Sport Class Air Racing
PRTC & PRS 2025
Race Ground School – PART 1

How to fly at 50 feet responsibly with 8 "uncooperative" airplanes

Sport Class Air Racing

NATIONAL CHAMPIONSHIP AIR RACES AND AIR SHOW

Sport Air Racing Council
Next Gen Air Racing

Revised March 2015

Sport Class PRTC & PRS Goals & Objectives

* Safely Introduce Pylon Racing to Rookie Race Pilots
  * Ground School
  * Briefings
  * Working Area Practice
    * Formation Skill Development
    * Required Maneuvers Demonstration
  * On-Course Training and Practice

* Hone Racing Skills of all Sport Class Race Pilots
  * All the above
  * Leadership Development

Sport Class PRTC & PRS Goals & Objectives

- Establish Standard Operating Procedures for all Aspects of Sport Class Air Racing:
  - Pre-Race Prep
  - Briefing
  - Ground Operations
  - Flight Operations
    - Departure/Join-up
    - Area Training
    - Starts
    - Racing
    - Recovery
    - Abnormals and Emergencies

Sport Class PRTC & PRS Goals & Objectives

* Provide look-ahead training for Race Week Operations
* Provide Class guidance on preparations for all racing events
* Establish a Sport Class culture of:

SAFETY and RACING EXCELLENCE!

Primary Benefits of PRTC & PRS

* Broaden your understanding of your airplane
* Hone your airplane handling skills
* Sharpen your Safety Focus
* Improve your Situational Awareness
* Learn the basics of Pylon Racing

Secondary Benefits

* Learn about yourself
  * Your tolerance to stress
  * Your ability to multi-task
  * Your ability to adapt to, and *follow*, SOP
* Enjoy the camaraderie of fellow aviators
  * Earn and share the TRUST of your fellow racers
  * *Oh yeah, and qualify to race!*

Presenters

* Andrew Findlay – Race Training
  * Sport Class Instructor, Check Pilot, Pace Pilot
  * Lancair Super Legacy – "One Moment" Race 30

* Sean VanHatten – Formation Training
  * Sport Class Instructor, Check Pilot, Pace Pilot
  * Menagerie of Airplanes, "Havoc" Race 3

A Little History

1998	2012	2022

* Racers
  * 10 total
  * 2 heats
  * several people raced twice
	* Racers
	  * 28 total
	  * 3 Heats
		* Racers
		  * 40 total
		  * 4 Heats

* Winning Speed
  * 308 MPH
	* Winning Speed
	  * 396 MPH
		* Qualifying Record
		  * 409.8 MPH

* Payout
  * $25,000
	* Payout
	  * $100,000 +
		* Payout
		  * $100,000 +

A Little History

2024	2025	2026

* First year operating under own ARO at KLRU
* Only close course air racing operations for the year
* Racers
  * 18 racing, 23 licensed
  * 3 heats
  * several people raced twice
* Winning Speed
  * 308 MPH
* Payout
  * Development of Cost Recovery model
	* 2 AROs to operate with
	  * SARC/RARA & RARA
	* First opportunity for multi-venue closed course Air Racing since early 1990s
		* Continue to grow the sport!

Keys to Sport Class Success

* Balance on the interests of 3 constituents:
  * The Racers
  * The Spectators
  * The Race Organizers

* Constant Focus on Safety/Risk Reduction and Excellence
  * Make it our Culture
  * Take Care of Each Other
  * Have Fun!

Risk Reduction

* Identify hazardous conditions
* Standardization
  * Everyone doing the same thing the same way
  * Keeps people predictable
  * Aids everyone's "Situational Awareness"
* People demonstrating poor airmanship or lack of discipline will not be tolerated in the class

Formation Competency

* Must meet one of the criteria below:
  * FFI/FAST card
  * Completion of formal formation training
    * Multiple FFI/FAST Clinics
  * Military or equivalent training
  * Sport Class Formation Training
    * Prior to FWU/PRS

Sport Class PRTC & PRS Syllabus Overview

- Tech requirements
- Ground Operations
- Flight Operations
  - How to start a race
    - Join-up/ Chute/ Start Lap
  - Rules and techniques around the Pylons
    - Fast line/ Passing
  - Recovery and Landing
    - Cool Down/ Traffic pattern
  - Simulated Emergencies/ Upset Recovery
- A look ahead at Qualifying, Racing, & Timing Runs for Rookies and Vets with new/mod AC

Training Outline

1. PRTC & PRS—Day One
    * Chronologically go through the day
2. PRTC & PRS—Days Two and Three
3. RACE WEEK
4. SAFETY Concerns

Preface to Day One: TODAY

* Before you leave Stead for Hotel--Make sure:
  * Windshield clean
  * Fuel—Oil Serviced
  * Pre-flight Complete
  * Helmet/Gloves/Flight suit ready
  * Cockpit items stowed
  * All questions answered
  * Ride/Show/Brief times are known!

PRTC & PRS
DAY ONE

First Fly Day

* Morning SARC/RARA Daily Brief
  * Last minute schedule changes plus weather
  * No Brief—No Fly
* Morning Sport Class Daily Brief
  * Immediately following SARC/RARA brief
  * Receive Flight Assignment/line-up card
  * Flight is given Course time
  * Flight Leads will then brief the specifics of the Flight

Learning Objectives

* Continue Formation Warm-up
* Area Work/Maneuvers
* How to find and fly the Chute
* How to find and fly the Pylons
* How to enter and exit “Cool Down”
* How to fly a standard recovery
* How to pass and be passed safely
* Emergency Procedures on the course

After Flight Brief
Spot Aircraft

* Find tow driver—offer bribe
* Spot At least 20 Minutes prior to Take-off
  * Lead Designates Spot and Start Times
* Meet for final brief at Lead's airplane
* "No Prop Turn" line in effect
  * Do not taxi or coast across it!

