Advanced Formation Clinic
Overview, Safety, Operations

Why Are We Here???

- Improve our formation artistry
- Airshow quality flight
- Earn an FFI card
- Better understand safety issues
- Fly with any FFI fourship in the USA
- Enjoy a weekend with some great people!

The Etiquette of Improvement

- Give/receive detailed feedback
- Say it in front of everyone
- Be constructive, positive, thickskinned
- Avoid denial/anger
- Different people use different techniques

Minimum Requirements

- Aircraft & Equipment must be ready in all respects
- 2 place Intercom and Radio. Dual com if cross country
- Dual Yoke preferable for training but not required unless by safety pilot

Formation Safety

Caution:

- Formation flight introduces a variety of new risks. It is your responsibility to understand these risks, to decide whether you want to participate, and to fly safely.

Emergency Escapes

- Military
  - Ejection seat
  - Parachute
- War bird
  - Parachute
- Bonanza
  - No escape
  - No parachute
  - Nonprofessional pilots
  - Requires extra safety margins

Safety Starts with You

- You are the PIC, be safe, exercise good judgment
- Fully understand any maneuver before you fly it
- Learn to say a friendly no
- Poor execution causes accidents
- Fly within your vision limitations
- Fly within your skill and experience level
- Pay attention, avoid talking out of turn
- Maintain a sterile cockpit
- Don’t take your eyes off your reference in close formation
  - Know switch and throttle locations and operate them by feel alone
  - Don’t adjust your radio in close formation
  - If you must, step out to a safe distance first

Keeping the Group Safe (1)

- Fly at a skill/risk level where everyone is comfortable
- Make a big change through progressive, small changes
- Avoid macho unsafe attitudes
- Don’t fly too close
- Avoid idle chatter
- New formation pilots fly with an experienced observer

Keeping the Group Safe (2)

- Get good at two ship and know the book before 4-ship
- Wherever possible, do something new with someone experienced in charge
- Always know where are the threats of collision and avoid them
- Make moves slowly
- Don’t move rapidly into the person on your blind side

Safe Technique

- Always use proper technique and discipline
- Always have multiple degrees of safety that will prevent an accident
- Don’t rush. Don’t let others rush you.
- Don’t get too excited or emotional
- Do all your checklists, pull out of flight if checklist item fails
- Don’t break up via other than standard echelon pitch out
- Don’t bunch up in the traffic pattern, especially on final
- Don’t give a frequency change to the formation in a turn
- Fully brief any non-standard maneuvers

Weather Safety

- In bumpy air, accept unstable step down and leave extra step out and step back
- Don’t fly high to practice in smooth air – stay within 3000’ of ground. Airshows rarely have smooth air
- Don’t fly formation if there are restrictions to visibility
- Keep clear of clouds by a larger distance than you would by yourself
- Make circling climbs and descents in clear air instead of climbing/descending directly towards a cloud

Don’t Fly IMC or Night Formation

- At Night:
  - Depth perception poor
  - Can’t see attitude of lead plane
  - Requires formation lights that we don’t have.
- In IMC
  - Can be lethal

