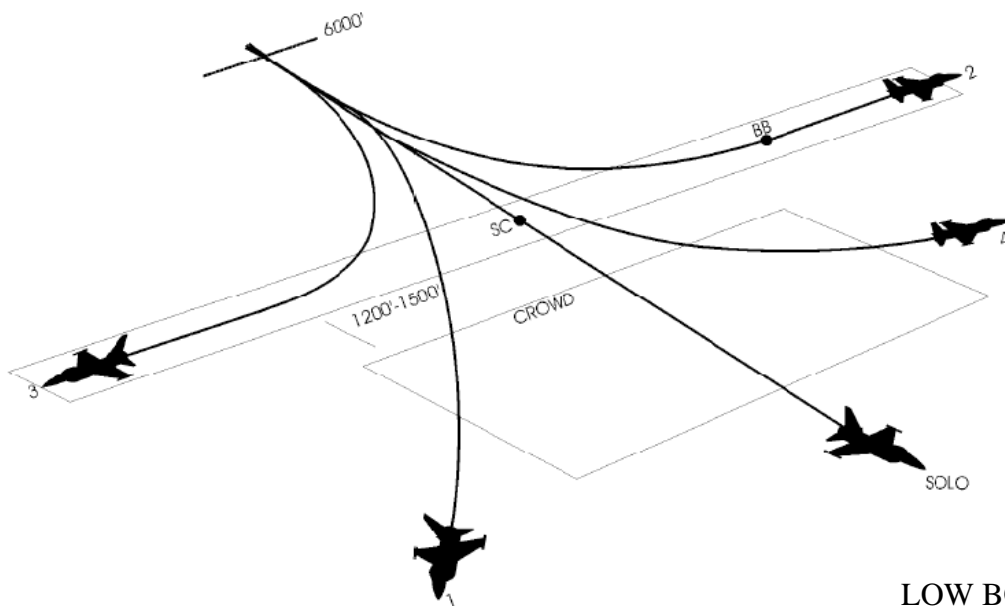
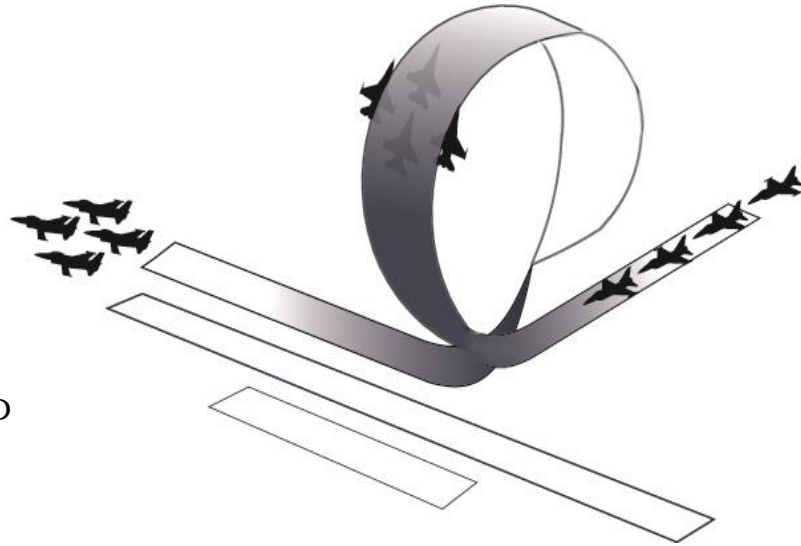
BON TON ROULLE