Engine Start

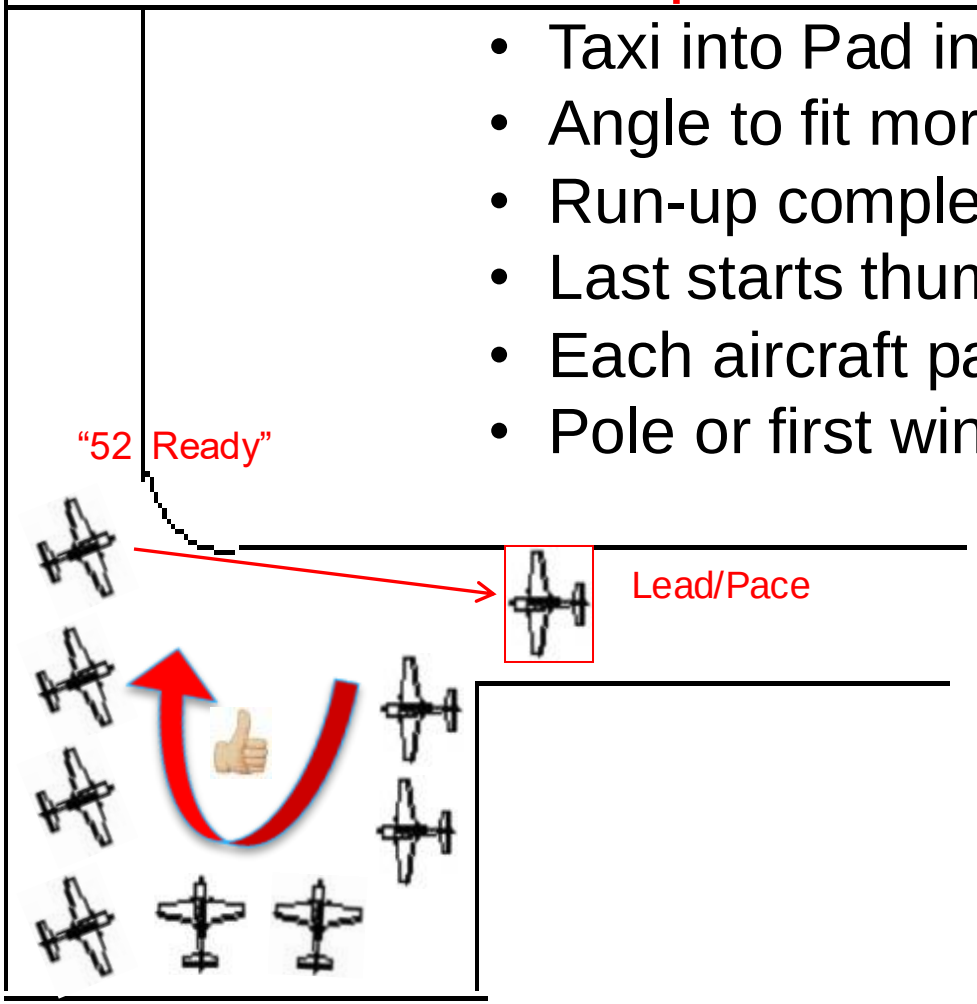
* Start Engines @ Briefed Time
  * Ramp Boss will alert racers to slides or move-ups
  * Watch Lead/Pace
* When ready for Check-In/Taxi pull forward 5 feet
* Lead will check everyone in at briefed time
* Check in with Race number in order

* BE VIGILENT ON THE RAMP!

TAXI

* Lead gets clearance for the group and directs the taxi
  * Same as race procedures with Pace (Lead acts as Pace)
  * First Wingman, or Pole Position leads the taxi
* Taxi Staggered
* Help out taildraggers
  * Spacing
  * “Eyeballs”
* Uniform spacing--Look professional
  * Airshow formation spacing not required

- Run-Up Area Procedures
  - Taxi into Pad in trail
  - Angle to fit more aircraft in
  - Run-up complete, check aircraft on both sides
  - Last starts thumbs up moving forward
  - Each aircraft passes thumbs up forward
  - Pole or first wing calls ready to Lead/Pace