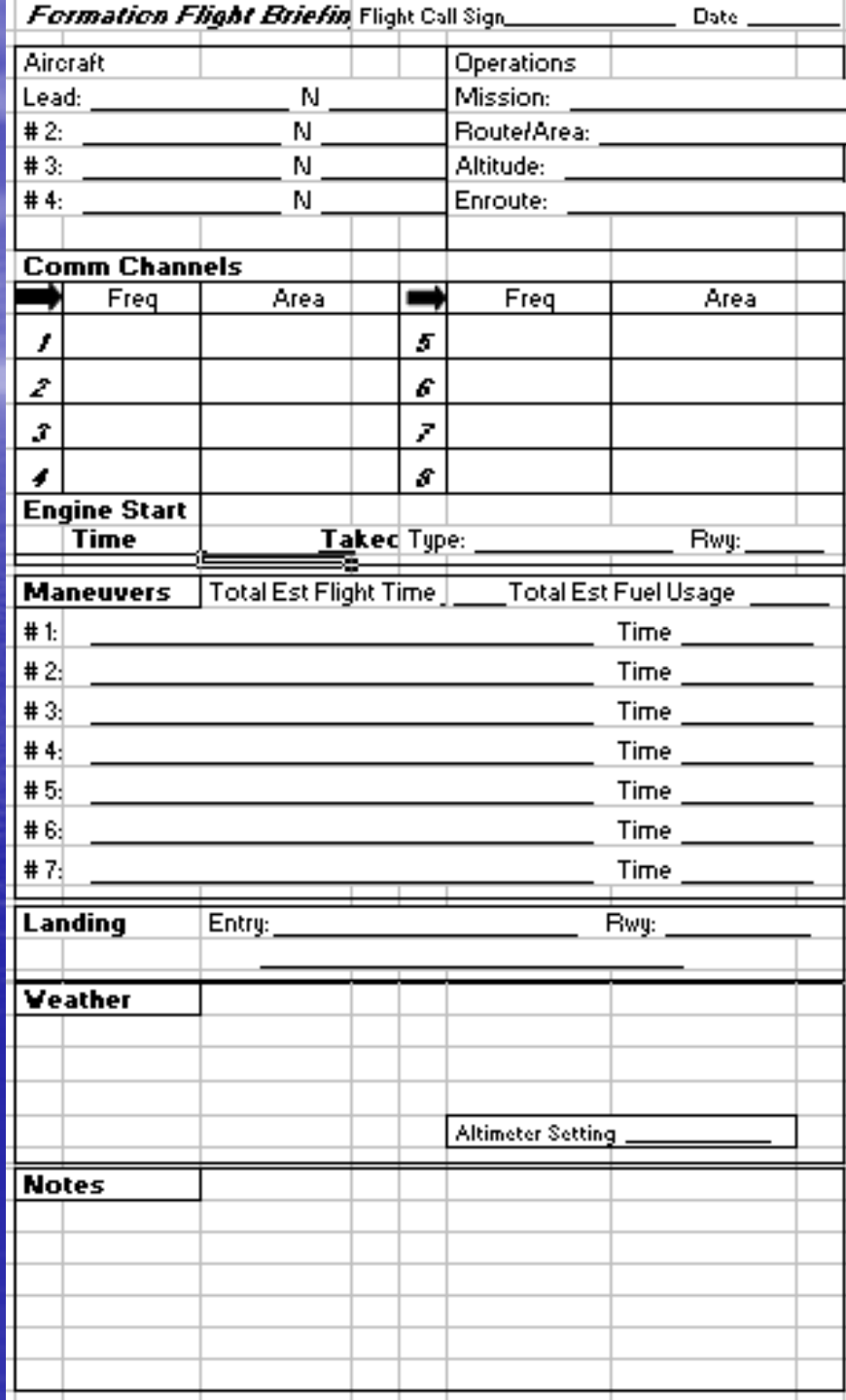
Emergency Procedures

- Pilot of stricken plane:
  - A) avoid rapid maneuvers so others can miss you. Fly smoothly straight ahead or maintaining gliding speed while formation goes around/under/over you. Or,
  - B) if safe, pull rapidly up and then to side of large formation to let it go by. (Brief ahead of time)
  - C) When safely clear of formation, go through emergency procedures to try and clear problem. Radio lead with your problem as you have time. Look for a field to land.
- Pilots of avoiding planes
  - Smoothly avoid stricken plane. Avoid sudden moves. Easy if you always maintain generous step down and step out.
- Lead:
  - provide assistance to troubled pilot. Assign someone to stay with stricken pilot 1000 feet above, look for airports within gliding distance and direct stricken pilot appropriately, coordinate search and rescue or emergency services with ATC or 121.5

Formation Operations

Briefing

- Lead goes through briefing form
  - Form pre-filled out for FFI Check
  - Lead goes first. Dry-run check-in and frequency change radio calls.
  - Std procedures need no briefing time. Know the T34 manual.
  - Lead covers safety issues and emergency procedures
  - #2 talks next, then #3, then #4
- Wingmen take notes
- Hold questions and comments until your turn (this means YOU!)
- Leadership, teamwork, and formation discipline start here
- Check pilot will fly near formation, out of the way, silent