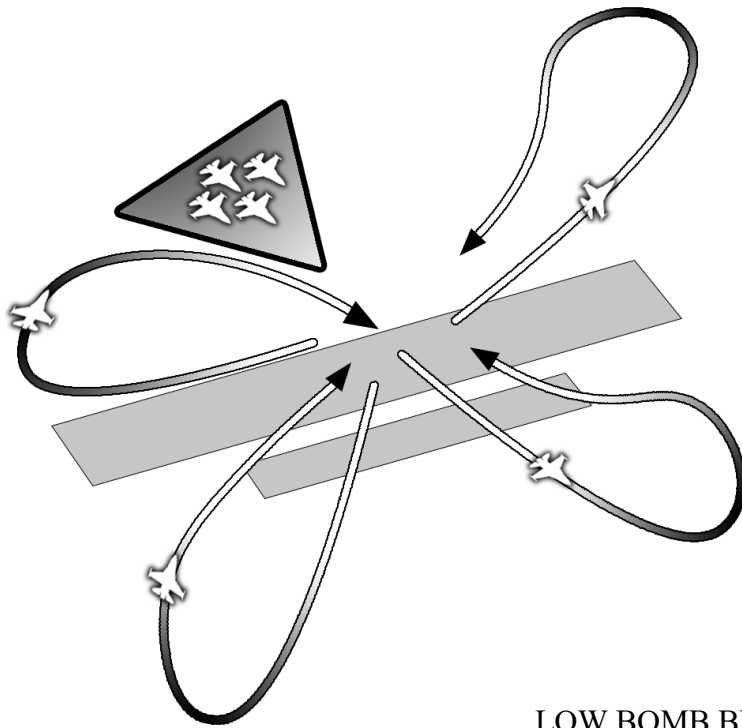
OPPOSING KNIFE-EDGE



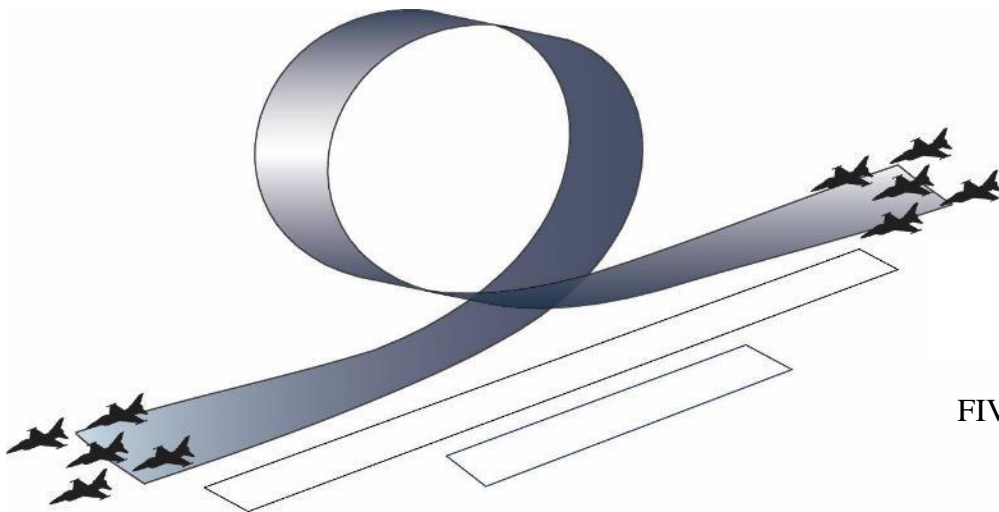
TRAIL TO DIAMOND
CLOVERLOOP



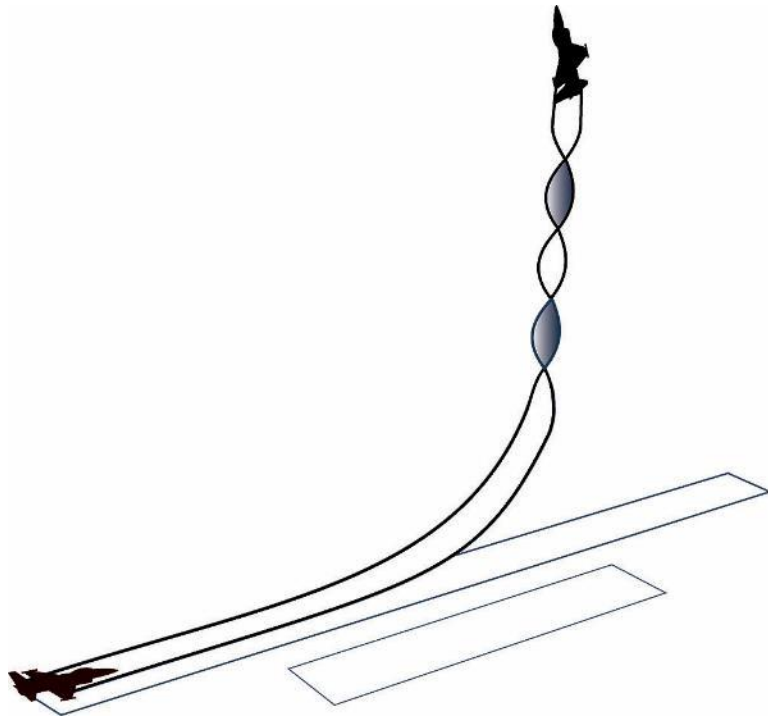
LOW BOMB BURST



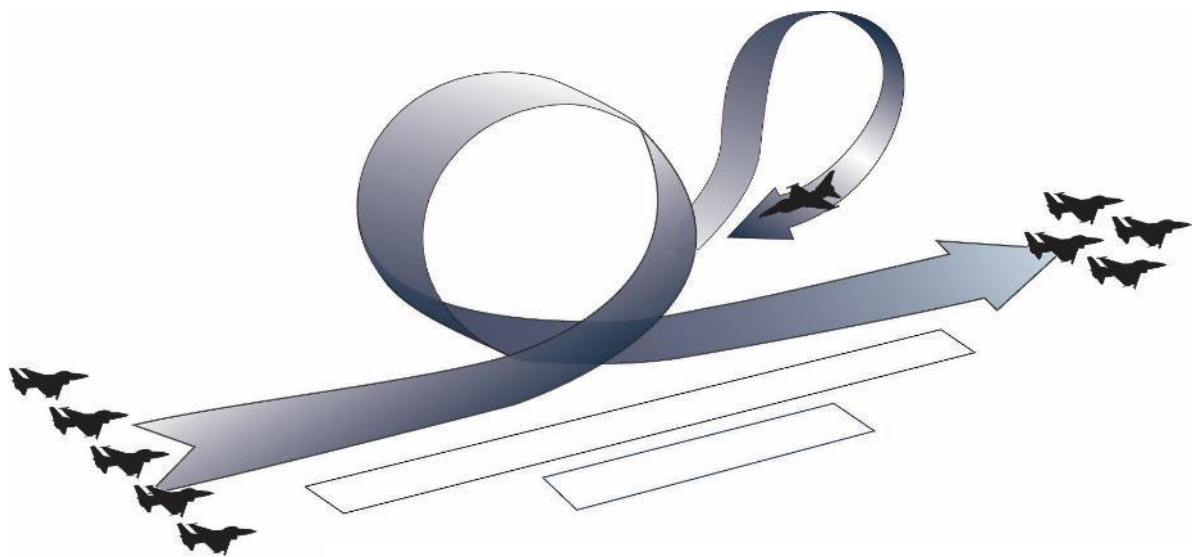
LOW BOMB BURST CROSS



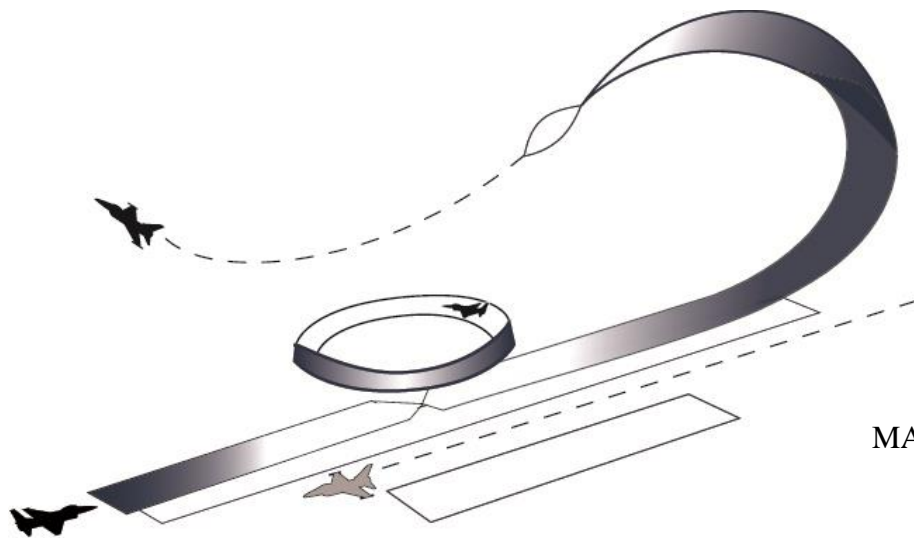