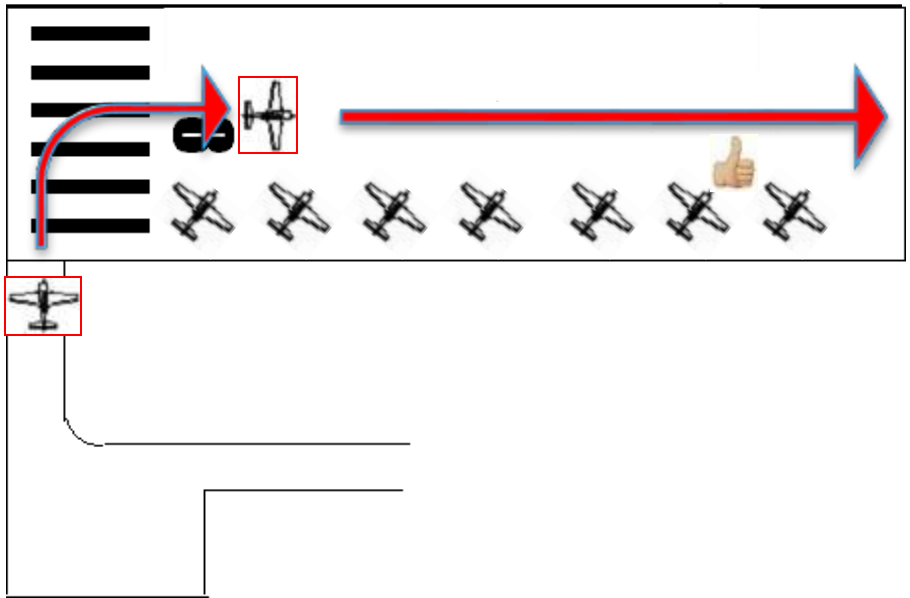


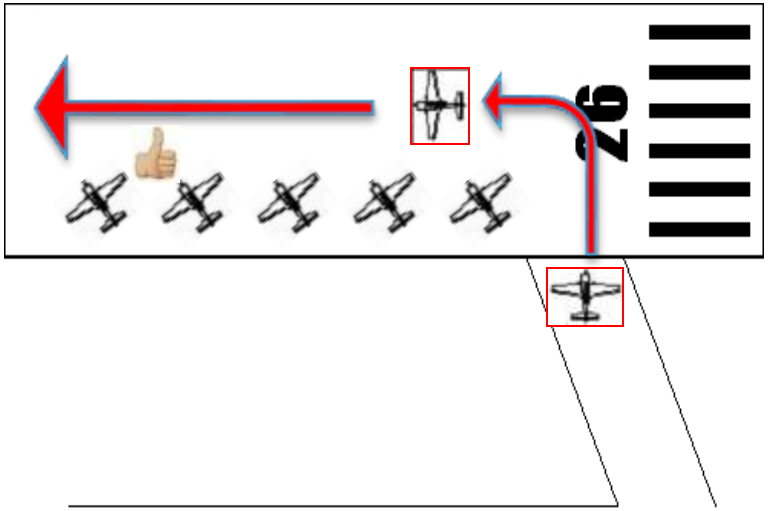
Run-up

* All Aircraft do Run-up on their own
  * No run-up signal required
* Wingmen Pass Thumbs-up back to front
* Pole or First Wingman calls “XX Ready” to Lead/Pace
* Pace/Lead switches flight to Race Control Frequency
  * Do not auto switch to Race Control
* Check-In with Race number
* Lead/Pace calls Race Control for Clearance
  * Line-up and Wait
  * Cleared for Takeoff

Line-Up

- Pole or First Wing taxis down runway to allow all members of the flight to stop on Cold side of the runway
- Angle 45 degrees to the runway heading
- Lead/Pace follows flight onto runway
- When Cleared for TO, Lead taxis past all aircraft
- Racers give thumbs up to Lead/Pace
- Lead/Pace Rolls and Calls 60 knots





Takeoff

* Racers roll in order when previous racer is 1000 ft. down the runway
  * Lead Call 60 knots
* Takeoff on Hot side, abort to Cold side