Formation Flight Briefin Flight Call Sign Date

Aircraft		Operations
Lead:	N	Mission:
# 2:	N	Route/Area:
# 3:	N	Altitude:
# 4:	N	Enroute:

Comm Channels

	Freq	Area		Freq	Area
1			5		
2			6		
3			7		
4			8		

Engine Start Time **Takec** Type: Rwy:

Maneuvers Total Est Flight Time Total Est Fuel Usage

# 1:		Time
# 2:		Time
# 3:		Time
# 4:		Time
# 5:		Time
# 6:		Time
# 7:		Time

Landing Entry: Rwy:

Weather

Altimeter Setting

Notes

Start Up

- Briefing will call for start time (GPS Hack)
  - Perform preflight checklist with adequate time.
  - Just prior to start time, check if other flight members are ready, watch lead's prop and start with him. Starting late together better than 3 on time and 1 late.
  - Do post-start checklist. Don't rush
  - Set altimeter to airport elevation

Check in

- After finishing post start checklist, getting ATIS, and giving flight ample time (1.5 to 2 minutes common), lead calls for check-in
- “bravo flight check in,” “bravo 2”, “bravo 3”, “bravo 4” (use bravo or similar if multiple flights active)
- Normal check-in response means you are ready to taxi
- Inform lead if you need more time or if you have a problem.
- Lead briefs flight on weather and any last minute adjustments
- Lead moves flight to ground. “Bravo flight, go ground.” “bravo 2,” “bravo 3,” “bravo 4.” (lead switches to ground) “Bravo flight check in.” “bravo 2,” “bravo 3” “bravo 4.”
- Lead calls ground. “Stockton Ground, Bravo flight, a flight of four Bonanzas, at the Jet Center with whiskey request taxi to runway 29 Right.” “Bravo flight, taxi to runway 29R. What is your departure heading from the airport?” “Bravo flight will depart straight out.”
- Lead is ready to handle queries from ground as to tail number, return time or other. Controllers may react differently to formation calls, and may be unaware of or use different formation terminology.

Taxi Out

- Taxi in trail at ramp, staggered on long wide taxiways. Follow lead's and 2's cues. Always be able to stop safely.
- Parade stagger taxi 8 – 12 kts, 3' step back, everyone matches lead's placement of wingtip over taxi centerline. Lead signals move back to trail with elevator flutter. Wingmen pass it back.
- The higher the speed, the more open the spacing. SAFETY.
- Line up for run-up. Butt over centerline easiest. Or nose wheel on center line.
- Lead gives runup signal to do pretakeoff checklist. Signal passes to end.
- Last one in line starts thumbs up when ready. When ready, pass signal down.

Take Off and Departure

- Lead calls flight, “Bravo flight, go tower.” followed by “Bravo 2,” “Bravo 3,” “Bravo 4.”
- Lead checks in flight “Bravo flight check in.” “Bravo 2,” “Bravo 3,” “Bravo 4.”
- Lead calls tower. “Stockton tower, Bravo flight at 29R, ready for straight out departure.”
- Or, lead radios traffic: “Grayson traffic, bravo flight taking the active runway 35 for circling overhead departure”
- Avoid circling departures when there is incoming traffic on initial
- Lead flies to the maneuver area
- Lead levels off, accelerates to cruise speed, then kicks out flight to do cruise checklist, wing rocks flight back in

Take Off

- Taxi on to runway with lead down wind
- Wingman (if element TO) pulls up abreast to wing aligned w/ empennage
- Lead gives run up signal (approx. 2000 rpm)
- Then head nod release brakes
- 75% power for take off
- Lead lifts off at 80 kts
- Thumbs up for gear
- Abort together if necessary w/ radio call (door pops open or other)
- Climb
  - 100 kts
  - 500 fpm
  - Gradual throttle reduction from takeoff power
- Following elements roll on 10 sec interval