FIVE CARD LOOP



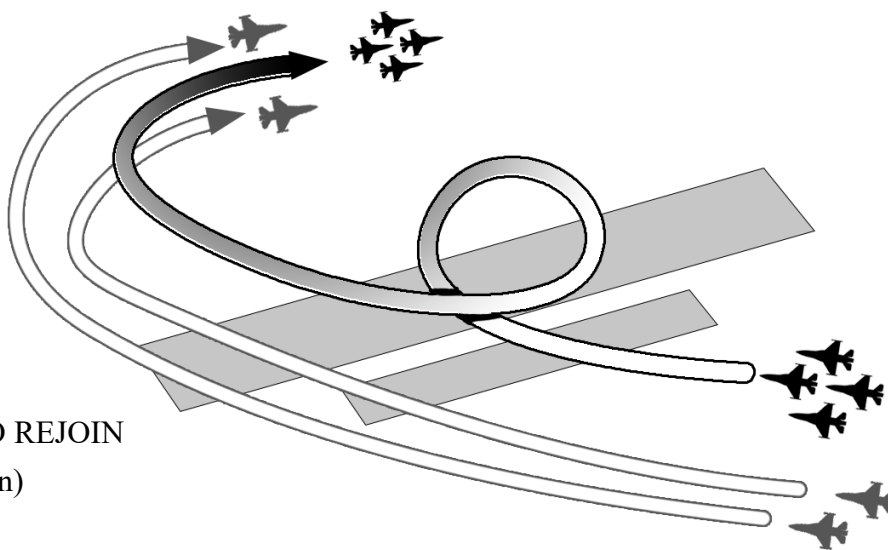
VERTICAL ROLLS



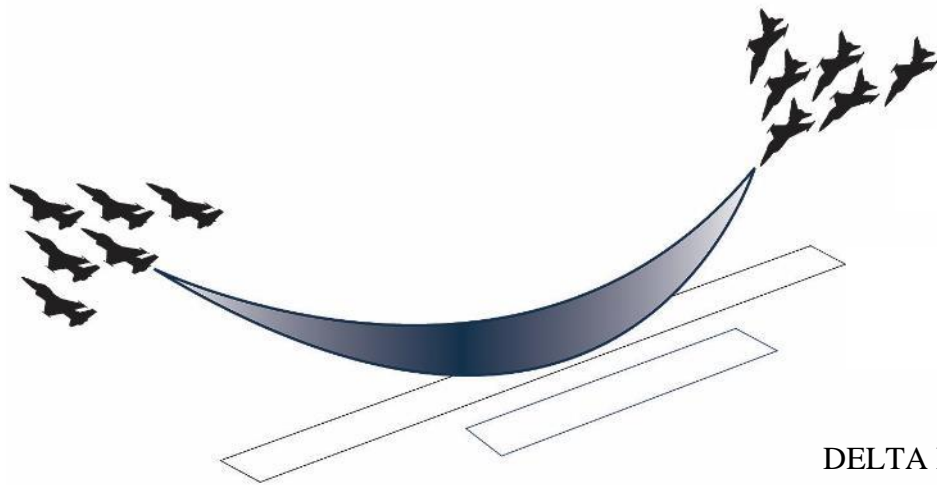
LINE BREAK LOOP



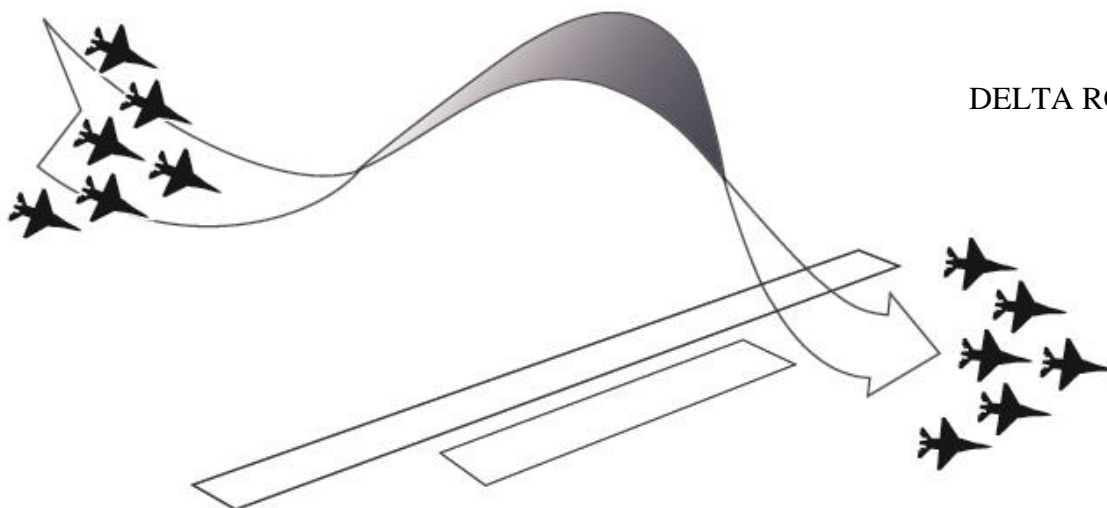
MAX TURN WITH HALF
CUBAN EIGHT



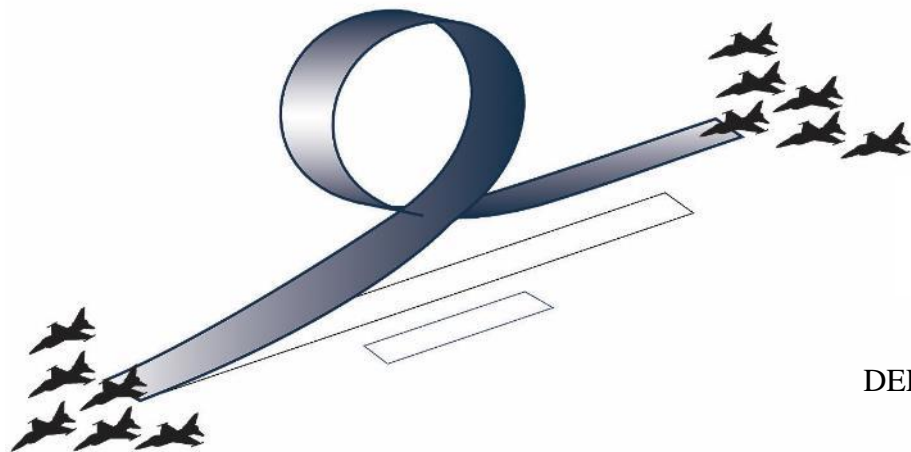
DIAMOND 360 SOLO REJOIN
(Afterburner On)