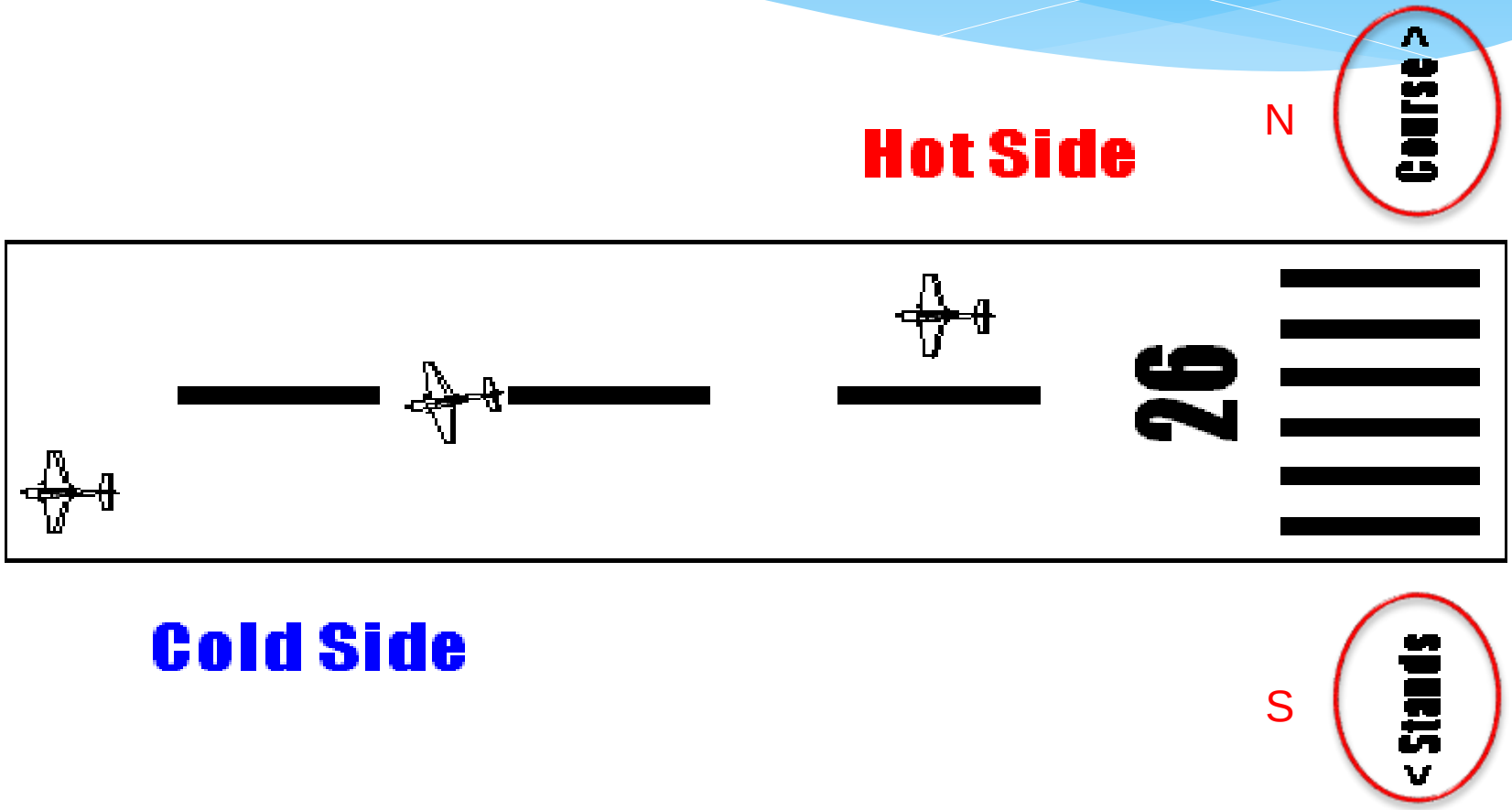
THERE WILL LIKELY BE RACERS ON THE COURSE

* Low Transition on South Edge of Runway
* No turns until past the race course
* Last aircraft in flight call "XX airborne"

Takeoff Aborts

* Aborting aircraft
  * Maintain Aircraft Control
  * Call Aborting
  * Move to Cold Side when under control and its clear to move
    * Call “cold” when moving to cold side
      * Control aircraft first!
* Remaining aircraft
  * If rolling, continue on Hot Side
  * If not rolling, hold

Hot Side / Cold Side



Departures

* All departures flown as practiced during FWU
* Lead starts left turn and all racers begin a left turn as soon as they are *past the race course.*
* CAUTION: There could be racers in the chute
  * Leads in Chute may stay high and enter Queue if needed

Area Work

* At Lead's discretion, you may go to a working area before maneuvering to enter the course via the chute

* Primary Drivers
  * Course Timing and Training Requirements

Revised March 2015

Area Work

* Close formation
  * Fingertip
  * Cross-under
  * Echelon/Echelon Turns
  * Pitchout/Rejoin Practice
  * Breakout Demo
* Upset maneuver (Flip-Flop)
  * Roll to Inverted and Return to Upright
  * Recognize limitations of no inverted oil
* Wingtip Vortex Awareness
* Extended Trail (Optional)

To the "Chute"

* All Rookies will enter the course for their first time by following lead down "The Chute" in echelon formation
* Chute Begins on S of bombing practice area
* Chute is basically S-N towards lighted Start Pylon
  * "Gouge" points
    * Bombing practice area
    * Dirt road N of 26 numbers

Entering the Course

* Lead will maneuver the flight to “The Chute”
  * Loose Echelon, Relatively Slow Speed
    * So you can see course highlights and pylons
* Lead de-conflicts with aircraft on course/in Queue
  * On-Course Racers will exit via “Escape Maneuver”
  * Lead also de-conflicts with aircraft on takeoff roll on 8 or landing on 26
* Lead may hold flight higher than normal or enter Queue if conflict is not resolved
  * Leads will communicate with each other

Race Course Familiarization

* Lead will fly at a pre-briefed speed and provide a guided tour
* Highlights include:
  * Start Chute and associated landmarks
  * Lighted Start Pylon
  * Lighted Guide Pylon (west side)
  * Outer Course Pylons
  * Middle Course Pylons
  * Inner Course Pylons (only for racers with top speeds </= 275 mph)
  * All Courses Share Pylons 7, Home and 1
* Lead will brief & clearly communicate all course-to-course transitions
* No Passing on the course during Fam Hop 1

Race Course Familiarization

* Lead will brief and fly the guided tour on appropriate course(s)
  * Subsequent PRTC & PRS hops will brief and fly on one course only for the period
    * Exception is all course entries from the chute fly one lap of Outer course first
* Flight composition determines what courses will be demonstrated – Lead Discretion
  * Gold-only racers may elect to fly only the Outer Course
  * > 275 mph racers will be guided on both Outer & Middle Courses
  * < 275 mph racers will be guided on Outer, Middle, & Inner Courses
  * Course Fam 1 hop will conclude with a demo of escape maneuver and entry into cooldown for recovery

Techniques On the Course

- Fast Line
  - Smooth, non-scalloped turns
  - Level
  - Minimum G
    - Outer & Middle Courses, 2.2 or less is all you need
    - Inner Course, perhaps a bit more
- Optimum Ground track changes with wind
- Plan the turns – Look at next two pylons
- Head on a swivel – Don't fixate and lose SA
- Situational and Terrain Awareness are paramount
- Scan Engine
  - Find a spot on the course to check Oil, EGT, CHT
  - Check engine at least once each lap

Hazards on course

* Turbulence
  * Different wind direction makes the course fly differently
* Wing Tip Vortices/Prop Wash
  * Particularly bad behind Thunder Mustang
  * Wind changes location of vortex
* Review course specific brief

Practice Periods
7-10 Laps

* If you are on time for the Chute, flight will have an opportunity for 7-10 laps (depending on speed) before the next group arrives down the Chute

* Next Flight in Chute?
  * Flight will exit out the ESCAPE ROUTE and up into COOL DOWN.