Maneuvers

- Lead works flight through all maneuvers on briefing card
- Plans maneuvers to waste minimum time
- Plans maneuvers to end in time for timely return over aiport
- No radio calls needed unless safety issue or something unbriefed occurs

Cross Under

- Signal
  - #2 hold arm
  - #3, #4 pump arm
- Sequence for #2 cross under
  - Lead signals #3 first, then #2
  - #2 verifies opening gap,
    - Reduces power, steps down and back extra 7’ to 10’
  - slide under walking speed
  - Power up into position
- Beware
  - Maintain positive step down/back
  - Stay below turbulent air
  - Vortexes can whip you across
  - Other wingman
  - Small bank or rudder only

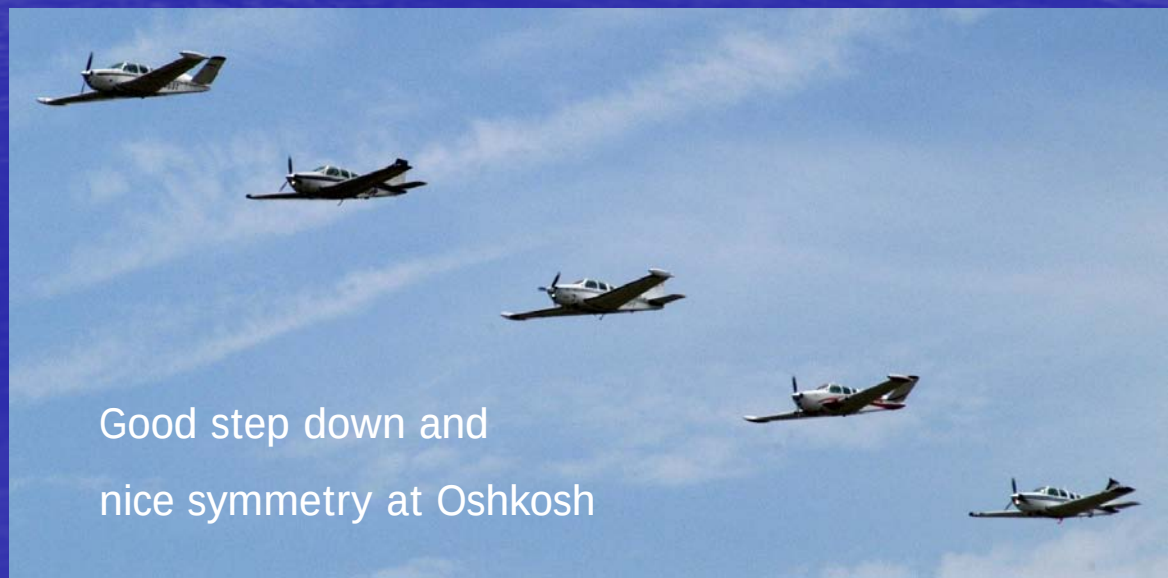
Fingertip 4 Ship Position

- Can be strong right or left
- Turns welded wing
- All maneuvers start and end with fingertip
- Lead rolls slowly in and out

Close Trail

- Line up your eyeballs on left tailpipe
- Uniform extra step down and step back (no step out)
- See little or no wing walk
- Be able to cleanly pass under with extra room without pushing yoke when power lost in plane ahead
- Turn as lead turns
- Lock on lead, avoid plane ahead
- Most maneuverable formation, but beware engine out

DANGER - #4 TOO HIGH!!!



Good step down and

nice symmetry at Oshkosh

Diamond Position

- #4 is in trail & step down with #2 and #3
- All turns standard
- 4 calls in

Flying the Slot in Diamond

- Eyeballs behind lead's left tailpipe
- Match geometry of 2 and 3. Make it pretty.
- #4 has a collision hazard on three planes
  - Keep them all in sight. Use peripheral vision or scan. Posts block vision.
  - Always maintain step down and step back on 2 **and** 3 (especially in turns). Able to pass under lead.