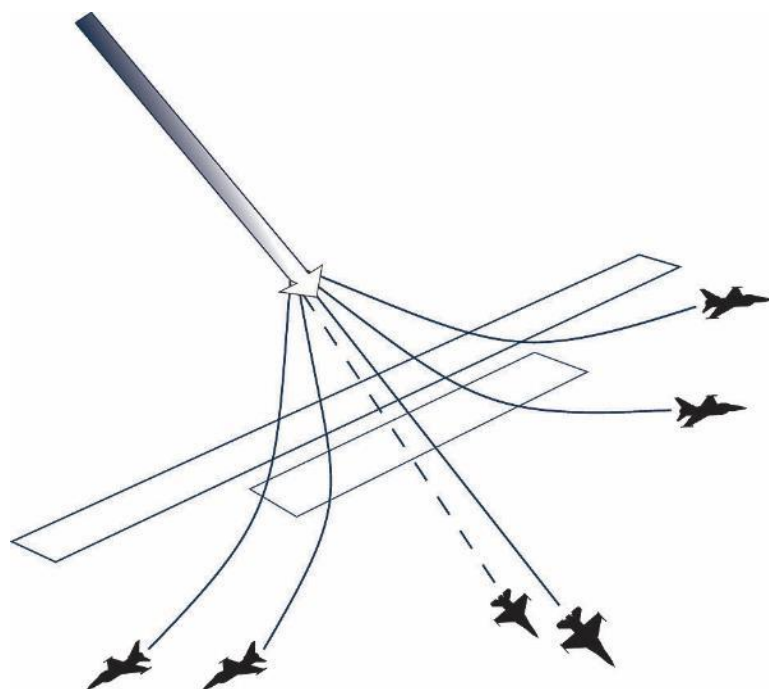
DELTA BOTTOM-UP-PASS



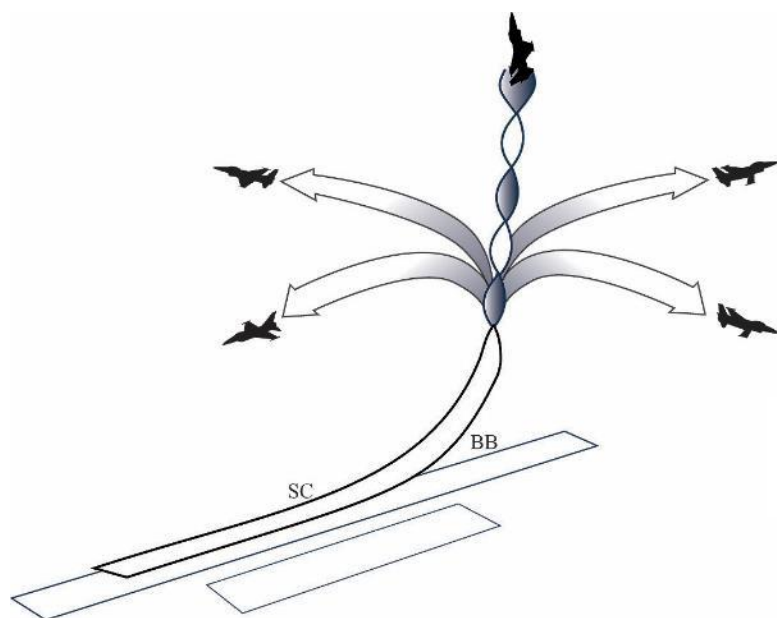
DELTA ROLL



DELTA LOOP

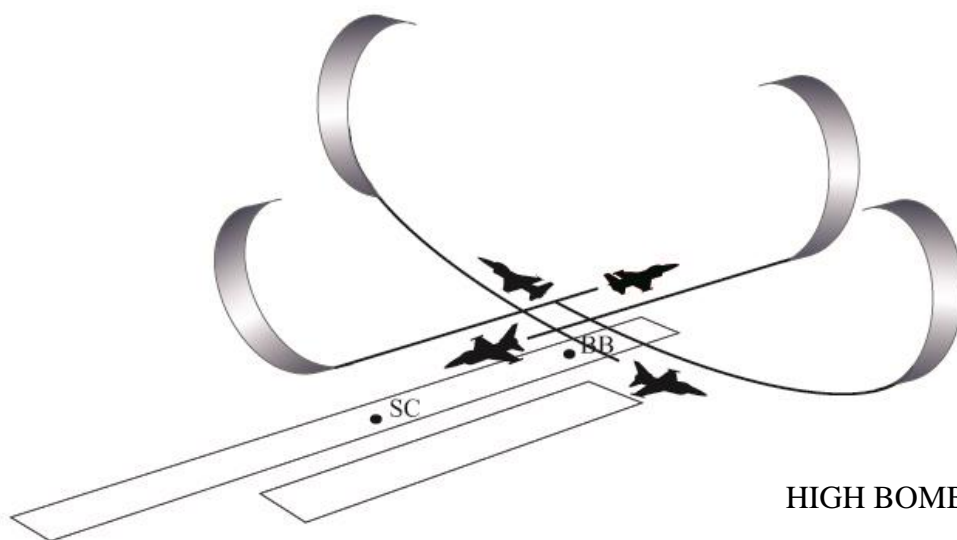


DELTA BURST