* Leads must communicate with each other
  * Wingmen must follow Lead's direction and exit course as instructed

The Escape Maneuver

* Pitch up and climb to 1500’ AGL +
* Fly around runways and crowd areas
* Used to exit course when:
  * Show line bust inevitable
    * Even if forced… Exit and protest
    * Re-entries specific to course (see course specific brief
  * When On-Course aircraft must clear with next group in the Chute
    * Caution for aircraft in chute
      * Give Chute Aircraft Right of Way

Exiting the Course

* Call off the course
  * "Sport XX is off at 7" (escape maneuver)
  * "Sport XX is off on the backside" (Medallion esc maneuver)
  * "Sport XX is off at Home"
* Climb to "Cool-Down" altitude 2,000 AGL
  * Use Escape Route if Racers in the Chute
* Fly over the race course
  * Watch for traffic in "Queue" at 1,500 AGL

Exiting and Re-Entering the Course for Priority Aircraft

* Examples of a Priority Aircraft
  * BLM operations
  * Air Guard
  * Airline Ops
  * Medevac
* When? As directed by Race Control
  * Exit from current position and maintain SA
* Re-enter the course via “Short Chute”
  * Follow the plane in front of you
  * Don’t pass till you are on the course
* Watch your Speed!
* Leads Maintain oversight and control
  * Be directive as needed

Exiting "Cool Down" to Land

* Do not stop flying!
* Manage the engine and systems!
* Switch brain to landing mode!
* Clear traffic in the Queue and Cool Down!
* Call "Sport XX Out of Cool Down"
* Fly *standard* procedures and patterns
  * See site specific brief

Radio Calls

* "Sport XX Leaving Cool Down"
* "Sport XX Downwind abeam"
  * Race Control may provide sequence at this point
* "Sport XX Base / Gear"

Use only Sport #

Landing

* Landing with Sport Aircraft still on roll-out is authorized
* Land on Hot Side, Check Brakes (as req), Clear to Cold Side
* Do not turn off mid-field
* Meet at Pace Plane / Lead Aircraft for debriefing
* Get Gas if required for next flight

Second Flying Period and Beyond

- Repeat of the Morning – Without Guided Tour
  - Flight will now train on one course per period after 1 lap on outer course
    - Lead Choice based on Wingmen Training Requirements
- Expect potential Conflicts/Coordination when entering/exiting course
  - Aircraft may enter course directly from takeoff (”Short Chute”)
  - Aircraft may enter course from Queue
  - Aircraft may enter course from Chute
  - Off at Home, Off at 7 or backside via the Escape Maneuver to deconflict chute traffic
    - Lead will direct exit plan
- Listen up - maintain Situational Awareness
- Develop Course Awareness and Techniques
- Ask Leads and Experienced Racers for clarification and assistance
  - They might even tell you the truth! (But few secrets!)

Entering from Queue

* Queue is flown at 1,500 AGL
* Clear traffic on course
* Radio Call “Sport XX out of the Q, entering at Pylon X”
* Enter Wide and Give Traffic On the Course R.O.W.
* Watch Your Speed!

Situational Awareness

* One of the key skills to acquire and develop at PRTC & PRS
  * Understanding the Flow of the events
    * How airplanes enter and exit the course
    * Where to look for airplanes
    * How airplanes fly the landing pattern
  * Listening to the radio and interpreting
  * Anticipating what will happen next

Flight Discipline

* Essential to Safety
  * Do what you say you are doing
  * Fulfill the formation "contract"
  * Remain predictable
* Must be Standardized to avoid potential conflicts:
  * Take-off with airplanes on course
  * Entering/exiting the course
  * Landing Pattern/Chute/Cool Down
* Must fly your plan

PRTC & PRS Day 2 and 3

* Format the same as Day One Plus:
  * Simulated Emergencies
  * Passing
  * Check Rides