Lazy 8's

- Can be done from fingertip, diamond, trail
- Shows lead's ability to continuously change in minute amounts
- Shows wingmen's ability to stay in position during continuous change in bank, pitch, and airspeed.
- Lead gradually pitches up, and gradually introduces more bank until 30° bank reached at 90° of turn at peak altitude, then gradually reduces bank and pitch until original altitude reached in level flight at 180° of turn. Then lead repeats the process turning the other way.
- Wingmen use standard formation turn technique (welded wing)
- Minimum airspeed is 100 kts for positive formation control
- 130 kts cruise speed gives more dynamic climbs, descents than 120 kts.
- Beware yellow lines and turbulent air speeds for different models

Echelon

- Least maneuverable
- Used for overhead break
- Never turn into an echelon. Only turn away
- Beware of amplifying oscillations 1 to 4 – lock it down
- Don’t get sucked in turns

Return to airport

- Lead ends maneuvers on airport side of sector
- Lead checks ATIS
- Lead kicks out flight for descent and landing checklists, gives radio call for ATIS, rocks flight back in, gives lights-on hand signal
- Lead gives adequate calls to tell traffic or tower of flight's location and for which runway it will set up on initial
- Lead calls "Bravo flight, go tower," followed by "Bravo 2" "Bravo 3," "Bravo 4". Lead checks in flight after changing to tower: "Bravo flight check in," "Bravo 2," "Bravo 3," "Bravo 4."
- Lead makes call 10 miles out: "Stockton tower, bravo flight 10 miles north east with romeo, request 5 mile initial to runway 29R, with romeo, request right overhead break with the option." "Roger Bravo flight, I have your request, report 5 mile initial runway 29R." "Bravo flight report 5 mile initial"
- "Grayson traffic, bravo flight 5 mile initial for runway 35, we will break over the runway in left traffic then land."

Landing Sequence

- “Stockton Tower, Bravo flight 5 mile initial.” “Bravo flight, cleared for overhead break with the option, make closed right traffic, runway 29R.” “Bravo flight wilco.”
- Flight is overhead the threshold at the agreed time.
- Create a routine to simulate a single ship landing and a pair landing
- Call if gear not down
- Wingmen ready to talk to tower or traffic if there is a safety hazard
- Make gaps for other arriving traffic

Overhead Break to Landing

- Lead will call “initial” to tower or traffic
- Formation arrives in echelon
- Overhead threshold, lead sharply breaks 45 degrees of bank at pattern altitude
- Full circle to land
- Gear lever comes down abeam threshold wings level
- Lead lands long (runway permitting)
- Each wing breaks at count
- Hold altitude until abeam numbers, then drop gear, and immediately begin turn to final (rwy permitting)
- Note, if element break, lead rolls gently to 30 degree bank

Element Landing

- Break in pairs, 7 seconds typical interval
- Look for gear thumbs down
- Flaps as briefed, look for signal
- Verify each other's gear down
- Wingman flies on outside of turns
- Lead lands with power
- Wingman is slightly acute
- Avoid sudden turns
- Wingman often touches down first
- Beware:
  - weight differences for bounced landings
  - Complicated go around
  - Dirty air tougher in pairs
  - Crosswinds

Staggered Landing

- 3 second break typical
- Check plane ahead's gear
- #2, #3, #4 announce down and slow
- Plane in front crosses to exit side after plane behind announces slow
- Hazards:
  - lead tends to land on the center line, causing turbulence problems for others
  - Cluttered runway difficult to make go around

Sturdy Landing

- 5 second break, single ships
- Land center
- Move to cold side (exit side) as soon as stable
- Plane with overrun problem has other side (hot side) clear
- Safest method

Taxi Back

- Lead taxi to end of runway, regroup at taxi way just like run-up
- “Bravo flight, turn left on echo and contact ground.”
- When lead is clear of the runway on echo, he calls “Stockton Ground, Bravo flight is clearing runway 29R. We need a minute to regroup and request taxi back to Stockton Jet Center.” “Bravo flight roger, taxi approved as requested.”
- Lead signals for clean up, #4 passes back thumbs up.
- Shutdown on lead’s briefed signal. “Bravo flight, shut down on the up.” “Bravo 2,” “Bravo 3,” “Bravo 4.”
- Write your debriefing notes from the flight before departing the aircraft