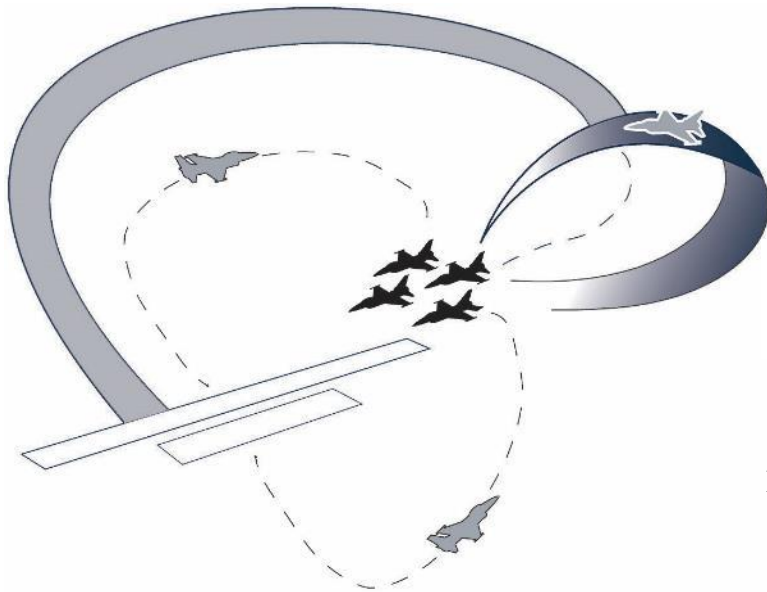


HIGH BOMB BURST WITH SOLO HIT
TO VERTICAL ROLLS

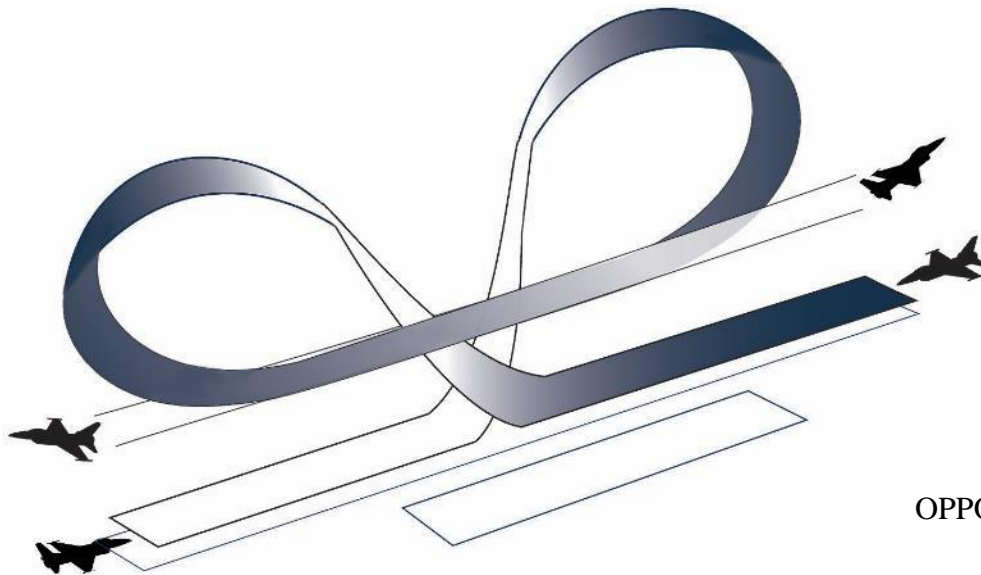
SC – SHOWCENTER
BB – BOMB BURST



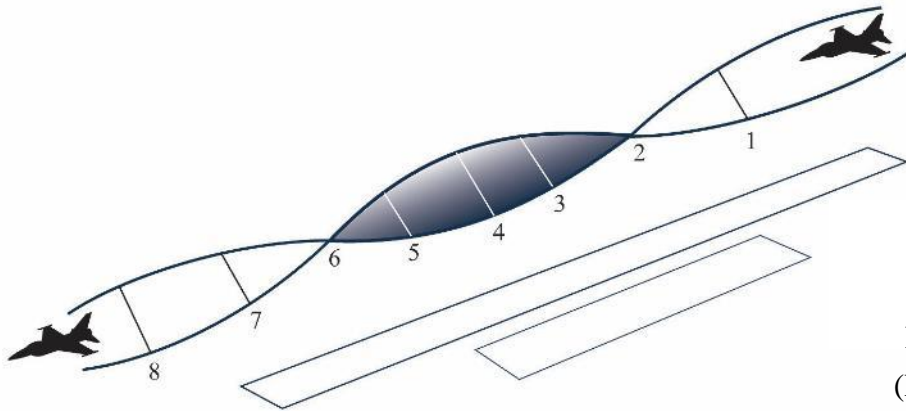
HIGH BOMB BURST CROSS