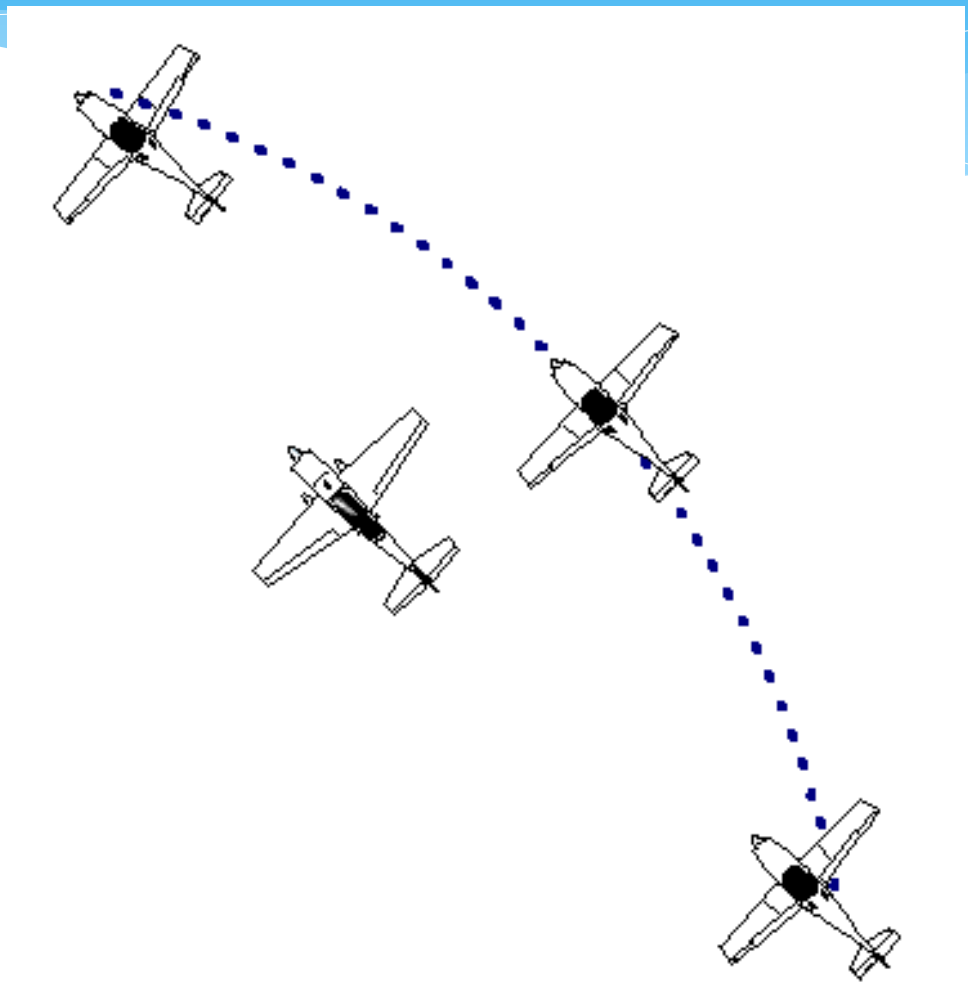
Learning Objectives
Fly-Days 2-3

* Integrate and Automate knowledge gained on Day One
  * Make it part of your Racing DNA
* Learn Passing techniques
* Demonstrate proper Simulated Emergency Landing procedures
* Demonstrate Upset recovery/Wing Vortex Knowledge

Passing

* **Passing –It is overtaking aircraft's responsibility to pass well clear.**
* **Pass on right unless racer being passed is <u>way</u> wide and you can keep him in sight.**
* **Formation on course**
  * ***Just because you are racing does not mean you can ignore formation contract with plane on your left.***
  * ***You are the Wingman until the pass is complete***
    * ***Defined by a "Clear" call or obvious nose to tail and opening***

Passing

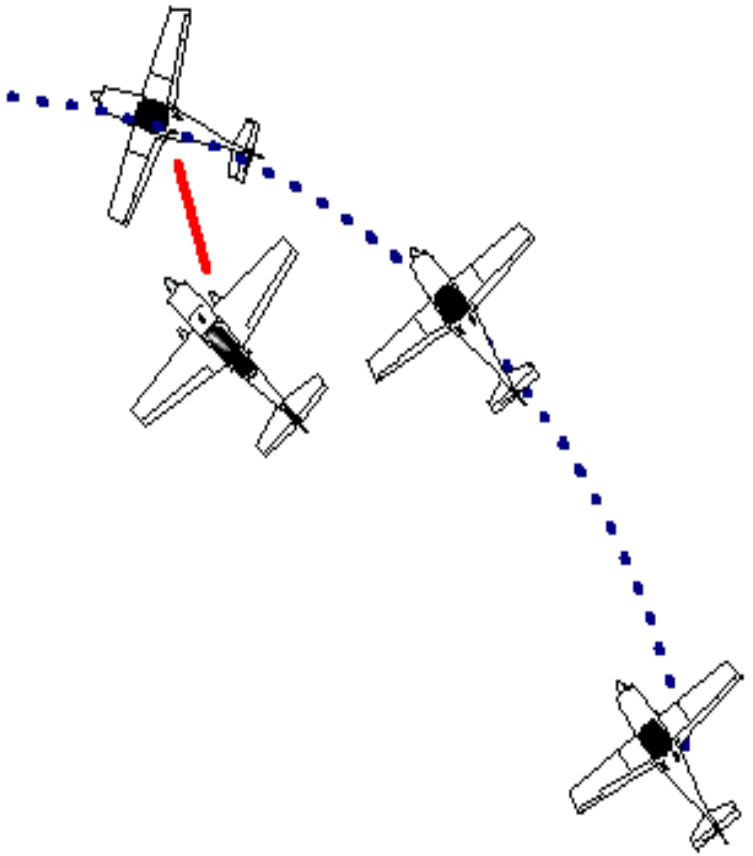


Good Pass!