De-Briefing

- Important learning phase of flight
- Be open to comments
- Lead goes first and then in order
- Lead goes through each segment of flight
- #2, #3, #4 cover things left out
- First call “safety’s” on yourself
- Then critique the rest of the flight
- Do not be defensive
- Be thorough - good & bad
- Don’t leave much unsaid for the check pilot

Maneuvers: Est. flt time: ___ Est. fuel usage: ___gal

Fly to enroute position, when called join in position
finger; diamond with #5 trail; diamond lazy-8; finger
close trail; close trail lazy-8; finger; diamond w#5 trail;
diamond lazy-8; finger-tip
echelon; break & rejoin; opposite echelon;
break & rejoin; echelon; echelon turn;
finger-tip; kick-out; rejoin; echelon for initial;
overhead break

NOTES: Standard T-34/Bonanza specific unless otherwise briefed.

Landing lights on when "initial" called;
Lights off & flaps up on signal when clear of runway;
Shut-down at 30" or 60" hack, lead calls, turbo respond if not able
Maneuvers at 130 kts;

Emergency Procs: On take off abort, call "# aborting" others fly normal;
In flight 1 up, 2 away and up, 3 down, 4 up, 5 away (Break, Break, Break!)
Single ship emergency - pull up
SAR: el wing/lead goes with ship 1000 ft above all times com 121.5

FFI Checkride Comments

- Lead be prepared
  - to plan a checkride that will pass FFI req’ts
  - for timing requirements to simulate airshow pass
  - to show a single ship and dual ship landing
  - to show leadership and the ability to adapt to changing requirements
- Wingmen show excellent discipline and skill
- Show the check pilot that you give a thorough brief/debrief