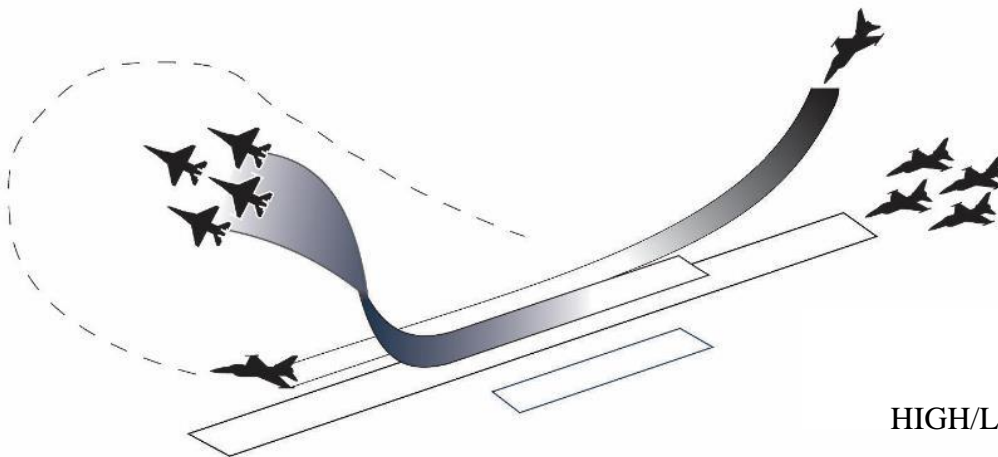
HIGH BOMB BURST REJOIN



OPPOSING SPLIT-S



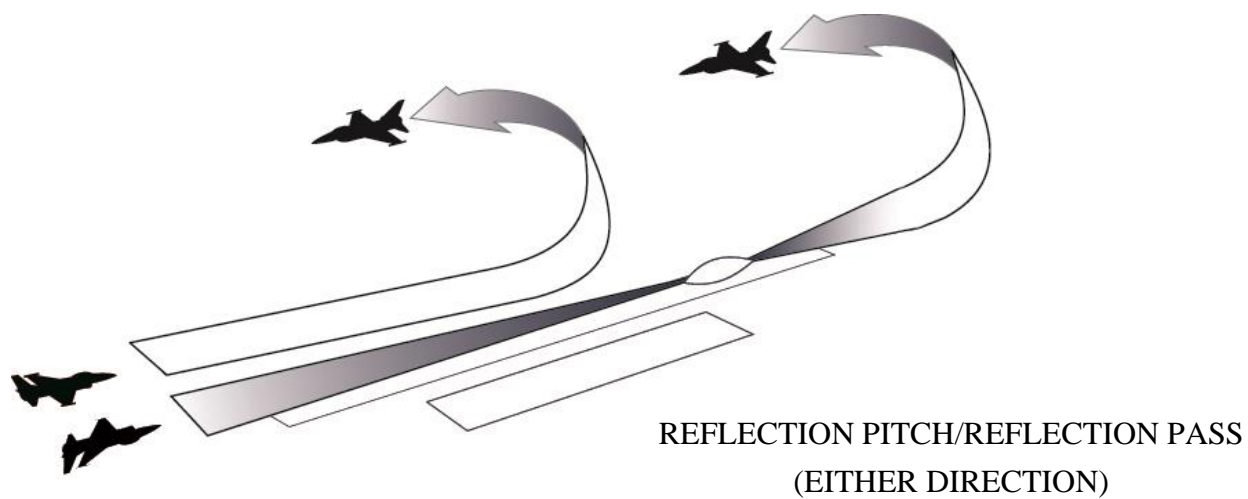
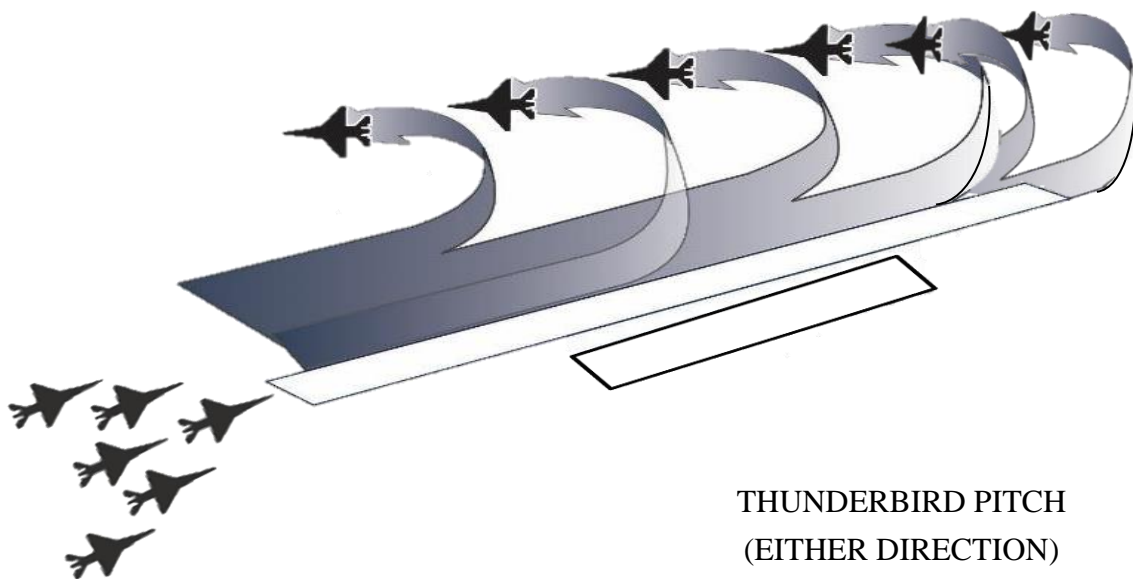
EIGHT-POINT ROLL
(EITHER DIRECTION)