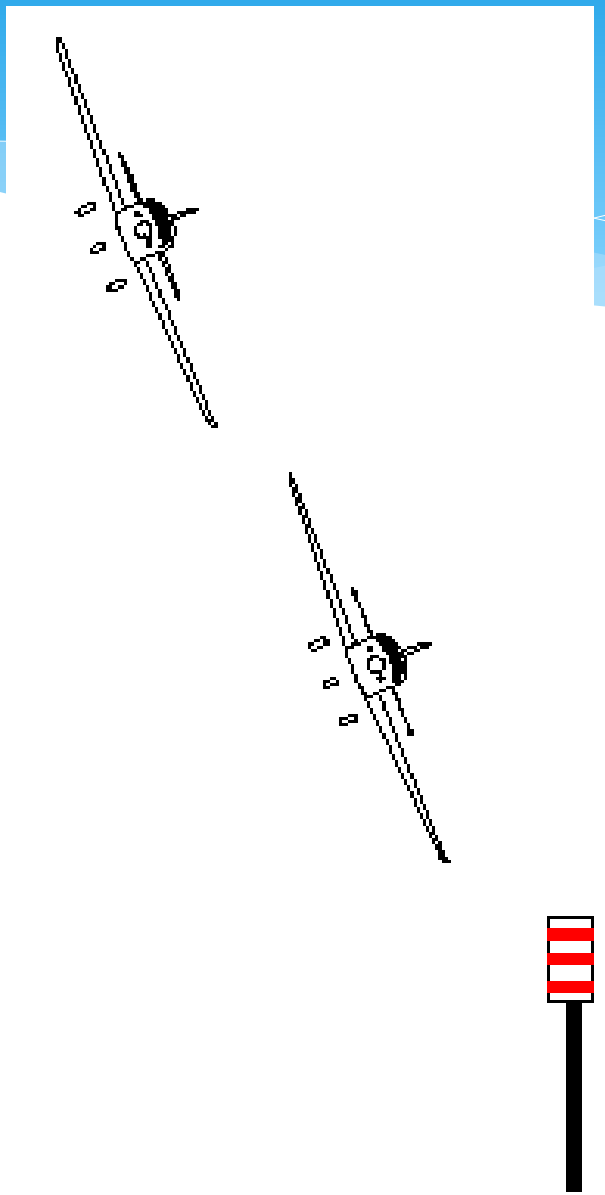
Passing Geometry

Pull too soon/too hard and you slow…

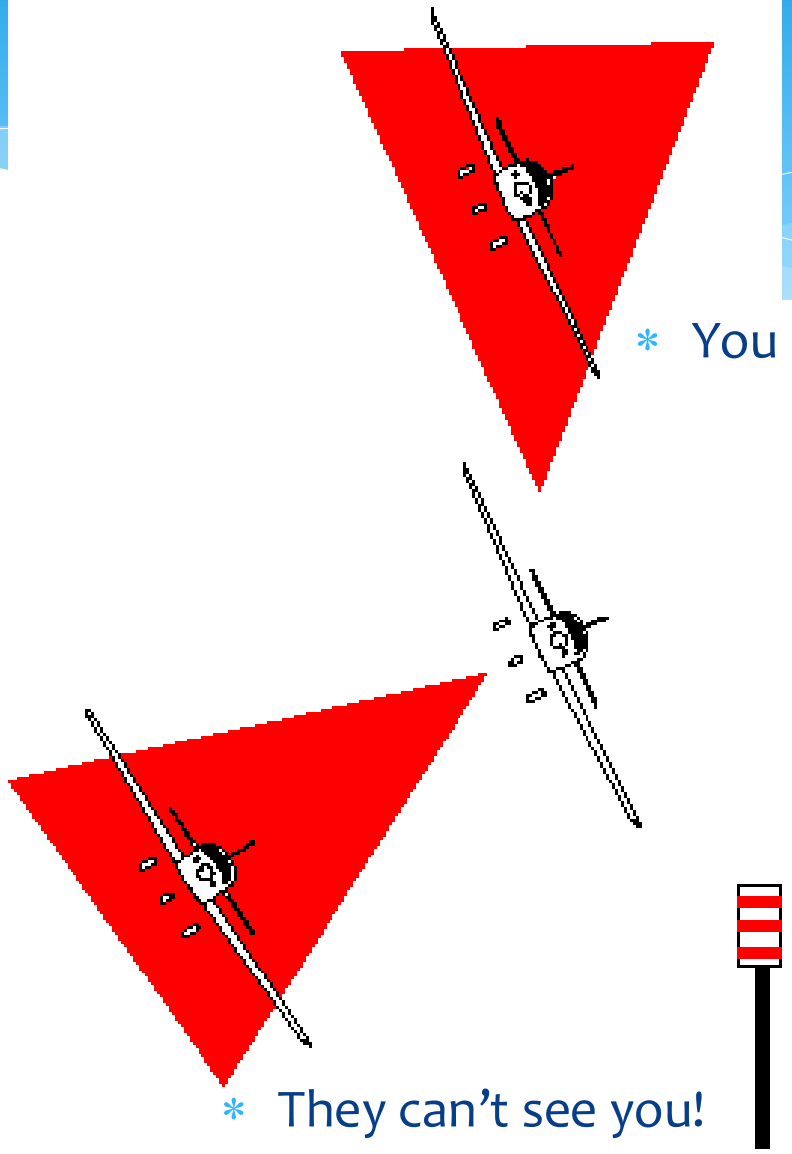
The Nose to Tail and Opening you thought you had…dissapears!



This is the perfect position for passing



* Not so perfect areas for passing!
  * (Actually, BAD areas!)



* You can't see them!
* They can't see you!

SAFETY

Preparation

* MINDSET – Heads into the game as you walk to the planes.
* Think out contingencies—engine failure, airframe malfunction, other aircraft MayDays, closed runway.
* FUEL - enough to hold for 20 minutes and divert to Reno International or other divert fields.