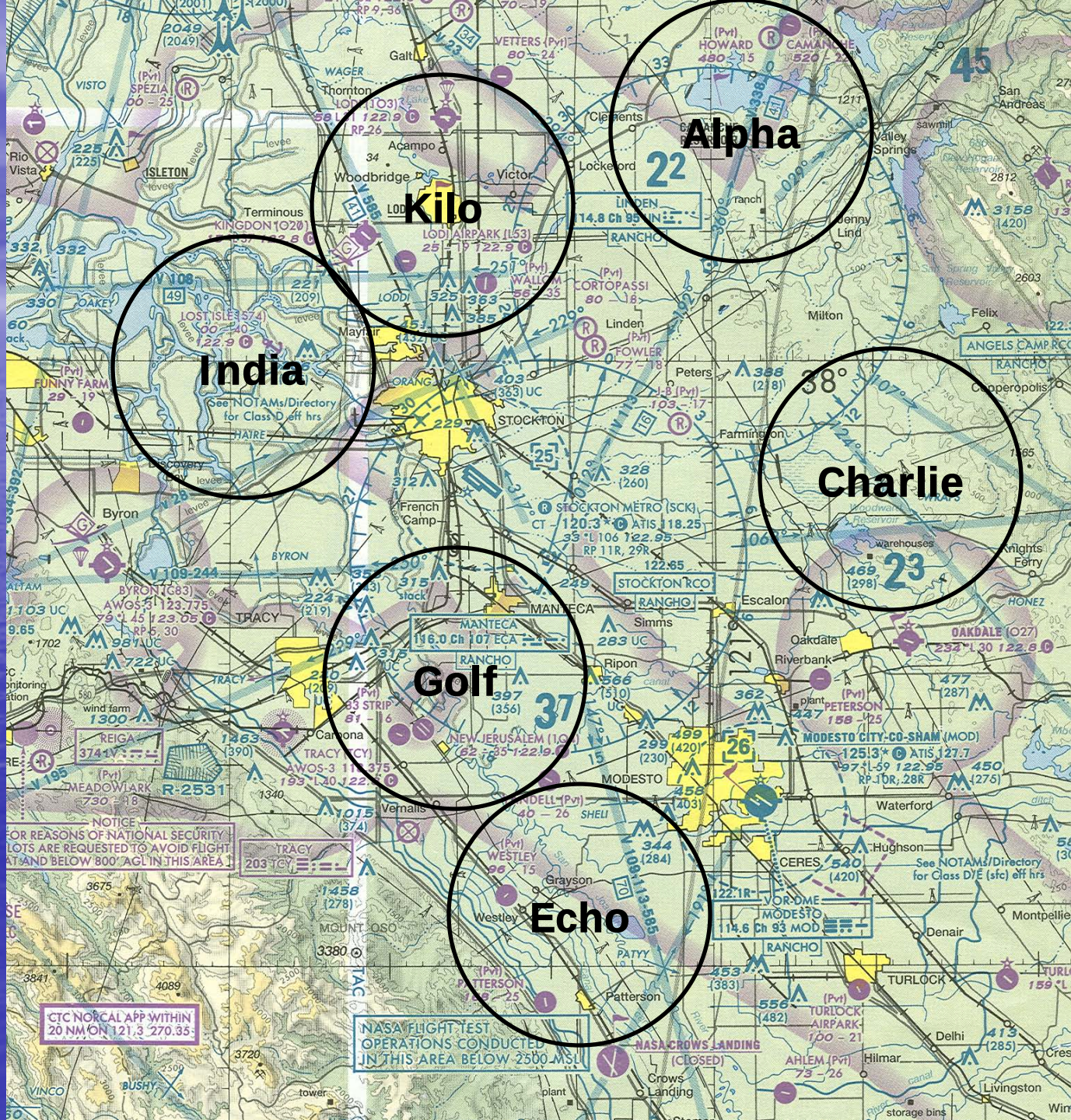
Schedule for the Weekend

- Wednesday:
  - 6:00 pm arrival
  - 6:30 pm Dinner at FBO
  - 7:00 pm Technique Review @ FBO
  - 9:00 pm head to motel
- Thursday:
  - 8:00 am Overview, Safety, Flight Ops
  - 10:00 am break into 4 ship groups
  - 11:00 am engine starts 1st flight
  - 12:20 pm Victims Missing Man
  - 12:45 pm debrief and lunch
  - 2:00 pm engine starts 2nd flight
  - 4:15 pm engine starts 3rd flight
  - 6:00 pm back to the motel
  - 7:00 pm dinner Mallard's or David Wong
- Friday:
  - 8:00 am Daily Briefing
  - 8:30 am break into 4 ship groups
  - 9:15 am engine starts 1st flight
  - 11:15 am engine starts 2nd flight
  - 12:30 pm lunch & debrief
  - 1:45 pm engine starts 3rd flight
  - 3:45 pm engine starts 4th flight
  - 7:00 pm dinner Garlic Brothers
- Saturday
  - 8:00 am Daily Briefing
  - 8:15 am 4 ship groups, newcomer briefing
  - 9:00 am engine starts 1st flight
  - 10:15 Newcomer briefing ends
  - 11:15 am engine starts 1st newcomer flight, 2nd FFI flight
  - 12:30 pm Lunch
  - 1:30 pm engine starts 6th flight
  - 3:30 pm engine starts 7th flight
  - 7:00 pm dinner Casa Filson
- Sunday
  - 8:00 am large formation brief
  - Morning – large formation work
  - Noon (Lunch at FBO)
  - 2:30 pm end of large formation work

Working Areas and Frequencies

Alpha: 123.47
Charlie: 123.27
Echo: 123.42
Golf: 122.67
India: 122.87
Kilo: 123.15

Flight assignments:
(see board)



Observe the Flight Board

- Time of next flight
- Four ship assignments
- Announcements, notes

- Victims of Violent Crime Notes

Final Remarks

- Safety First!!
- If you don’t understand – ASK
- Stay in control and ahead of your plane
- Do not rush or be rushed
- This presentation, although detailed, did not cover everything you need to know
- Have fun!