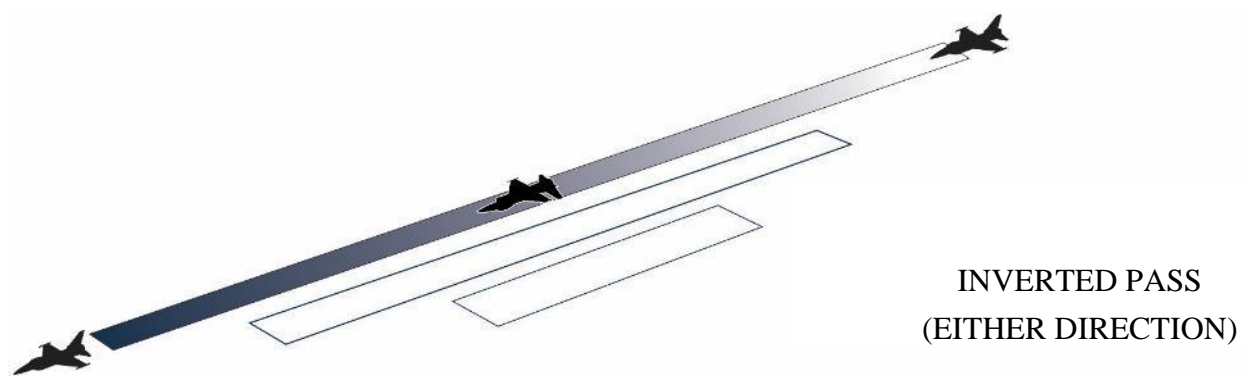
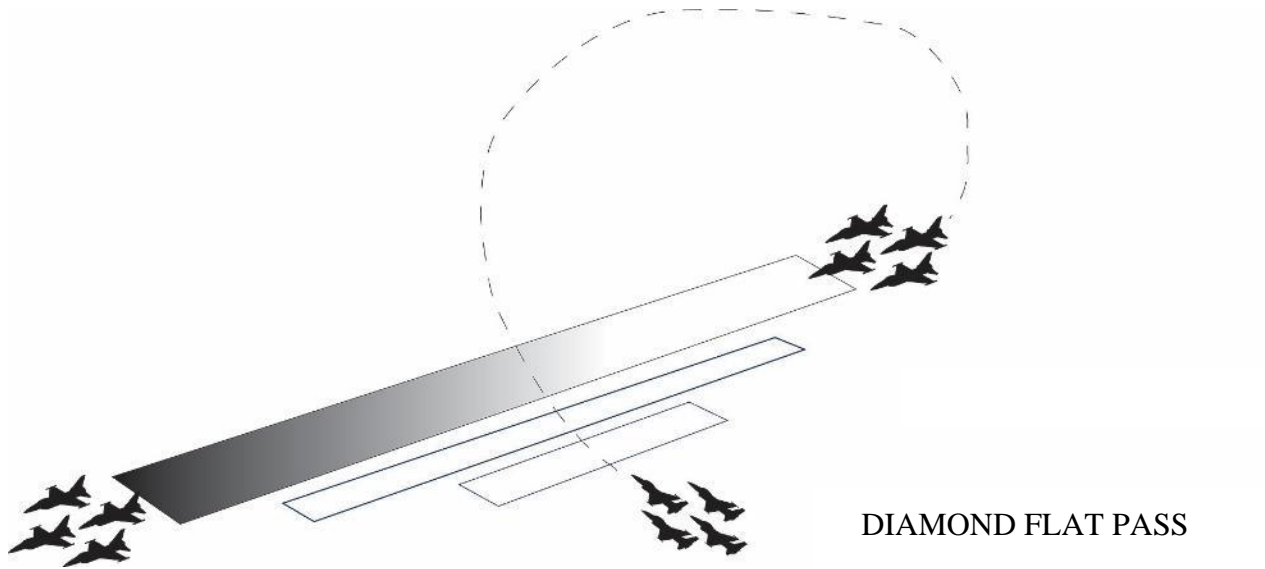