Emergencies

* Each Aircraft type presents different challenges
  * Pre-think your plan
* There are automatic responses that will help your chances of success
  * They result from preparation and practice (muscle memory)

Mayday

* Automatic response:
  * Zoom climb inside the race course to Best Glide Speed
  * Call "Sport XX Mayday"
  * (CFR scrambles vehicles)

* Race Control responds with winds—listen and pick your runway
  * Announce intentions if possible

* Aim 1/3 of the way down the runway

Engine Failure on Take-off

* Maintain Aircraft Control
* Right after lift-off--aim straight down the runway
* Fuel Pump on
* Consider switching tanks if time allows
* Consider crossing runways if time and altitude allows
* Consider Gear Up if landing off pavement
* Fly the airplane as far “into the crash” as possible
* Think through various scenarios before PRTC & PRS and race week

Engine Failure in Chute

(LRU Examples)

* Maintain Aircraft Control
* Zoom to best glide speed
* Call “Mayday”
* S turn behind formation if speed and altitude require
* Runway 26 or 30 may be best choices from the Chute
  * Lots of altitude… consider left downwind for 12
* Aim 1/3 of the way down runway
* Gear Down only after landing on runway assured
* Know your system

Engine Failure/Emergency on the Race Course

(LRU Examples)

- Maintain Aircraft Control
- Zoom up and to left (inside course) to best glide speed
- Call "Mayday"
- Choose appropriate Runway
  - Resist temptation to favor the runway you took off from
  - Plan your runway choices ahead of time
- "Clock" Method (covered later)
- 12 is very often the best choice (some say only)
- Fuel Pump/switch tanks
- State intentions if possible
- Aim 1/3 of the way down the runway
- Gear down only after landing on pavement assured
  - Know your system

Loss of Control

Know your aircraft's characteristics

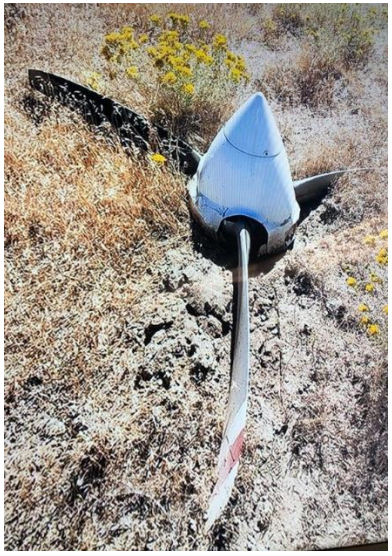
* Consider flight control positioning
  * Neutral? Anti-Spin?
* Consider reducing power
* Consider deploying speed brakes
* Consider extending landing gear
  * Caution if mains don't come down together!

Emergencies-continued

* During Mayday, all other aircraft continue racing
* Remember—Biggest problem is denial
* Bernoulli determines aircraft position—not Marconi
  * Aviate, Navigate, Communicate

Propeller Over-Speed

* The single most common cause of Emergencies/Engine Failures
  * Much has been written on the subject
  * Can be caused by high oil temps or over-boost
  * Counter-weighted Props recommended for high performance engines
  * High Flow Governors
  * Consider resetting the fine-pitch stops
* Full RPM and Jam Accel Throttle at start is a bad
  * Manage RPM after full throttle in may be better
  * Know your plane and motor!



Simulated Emergencies

- Divide race course in thirds and decide a plan of action for each third of the runway.
  - Or Use The Clock Method
  - Remain flexible—winds change everything
- Zoom climb inside race course to best glide speed
  - Initially climb towards course apex
  - Manage Airspeed and Emergency
  - Select Runway
  - Delay Gear until necessary and runway is made
- Call "Sport XX Simulated Emergency"
  - Race Control will call winds
  - YOU select and communicate runway
    - Comm if able… but crash crew responds to your call!

Simulated Emergencies

* Aim for 1/3 to 1/2 of the way down the runway
  * Do not attempt sim emergency landing against traffic
    * Of course a real Mayday has priority!

* Terminate with a low approach if not on the active runway
  * Early go around to prevent a conflict is a gold star

Keys to Safety

* Procedural Knowledge
* Standardization
* Situational Awareness
* Flight Discipline/Airmanship
* Attitude

State-of-Mind

* No one makes money Racing at Reno
* The winner is a determined based on advance airplane preparation—not last minute efforts
* GOAL--Have a great time, go home with new friends, new memories, and in the same airplane you brought.

Final Objective

Pass Check Ride and

Earn Racing License

What it takes to Pass PRTC & PRS

* Close Formation
* Turning Rejoins
* Upset Recovery
* Blind Breakout
* Proper Start procedures and technique
* Level turns on the course
* Proper passing technique
* Proper execution of Simulated emergency
* Proper recoveries
* Situational Awareness
* Knowledge/Compliance with rules and SOP
* Buy-in to the Sport Class Culture of Safety and Racing Excellence

Sport Class Culture

* We are disciplined in the air
  * We take the responsibility we have to each other *seriously*
* We help each other
* We are here for the joy of flying and the camaraderie
* We seek self improvement
* We take pleasure in a well prepared airplane and a well flown race
* Our Core Values are Safety, Racing Excellence and Teamwork

If you don't fit into our culture—you don't fit into our Class

If you buy in to our culture,

We welcome you to the brotherhood of Air Racing!

Questions?

GO Fast,
Turn Left,
and Have Fun!