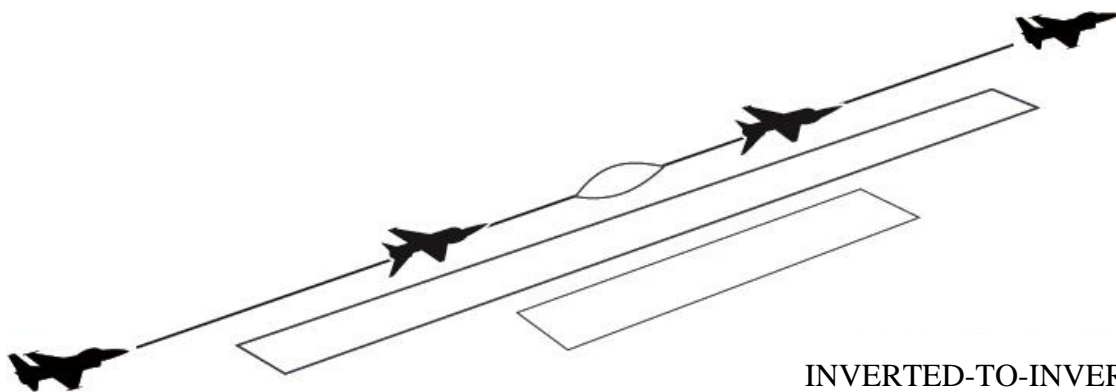
HIGH/LOW PASS

.94 Mach Max

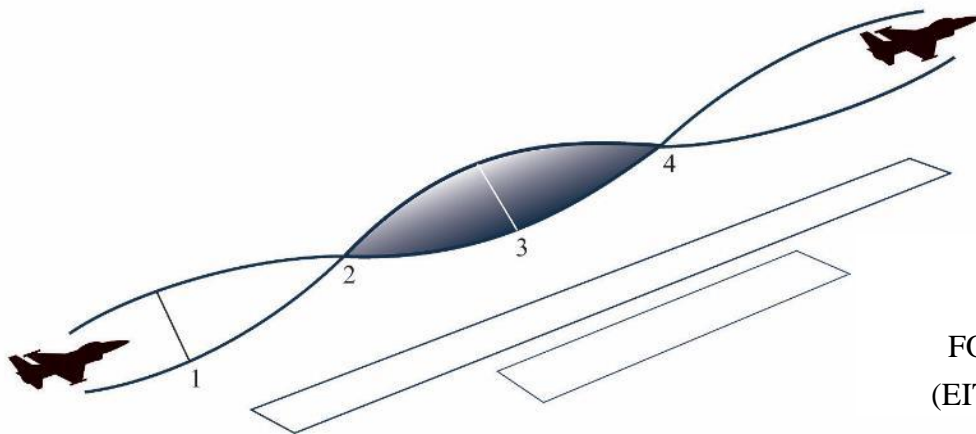
Post Pass, Solo Executes Half Cuban then rejoins with Diamond.



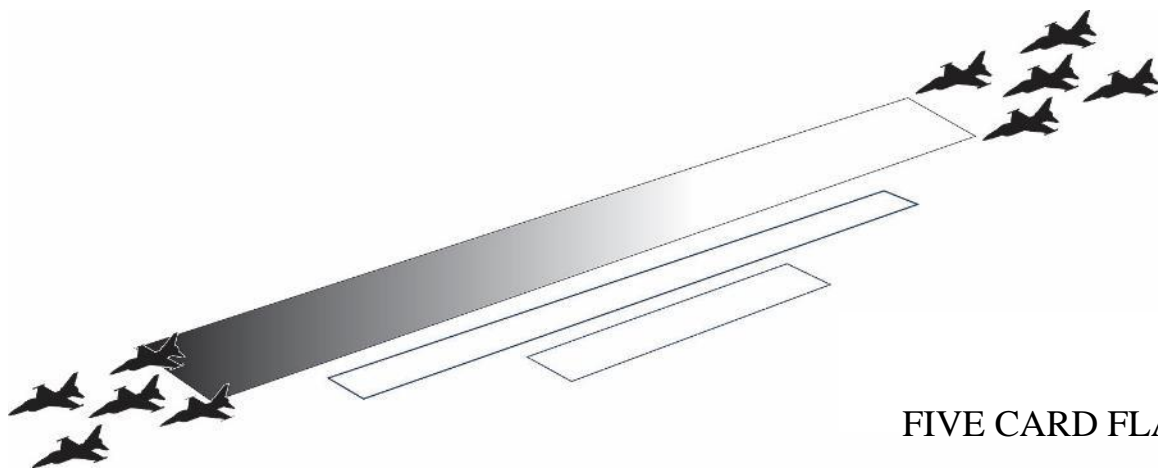




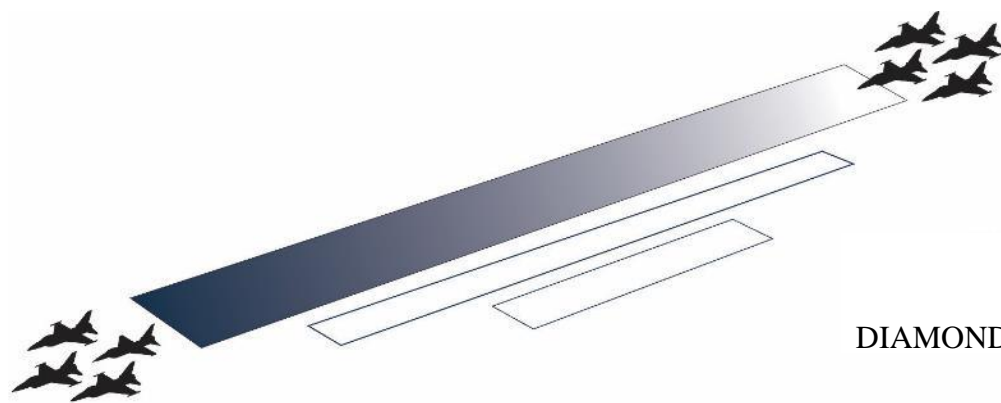
INVERTED-TO-INVERTED PASS
(EITHER DIRECTION)



FOUR-POINT ROLL
(EITHER DIRECTION)



FIVE CARD FLAT PASS



DIAMOND FLAT PASS

Section III

Aerobatic Box

Typical show site airfield layout:

